

Early Results From the Hospital Electronic Health Record Incentive Programs

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The 2009 Health Information Technology for Economic and Clinical Health (HITECH) Act authorizes the federal government to implement policies to incent hospitals, physicians, and other healthcare professionals to adopt electronic health records (EHRs) and use them in ways expected to improve care (“meaningful use”).¹ The Act was motivated by broad consensus that persistent quality and efficiency challenges in our healthcare system, at least in part, from reliance on paper-based records.² The primary mechanism to promote meaningful use of EHRs under HITECH is direct payments to eligible professionals and hospitals, for which the Act set aside \$27 billion.

For hospitals, there are 2 approaches to qualify for incentives. The first is “attestation,” in which hospitals report that they have met a set of federally defined meaningful use criteria using a certified EHR technology. The alternative, which is open primarily to hospitals with at least 10% Medicaid patient volume, is known as Adopt-Implement-Upgrade (AIU) and allows eligible hospitals to receive an incentive payment before they meet meaningful use. The AIU option was created in response to data suggesting that safety-net hospitals would have trouble accessing the capital required to purchase and fully implement an EHR.³ The AIU option therefore sought to ensure that HITECH did not result in a digital divide. While AIU helps in the short term by giving financially stressed hospitals access to capital to support EHR adoption, hospitals that choose this option may struggle in the long run when they have to play catch-up and achieve the same requirements of increasingly sophisticated EHR use as other hospitals.

While the incentive program has been in place for nearly 2 years, we lack a comprehensive evaluation of the types of hospitals that have qualified for incentives, and whether the program is leaving certain groups of hospitals behind. These issues are important for 2 reasons. First, data collected prior to HITECH revealed a digital divide in which large, academic teaching institutions were far more likely to have EHRs compared with smaller, rural, and safety-net institutions.⁴ Second, the benefits from EHRs are substantially greater when there is broad adoption and connectivity between systems.⁵ These “network” effects will only be realized if the incentive program significantly increases adoption, and does not

simply reward those who already had EHR systems. Therefore, empirical data on how many hospitals have received incentives, and whether there are systematic dif-

Objectives: To assess the level of hospital participation in the first 18 months of the Medicare and Medicaid Electronic Health Record (EHR) Incentive Programs, and to identify whether vulnerable hospitals lag behind.

Study Design: Retrospective study of participation among the 4938 Medicare-certified hospitals from the beginning of the incentive payment period (June 2011) through December 2012.

Methods: We used multivariate models to examine which types of hospitals qualified for financial incentives either through attesting to meaningful use of EHRs or by meeting the “Adopt-Implement-Upgrade” (AIU) option that requires demonstrating progress toward achieving meaningful use. We focused on small, Critical Access, and safety-net hospitals.

Results: We found that more than 75% of all eligible US hospitals have qualified for financial incentives in the first 18 months of the program. Nearly two-thirds of these hospitals (52% of all hospitals) attested to meaningful use while the remaining one-third (24% of all hospitals) were paid under the AIU option only. Small hospitals were less likely than large hospitals to qualify for incentive payments (odds ratio [OR] = 0.49, 95% confidence interval [CI] 0.36-0.68; $P < .001$ across categories). Critical Access hospitals also had lower odds of incentive payment (OR = 0.69, 95% CI 0.57-0.84, $P < .001$). Safety-net hospitals were more likely to qualify for payments overall (OR = 2.51; 95% CI 1.92-3.38, $P < .001$), but did so primarily through AIU.

Conclusions: There is broad participation in the federally led incentive program to promote nationwide EHR uptake. Lower rates of participation among smaller hospitals and Critical Access hospitals merit close monitoring to ensure that broad adoption is achieved.

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Take-Away Points

- The federal government is providing financial incentives to hospitals to encourage adoption and use of electronic health records (EHRs). The level of participation in the incentive program overall and by key groups of hospitals is not widely known.
- We found broad engagement, with more than three-fourths of hospitals receiving incentive payment. Further, most hospitals that attested to meeting federal meaningful use criteria went well beyond the minimum required thresholds and were using their EHRs broadly for all patients.
- Key policy challenges that remain include bringing small, Critical Access hospitals along and helping safety-net institutions transition to achieving meaningful use.

ferences in the kinds of hospitals receiving the incentives, are critically important.

To address this gap, we use data from the Centers for Medicare & Medicaid Services (CMS), the agency administering the EHR Incentive Programs, to answer 4 questions: (1) What proportion of US hospitals have qualified for incentive payments through the programs, and how many of these hospitals were capable of qualifying prior to the programs? (2) Are certain types of hospitals, specifically small, Critical Access or safety-net institutions, less likely to receive payments compared with other institutions? (3) To what extent are safety-net institutions opting for the AIU approach to receive payments? (4) And finally, to what extent are the meaningful use criteria serving as a minimum for EHR use or are hospitals going beyond the basic requirements to widely use EHR functionalities for all their patients? Our findings offer a comprehensive examination of national data on the implementation of HITECH through 2012, with a focus on how incentives are being distributed across US hospitals.

METHODS

Data and Sample

Data on hospital participation in the first stage⁶ of the EHR Incentive Programs as of December 31, 2012, came from CMS and were made available to our research team through the Office of the National Coordinator (ONC) for Health Information Technology at the Department of Health and Human Services. This provided unique access to the list of hospitals that qualified for payment under AIU and Medicaid Stage 1 meaningful use, which is not publicly released along with hospitals that have attested to Stage 1 meaningful use under Medicare. AIU-eligible hospitals are acute care hospitals with at least 10 percent Medicaid patient volume and children's hospitals; to receive AIU payment, eligible hospitals must adopt, implement, or upgrade a certified EHR technology during the first year of participation in the program.

The CMS data also included the specific meaningful use criteria met by attesting hospitals, and the level of achievement for each of those criteria. Meaningful use criteria come

in 2 varieties: the first type requires that the EHR perform specific tasks (ie, dichotomous measures), such as having the capability to exchange clinical data electronically. The second type, which is more common, focuses on broad-based clinical use of specific functions and is reported as a continuous variable, with the meaningful use criteria specifying a threshold that has to be achieved

to receive credit. For example, the criterion for computerized provider order entry (CPOE) for medications requires that medications are ordered electronically for at least 30% of patients in a hospital.⁶

We used the Medicare-certified list of 4938 hospitals to identify hospitals eligible for, but not participating in, the incentive program. We assigned characteristics to hospitals based on their responses to the 2011 American Hospital Association (AHA) survey. We obtained hospital financial data, including each institution's Disproportionate Share (DSH) Index, from Medicare Cost Reports, which are publicly available for nearly all Medicare-eligible hospitals. When we merged the sources of data, 275 hospitals (5.6%) were missing 1 or more characteristics, resulting in an analytic sample of 4663 hospitals ([Appendix Table 1](#)).

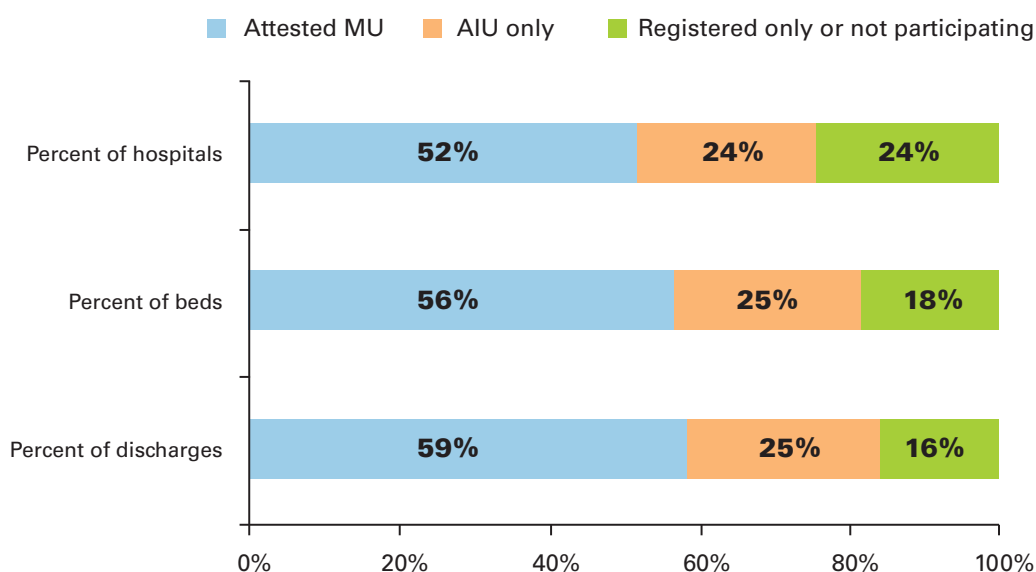
Measures

Outcome Measures. We classified hospitals into 1 of 3 mutually exclusive groups: (1) hospitals that attested to Stage 1 meaningful use under the Medicare or Medicaid EHR Incentive Program; (2) hospitals that chose to follow the AIU option; and (3) all remaining Medicare-certified hospitals, including those that registered for the incentive program but did not qualify for payment, as well as those that have not engaged with the program in any form. If a hospital attested to meaningful use as well as qualified for AIU payment (which is allowed under the program), we categorized it in the attested group (Group 1). To assess the proportion of Group 1 hospitals that appeared to be close to attaining (or perhaps had already attained) Stage 1 meaningful use prior to the program period, we leveraged prior work to define and determine which hospitals met a meaningful use proxy measure using mid-2010 data from the AHA Information Technology Supplement.⁷

We also examined the degree of sophistication of EHR use among attesting hospitals (Group 1). For the subset of meaningful use criteria that are measured on a continuous scale, we focused on the degree of deployment of these meaningful use functionalities to determine whether hospitals did just enough to meet the thresholds or whether they deployed these electronic functionalities widely across the institution.

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■ **Figure.** Overview of Hospital Participation in Medicare and Medicaid Electronic Health Record Incentive Program



Source: ONC analysis of data from CMS EHR Incentive Program.

AIU indicates Adopt-Implement-Upgrade; MU, meaningful use.

Attested MU excludes hospitals that attested to meaningful use in Medicaid program but not yet paid.

We defined a “sophisticated” hospital as one that met all 5 dichotomous criteria and the 9 continuous criteria at least 90% of the time in the reporting period. We also examined which hospitals were able to achieve the medication CPOE measure, arguably one of the hardest criteria, for at least 90% of patients.

Hospital Characteristics. Because pre-HITECH data found that small hospitals in general, and Critical Access hospitals (CAHs) in particular, were less likely to have EHRs,⁴ we were interested in assessing the degree to which these institutions were receiving incentives. In addition, safety-net institutions—those with a high DSH Index—were also less likely to have adopted EHR systems, due in part to greater difficulty accessing required capital.³ Therefore, we sought to assess whether these institutions were receiving incentives at the same rate as non-safety-net hospitals.

We examined an additional set of hospital characteristics, either because prior data suggest that they are associated with differential EHR adoption or because they are of policy interest. These characteristics included ownership (for-profit, non-profit private, or public), teaching status, whether the hospital was affiliated with a system, whether the hospital was part of a system that offered a health maintenance organization (HMO) product, geographic location (urban/rural and region), and 3 dimensions of financial health (operating margin, capitalization, liquidity). Financial variables were calculated using an approach⁸ that captures financial health over a 3-year period (2007-2009) to best reflect the ability of hospitals to

invest in IT systems at the start of HITECH.

Analysis. We first examined the proportion of hospitals (and associated proportion of discharges and of beds) that attested to Stage 1 meaningful use, met AIU only (ie, did not attest), and were not participating. We then examined the bivariate relationships between these 3 groups and the hospital characteristics of interest. We subsequently built multivariable logistic regression models to identify the independent associations between each characteristic and our 4 outcomes of interest: hospitals that qualified for incentives versus those that did not, hospitals that attested to meaningful use versus those that chose AIU (among those that qualified for incentives), and 2 measures of sophistication. Finally, we generated descriptive statistics that reflect the distribution of hospital achievement for each of the 9 continuous meaningful use criteria.

RESULTS

Hospital Participation in the EHR Incentive Programs

We found that 75.5% of eligible US hospitals qualified for payments under the federal EHR incentive programs through the end of 2012. Just over half of all hospitals qualified for incentive payment because they had attested to Stage 1 meaningful use (2512 hospitals, or 52% of all hospitals, representing 56% of beds and 59% of all discharges, **Figure**). An additional 24% of hospitals (1141 hospitals, representing 25% of beds and discharges) qualified for payment under the

■ **Table 1.** Hospital Characteristics by Type of Participation in EHR Incentive Programs

Hospital Characteristic	Qualified for Incentive Payment			P
	Attested MU ^a (N = 2512) ^b	AIU Only (N = 1141) ^b	No Payment (N = 1185) ^b	
Primary Characteristics of Interest				
Size				<.001
Small (<100 beds)	49%	20%	31%	
Medium (100-399 beds)	55%	28%	18%	
Large (400+ beds)	58%	24%	18%	
Critical Access Hospital				<.001
Yes	50%	18%	32%	
No	53%	26%	22%	
Safety-Net Status				<.001
Quartile 1 (Low DSH)	50%	15%	35%	
Quartile 2	54%	24%	22%	
Quartile 3	53%	27%	21%	
Quartile 4 (High DSH/Safety Net)	53%	29%	19%	
Other Hospital Characteristics				
Ownership				.002
Not-for-profit	52%	25%	23%	
For-profit	49%	25%	26%	
Public	53%	20%	27%	
Teaching				<.001
Major or minor teaching	50%	26%	25%	
Non-teaching	49%	21%	31%	
System Membership				<.001
Yes	52%	28%	20%	
No	52%	19%	29%	
HMO Product Offered				<.001
Yes	51%	23%	25%	
No	55%	27%	18%	
Metropolitan Status				.003
Metro	52%	25%	23%	
Non-metro	52%	22%	26%	
Region				<.001
Northeast	59%	23%	18%	
Midwest	52%	23%	25%	
South	55%	24%	22%	
West	43%	24%	32%	
	Mean (SD)	Mean (SD)	Mean (SD)	P
Financial Status				
Margin (%)	2.9 (12.6)	-4.8 (13.2)	2.5 (47.7)	.006
Liquidity	32.716 (1478)	2.2 (5.8)	2.471 (4.2)	.63
Capitalization	0.46 (3.51)	0.42 (1.14)	0.44 (1.03)	.90

AIU indicates adopt-implement-upgrade; DSH, disproportionate share hospital; EHR, electronic health record; HMO, health maintenance organization; MU, meaningful use; SD, standard deviation.
^aExcludes hospitals attested for MU in Medicaid program but not yet paid.
^bEligible hospitals identified using Medicare certified list (n = 4938); 94.4% had complete AHA and Medicare Cost Report data.

AIU path. Approximately 1 in 4 hospitals (1185 or 24% of hospitals, representing 18% of beds and 16% of discharges) did not participate. Among the 1573 hospitals attesting to Stage 1 meaningful use for which the meaningful use proxy measure was available, 93% (1468 hospitals) did not meet

the proxy measure in 2010 (ie, appeared to be a “new” meaningful user) and the remaining 7% (105 hospitals) were at least capable of meeting Stage 1 meaningful use prior to the incentive program.

Characteristics of Hospitals Qualifying for Incentive

Payments. In bivariate analyses, we found important differences between hospitals that attested to meaningful use, those that chose AIU, and those that did not participate. Consistent with our hypothesis, we found that small hospitals were less likely than large hospitals to have qualified for payment (69% vs 82%, *P* value for differences across groups <.001, **Table 1**). Similarly, we found that CAHs were less likely to have qualified for payment than non-CAHs (68% vs 79%, *P* <.001 across categories). Most of this difference was due to lower rates of AIU (18% among CAHs compared with 26% among non-CAHs, *P* <.001). We found no evidence that safety-net hospitals (those in the highest DSH quartile) were less likely to receive incentives under HITECH. In fact, safety-net hospitals had substantially higher rates of incentive payment compared with hospitals with the lowest DSH index (82% versus 65%, *P* value for differences across the 4 quartiles <.001), which was driven by higher AIU participation.

In multivariate models that adjusted for our set of hospital characteristics, we found similar results. Small hospitals had less than half the odds of qualifying for incentives compared with large institutions (OR = 0.49, 95% CI 0.36-0.68 for small, *P* <.001 across categories, **Table 2**). Even when taking size into account, we found that CAHs were less likely to have received incentives compared with non-CAHs (OR = 0.69, 95% CI 0.57-0.84, *P* <.001). In contrast, safety-net hospitals had more than twice the odds of receiving incentives compared with hospitals in the lowest quartile of DSH (OR = 2.51, 95% CI 1.92-3.28), and odds increased for each DSH quartile (*P* <.001 across all categories).

Characteristics of Hospitals That Attested to Mean-

■ **Table 2.** Predictors of Hospital Participation in the Medicare and Medicaid EHR Incentive Program

	Qualified for Incentive Payment (Attested to Meaningful Use or Adopt-Implement-Upgrade) N = 4663	
	Odds Ratio (95% CI)	<i>P</i>
Primary Characteristics of Interest		
Size		
Small (<100 beds)	0.49 (0.36-0.68)	
Medium (100-399)	0.94 (0.70-1.26)	<.001
Large (400+)	Reference	
Critical Access Status		
Non-Critical Access Hospital	Reference	<.001
Critical Access Hospital	0.69 (0.57 - 0.84)	
Disproportionate Share^a		
First Quartile (Lowest DSH)	Reference	<.001
Second Quartile	1.79 (1.40-2.29)	
Third Quartile	1.95 (1.52-2.51)	
Fourth Quartile (Highest DSH/Safety Net)	2.51 (1.92-3.28)	
Other Hospital Characteristics		
Financial Status		
Margin	0.97 (0.83-1.14)	.735
Liquidity	1.01 (0.99-1.02)	.292
Capitalization	1.00 (0.97-1.03)	.876
Ownership		
Not-for-profit	Reference	
For-profit	0.94 (0.77-1.16)	.027
Public	1.26 (1.05-1.51)	
Teaching		
Non-teaching	Reference	
Teaching	0.92 (0.75-1.12)	.397
Multi-Hospital System	1.59 (1.37-1.85)	<.001
HMO Product Offered	1.27 (1.00-1.62)	.048
Metropolitan Status		
Non-metro	1.36 (1.14-1.63)	<.001
Region		
Northeast	Reference	
Midwest	0.74 (0.56-0.96)	<.001
South	0.74 (0.57-0.96)	
West	0.43 (0.33-0.57)	
CI indicates confidence interval; DSH, disproportionate share hospital; EHR, electronic health record; HMO, health maintenance organization.		
^a Odds ratios for quartiles of disproportionate share come from a separate logistic regression model that excludes the Critical Access hospital measure due to collinearity with Critical Access hospitals.		

ingful Use Versus Adopt-Implement-Upgrade. Among the 75% of hospitals that qualified for incentives, the key difference between those that attested to meaningful use versus those that met AIU was safety-net status. Hospitals in the highest DSH quartile had 42% lower odds of having attested to meaningful use compared with having chosen AIU (OR = 0.58, 95% CI 0.44-0.75, **Table 3**). The middle 2 quartiles of

Table 3. Predictors of Type of Hospital Participation in the Medicare and Medicaid EHR Incentive Program (Attestation to Meaningful Use vs Adopt-Implement-Upgrade)

	Attested to Meaningful Use vs Adopt-Implement-Upgrade N = 3556	
	Odds Ratio (95% CI)	P
Primary Characteristics Of Interest		
Size		
Small (<100 beds)	0.83 (0.61-1.13)	
Medium (100-399)	0.80 (0.61-1.03)	.227
Large (400+)	Reference	
Critical Access Hospital	1.21 (0.97-1.50)	.091
Disproportionate Share^a		
First Quartile (Lowest DSH)	Reference	<.001
Second Quartile	0.70 (0.54-0.91)	
Third Quartile	0.61 (0.47-0.79)	
Fourth Quartile (Highest DSH/Safety Net)	0.58 (0.44-0.75)	
Other Hospital Characteristics		
Financial Status		
Margin	2.56 (1.44-4.57)	.001
Liquidity	1.01 (1.00-1.03)	.060
Capitalization	1.00 (0.98-1.02)	.865
Ownership		
Not-for-profit	Reference	
For-profit	1.03 (0.84-1.27)	.866
Public	1.05 (0.86-1.29)	
Teaching		
Non-teaching	Reference	
Teaching	0.83 (0.69-1.01)	.060
Multi-Hospital System	0.71 (0.60-0.83)	<.001
HMO Product Offered	0.98 (0.79-1.21)	.835
Metropolitan Status		
Non-metro	1.02 (0.85-1.23)	.825
Region		
Northeast	Reference	
Midwest	0.82 (0.64-1.05)	<.001
South	0.88 (0.69-1.13)	
West	0.60 (0.46-0.78)	

CI indicates confidence interval; DSH, disproportionate share hospital; EHR, electronic health record; HMO, health maintenance organization.
^aOdds ratios for quartiles of disproportionate share come from a separate logistic regression model that excludes the Critical Access hospital measure, which was collinear with non-disproportionate share hospitals.

DSH had similarly lower odds of having attested to meaningful use versus having chosen AIU (OR = 0.61, 95% CI 0.47-0.79 for quartile 3 and 0.70, 95% CI 0.54-0.91 for quartile 2; *P* <.001 across the 4 quartiles). We did not find systematic differences in whether hospitals qualified for incentives under meaningful use or AIU based on size or Critical Access status (Table 4).

Sophistication of Meaningful Use. Among the 52% of

hospitals that attested to meaningful use, the majority substantially exceeded the minimum threshold for each of the continuous criteria (Table 4). For example, although meaningful use requires medication CPOE to be used for at least 30% of patients, median adherence was 92% with an interquartile range of 74% to 99%. Similarly, for the 5 measures requiring a 50% threshold, median adherence was above 95%, ranging from 96% for vital signs to 100% for electronic copy of health information and discharge instructions.

The only characteristic that distinguished sophisticated meaningful users from those that attested but did not at least achieve 90% use for all criteria was whether the hospital was part of a system that offered an HMO product (OR = 1.33, 95% CI 1.02-1.74, *P* = .038, Appendix Table 2). When we examined medication CPOE sophistication alone, we again found that offering an HMO product was associated with at least 90% use (OR = 1.39, 95% CI 1.08-1.78, *P* = .01). We also found that for-profit hospitals were less likely to be a sophisticated CPOE user compared with not-for-profit hospitals (OR = 0.65, 95% CI 0.51-0.83, Appendix Table 3). We did not find differences on either measure of sophistication for our 3 characteristics of interest: size, CAH, and safety-net status.

DISCUSSION

In an early examination of the Medicare and Medicaid EHR Incentive Programs, the centerpiece of the HITECH Act, we found that more than 3 in 4 hospitals are participating, and that more than half have achieved Stage 1 meaningful use. While small hospitals in general and Critical Access hospitals in particular are less likely to have received incentives, the vast majority of both groups are

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■ **Table 4.** Adherence to Meaningful Use Criteria Among Attesting Hospitals: Summary Statistics

Criterion	Min to Meet Criteria	N	Mean (SD)	Median (IQR)	Minimum	Maximum
CPOE for Medication Orders	30%	2511	84% (18%)	92% (74%-99%)	30%	100%
Maintain Problem List	80%	2511	95% (5%)	97% (92%-100%)	80%	100%
Active Medication List	80%	2511	98% (4%)	99% (97%-100%)	80%	100%
Medication Allergy List	80%	2511	98% (3%)	99% (97%-100%)	80%	100%
Record Demographics	50%	2511	96% (6%)	99% (97%-100%)	51%	100%
Record Vital Signs	50%	2511	92% (9%)	96% (89%-99%)	50%	100%
Record Smoking Status	50%	2497	93% (9%)	97% (90%-99%)	50%	100%
Electronic Copy of Health Information	50%	842	96% (9%)	100% (100%-100%)	54%	100%
Electronic Copy of Discharge Instructions	50%	919	95% (10%)	100% (96%-100%)	52%	100%

CPOE indicates computerized provider order entry; IQR, interquartile ratio; SD, standard deviation.

We do not include in the table the 5 meaningful use criteria that are dichotomous (yes/no) that were met by all attesting hospitals—drug interaction checks, clinical decision support, health information exchange, clinical quality measures, and protect electronic health information. Number of observations vary due to exclusions and optional (“menu”) measures.

participating in the program, and half had attested to meaningful use. Further, we found that safety-net hospitals were as or even more likely to qualify for incentives. Taken as a whole, our study finds little evidence for the concern that the HITECH Act will give additional resources to well-heeled hospitals that already have EHRs while setting up struggling institutions to be penalized later. While differences exist in who is receiving incentive payments and who is not, overall the incentives seem to be flowing to a broad swath of US hospitals.

Any federal incentive program that rewards hospitals for adopting and using an expensive technology such as EHRs while penalizing those who do not (which HITECH will do starting in 2015) runs the risk of worsening the gap between wealthy and poor hospitals. Indeed, evidence prior to HITECH suggested that there were important differences in EHR adoption based on size, Critical Access status, and safety-net status.^{4,9} Based on this concern, federal policy makers created a more flexible path to incentives, the AIU approach, which provides upfront capital to hospitals that are working toward achieving meaningful use. Our findings suggest that

safety-net hospitals are availing themselves of this path, using it far more often than other institutions. Other groups of hospitals that were expected to struggle to achieve meaningful use, in particular small hospitals and CAHs, are attesting at similar rates to other institutions.

In addition, hospitals attesting to meaningful use are not simply doing the minimum necessary to receive the incentives; instead, the vast majority of patients in these hospitals are being cared for using EHRs. For policy makers, this finding should offer reassurance that they selected thresholds that were achievable. It also suggests that an approach of gradually raising the threshold may not be necessary, and future criteria could instead focus on new uses of EHRs that may deliver greater improvements in both the quality and costs of care.

As policy makers plan for future stages of the EHR incentive programs, our findings point to challenges that lie ahead. First, although small hospitals and CAHs are only modestly behind, the gap has the potential to widen as the program matures. If a subset of smaller, Critical Access hospitals take longer or fail to meet Stage 1 altogether, the financial penalties slated to begin in 2015 could make EHR adoption even more

difficult for these institutions. The challenge for safety-net institutions is somewhat different. Although they are faring well under the incentive program, whether those that have gone down the AIU path will be able to transition to becoming meaningful users on the accelerated timeline is unclear and will need to be closely tracked.

Our study contributes to the growing body of work examining the impact of HITECH on EHR adoption. During the first year of HITECH, DesRoches et al found that 26.6% of hospitals had adopted at least a basic EHR and 18.4% of hospitals could meet a proxy measure of meaningful use.⁴ They also found evidence of a digital divide with small, nonteaching, and rural hospitals adopting EHRs to a lesser extent than other types of hospitals. Compared with these data, our results suggest substantial progress. We found that in the year prior to the onset of incentives, only 7% of hospitals that eventually attested could meet the criteria for meaningful use. In the past 2 years, ONC released a report on EHR adoption trends over time,¹⁰ and CMS has issued monthly reports that include the number of hospitals that have received payment under the EHR Incentive Programs.¹¹ More detailed data from the Government Accountability Office in 2011 reported many of the same bivariate relationships that we observed (eg, higher participation among larger hospitals).^{12,13} Our study extends this literature in several ways—by examining the full set of hospitals that qualified for incentive payments under both the attestation and AIU approaches, by assessing whether key types of hospitals are falling behind, and by reporting the degree to which hospitals attesting to meaningful use are going beyond the basic thresholds required by the criteria.

Our study has important limitations. First, we were unable to assess where hospitals that did not participate in the program stood with respect to EHR adoption. It may be that these hospitals have responded, but not quickly enough to have qualified for an incentive payment through 2012, and that over the next year they will catch up to their larger and better-resourced counterparts. Alternatively, given the persistence of a digital divide in other measures of EHR adoption, these non-participating small hospitals and CAHs may still have substantial work ahead to qualify for incentives.⁴ Second, we were unable to definitively differentiate which hospitals adopted EHRs or achieved meaningful use specifically in response to the incentives, and which hospitals had already done so or would have done so without the incentives. We therefore are not certain about the extent to which HITECH is driving EHR adoption or the achievement of meaningful use. However, electronic functionalities that have been adopted most quickly over the past 2 years are those required for meaningful use, suggesting that the pro-

gram is likely playing an important role.¹⁰ Finally, our findings reflect achievement of the first stage of a 3-part program. Upcoming stages of meaningful use are expected to be more challenging and our results may not predict how hospitals will fare.

In summary, we examined the uptake of the federal incentive program designed to achieve widespread adoption and use of electronic health records across US hospitals. Our findings show broad engagement, with more than three-fourths of hospitals qualifying for incentives. Further, among the half of all hospitals that attested to meeting meaningful use through 2012, most were able to go well beyond the minimum required threshold. However, key policy challenges remain, including bringing small, Critical Access hospitals along and helping safety-net institutions transition to achieving meaningful use. Meeting these challenges will be critical to ensuring that all Americans, regardless of where they are treated, receive high-quality care.

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■ **Appendix Table 1.** Characteristics of Included and Excluded Hospitals

	(1)	(2)	(3)	
	Analytic Sample: All Data Available N = 4663	Missing Medicare Cost Report Data N = 175	Missing AHA Data N = 100	P for (1) versus (2)
Size				
Small (<100 beds)	49%	71%	—	<.001
Medium (100-399)	41%	26%	—	
Large (400+)	10%	3%	—	
Critical Access Hospital	28%	14%	—	<.001
Disproportionate Share^b				
First Quartile (Lowest DSH)	25%	46%	—	<.001
Second Quartile	25%	5%	—	
Third Quartile	25%	7%	—	
Fourth Quartile (Highest DSH/ Safety Net)	25%	42%	—	
Financial Status				
Margin	0.02	—	—	—
Liquidity	18.28	—	—	—
Capitalization	0.45	—	—	—
Ownership				
Not-for-profit	59%	52%	—	.16
For-profit	18%	19%	—	
Public	23%	29%	—	
Teaching				
Non-teaching	75%	67%	—	.015
Teaching	25%	33%	—	
Multi-Hospital System	54%	67%	—	<.001
HMO Product Offered	12%	12%	—	.889
Metropolitan Status				
Non-metro	43%	30%	—	.001
Region				
Northeast	13%	6%	—	<.001
Midwest	38%	32%	—	
South	30%	13%	—	
West	19%	49%	—	

AHA indicates American Hospital Association; DSH, disproportionate share hospital; HMO, health maintenance organization.

■ **Appendix Table 2.** Predictors of Sophisticated^a Meaningful Use Among Attesting Hospitals: All Criteria

	Sophisticated on All Core Criteria N = 2444	
	Odds Ratio (95% CI)	P
Primary Characteristics of Interest		
Size		
Small (<100 beds)	1.25 (0.84-1.88)	
Medium (100-399)	1.14 (0.81-1.60)	.532
Large (400+)	Reference	
Critical Access Hospital	1.19 (0.91-1.55)	.216
Disproportionate Share^b		
First Quartile (Lowest DSH)	Reference	.700
Second Quartile	0.90 (0.66-1.22)	
Third Quartile	0.93 (0.68-1.27)	
Fourth Quartile (Highest DSH/Safety Net)	0.82 (0.59-1.14)	
Other Hospital Characteristics		
Financial Status		
Margin	0.92 (0.44-1.91)	.813
Liquidity	1.00 (0.99-1.02)	.772
Capitalization	1.02 (0.95-1.10)	.525
Ownership		
Not-for-profit	Reference	
For-profit	0.93 (0.70-1.22)	.235
Public	0.80 (0.62-1.04)	
Teaching		
Non-teaching	Reference	
Teaching	1.02 (0.79-1.32)	.856
Multi-Hospital System	0.93 (0.75-1.14)	.466
HMO Product Offered	1.33 (1.02-1.74)	.038
Metropolitan Status		
Non-metro	0.84 (0.66-1.06)	.137
Region		
Northeast	Reference	
Midwest	1.29 (0.94-1.77)	.207
South	1.37 (1.02-1.89)	
West	1.19 (0.83-1.71)	
DSH indicates disproportionate share hospital; HMO, health maintenance organization.		
^a Defined as 90% or higher compliance with meaningful use measure.		
^b Odds ratios for quartiles of disproportionate share come from a separate logistic regression model that excludes the Critical Access hospital measure, which was collinear with non-disproportionate share hospitals.		

■ **Appendix Table 3.** Predictors of Sophisticated^a Meaningful Use Among Attesting Hospitals: CPOE

Sophisticated on CPOE for Medication Orders Criteria N = 2444		
	Odds Ratio (95% CI)	P
Primary Characteristics of Interest		
Size		
Small (<100 beds)	1.32 (0.93-1.87)	
Medium (100-399)	1.14 (0.84-1.53)	.264
Large (400+)	Reference	
Critical Access Hospital	1.10 (0.87-1.39)	.435
Disproportionate Share^b		
First Quartile (Lowest DSH)	Reference	.863
Second Quartile	0.90 (0.69-1.18)	
Third Quartile	0.94 (0.71-1.24)	
Fourth Quartile (Highest DSH/Safety Net)	0.90 (0.67-1.20)	
Other Hospital Characteristics		
Financial Status		
Margin	1.27 (0.66-2.43)	.478
Liquidity	1.00 (0.99-1.01)	.856
Capitalization	1.03 (0.98-1.07)	.283
Ownership		
Not-for-profit	Reference	
For-profit	0.65 (0.51-0.83)	.003
Public	0.92 (0.74-1.15)	
Teaching		
Non-teaching	Reference	
Teaching	1.16 (0.92-1.45)	.203
Multi-Hospital System	0.97 (0.81-1.17)	.770
HMO Product Offered	1.39 (1.08-1.78)	.010
Metropolitan Status		
Non-metro	0.86 (0.70-1.06)	.150
Region		
Northeast	Reference	
Midwest	1.16 (0.89-1.51)	.343
South	1.26 (0.97-1.64)	
West	1.24 (0.92-1.69)	

CPOE indicates computerized provider order entry; DSH, disproportionate share hospital; HMO, health maintenance organization.

^aDefined as 90% or higher compliance with meaningful use measure.

^bOdds ratios for quartiles of disproportionate share come from a separate logistic regression model that excludes the Critical Access hospital measure, which was collinear with non-disproportionate share hospitals.