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Meaningful use: Floor or ceiling?

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ABSTRACT

Background: In 2011, federal incentive payments for meaningful use of electronic health records (EHRs) began. This study evaluates the impact of the program on hospitals and EHR vendors, identifying how it affects EHR planning and development. Specifically, it assesses whether vendors and Chief Information Officers (CIOs) are viewing the meaningful use requirements as a floor – the minimally acceptable level of implementation, upon which development continues – or as a ceiling – the upper-bound on EHR development and implementation.
Methods: The study combines interviews with EHR vendors and hospital CIOs with EHR adoption data from American Hospital Association surveys. Results from interviews with 17 hospital and system CIOs (representing 144 individual acute-care hospitals) and 8 EHR development executives (representing two-thirds of installations) are detailed. Furthermore, it compares adoption of two key EHR functions, BCMA and CPOE, which are treated differently under stage 1 of the incentive program.
Results: Three key findings emerge from the study. First, meaningful use requirements can serve as either a floor or a ceiling, depending on the abilities of institutions implementing EHRs. Second, the increasing focus on achieving meaningful use across both hospitals and vendors risks missing the forest of health care system change through the trees of meeting discrete requirements. Third, while the meaningful use incentive program has accelerated the development and implementation of some key functions, it has also slowed development of others.
Conclusions: Policy makers should craft subsequent stages of the incentive program to ensure smaller facilities and additional features necessary for health care system change are not left behind.
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1. Introduction

The introduction of federal incentive program for health information technology has served as a powerful motivating force, driving adoption of comprehensive electronic health records (EHRs) across the United States.[1] The program, which provides financial reimbursement for hospitals demonstrating their adoption and "meaningful use" of certified EHR systems, takes a step-by-step approach toward its goal of ensuring that the vast majority of US hospitals use comprehensive electronic systems by 2020.

In 2011, the Centers for Medicare and Medicaid Services (CMS) allowed hospitals to begin to attest to successful achievement of the stage 1 requirements and by February of 2013 it was clear that CMS had greatly exceeded its goals. Among hospitals, nearly 4300 have registered for stage 1 of the incentive program, receiving over $8 billion in payments. Research by DesRoches et al. and others suggests that the meaningful use incentive program has been successful at increasing the number of hospitals pursuing comprehensive EHR adoption, but overall adoption is still progressing slowly, particularly in small, rural, and non-teaching hospitals.[1]

To date, Jha et al., Desroches et al. and others have highlighted the extent of comprehensive EHR adoption and important variations in adoption by key hospital characteristics. But little has been done to find variations in which functions hospitals are adopting and how hospitals are choosing which functions to adopt. Furthermore, within the Health IT (HIT) industry we know little about how vendors and Chief Information Officers (CIOs) have responded to the meaningful use incentives in their planning and development. Given the significant effort required to meet the requirements set forth in stages 1 and 2 of the meaningful use incentive program, policy makers should be aware of whether vendors and CIOs are viewing the meaningful use requirements as a floor – the minimally acceptable level of implementation, upon which they will continue development and customization – or as a ceiling – the upper-bound on their EHR development and implementation efforts.

2. Study data and methods

This study uses a mixed-methods approach, combining semi-structured interviews with EHR vendors and hospital CIOs from

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across the United States with EHR function adoption data from American Hospital Association surveys. The quantitative analysis compares the adoption rates over time of two distinct functions with the shared goal of preventing medication errors – bar code medication administration (BCMA) and computerized physician order entry (CPOE). The two elements vary in their cost, time to implement, and their status with regards to meaningful use requirements. CPOE is the more expensive and time-intensive of the two, with estimates for cost and time of adoption placing the figures at approximately $34,000 in 5-year costs per bed[2–4] and 1–4 years per facility.[4,5] BCMA adoption, by contrast, is estimated at averages of $3000 per bed[6–8] and 4–6 months per facility.[8] While CPOE is included as a core function in stage 1 of meaningful use, BCMA was not required (or listed as a menu item). This provides an opportunity to track the growth rates of adoption of the two functions, which prior to the release of the stage 1 requirements held similar levels of support among HIT experts when evaluating clinical benefits.[3,9,10] Prior to beginning analysis, our hypothesis was that the rate of CPOE adoption increased and the rate of BCMA adoption decreased after the release of meaningful use stage 1 criteria.

2.1. Quantitative component – data collection

2.1.1. American Hospital Association annual surveys and health IT supplemental – 2008–2011

During March–September of 2007–2010, the American Hospital Association surveyed all acute care hospitals about their health IT activities. A paper copy of the survey was sent to each hospital's chief executive officer, who asked the person most knowledgeable about the hospital's health IT efforts to complete it. Response rates varied from a low of 58% of all acute-care hospitals in 2011 to a high of 69% in 2009.

Following the methods laid out in Jha et al. I measure adoption of specific EHR functions in each hospital.[12] A function is counted as adopted by a given hospital in a given year if the hospital responded to the corresponding question in the AHA survey by stating that the function or analogous capability was fully implemented in one or more units. Analyses were conducted at both the 95% and 90% confidence levels. We find that all differences in time series results within the same category (e.g. within BCMA, the difference in adoption rate between 2009 and 2010) are significant at the 95% confidence level. Differences across categories (BCMA in 2009 vs CPOE in 2009) are not significant at the 95% confidence level, but are significant at the 90% confidence level. Results were estimated using both weighted and unweighted models, and there were no significant differences between methods. To demonstrate overall penetration, results weighted by number of beds are included below. Quantitative data was analyzed using the Stata statistical software (Version 11).

2.2. Qualitative component

To select hospitals to contact, we adopted a stratified sampling approach. All United States acute-care hospitals were grouped by size according to AHA definitions, and then randomized within those categories. When hospitals selected were part of a hospital system, we attempted to speak with both the hospital-level official responsible for implementation as well as the system-level official responsible. 15 Hospitals each from the small, random, and large categories (45 hospitals total) were contacted. CIOs from 17 hospitals and hospital systems agreed to participate. 45-minute semistructured interviews were conducted over the telephone and in person with the Chief Information Officer (CIO) or equivalent senior staff member directly responsible for EHR adoption decision-making at 17 hospital systems and independent hospitals, representing a total of 144 individual acute-care hospitals.[b] Respondents were responsible for a mix of small, medium and large facilities in urban and rural locations as well as a mix of for-profit and not-for-profit, and teaching and non-teaching facilities. Hospital CIO interviews included open-ended questions about how hospitals decided when to adopt EHRs, which functions they chose to adopt, and how stages 1 and 2 of the meaningful use regulations affected their decision-making (Table 1).

Table 1
Characteristics of the 144 hospitals represented by respondents.

Characteristic	Mean number/ percent
Number of beds	283
Teaching status	
Teaching hospitals	35%
Non-teaching hospitals	65%
Location	
Rural	28%
Urban	72%
Profit status	
Not-for-profit	52%
For-profit	48%
Geographic region	
Midwest	18%
Northeast	25%
South/southeast	55%
West	2%
Hospital system membership	
System member	96%
Unaffiliated	4%
Hospital size[a]	
Small	35%
Medium	36%
Large	29%

[a] AHA hospital size definitions: small: 99 beds or fewer; medium: 100–399 beds; large: 400 beds or more.

To identify subjects for EHR vendor interviews, we referenced HIMSS data measuring the top 10 EHR vendors by number of current hospital installations in 2012 and contacted the lead executive in charge of product development at each company. Representatives of all 10 leading hospital health IT vendors were contacted and 8 agreed to participate. According to HIMSS data, the 8 vendors contacted represent over two-thirds of all current hospital EHR installations. Vendor interviews included open-ended questions about how vendors made decisions on which functions to develop and improve, and how stages 1 and 2 of the meaningful use regulations affected their decision-making.

All interviews were conducted from December 2012 to March 2013. The authors conducted, transcribed, and coded all interview data using the qualitative research software ATLAS.ti (Version 6). To preserve anonymity, no identifying characteristics of the individuals contacted or the companies/hospitals they represent have been included here. All respondents, regardless of gender, are referenced using male pronouns to avoid identifying individual respondents. Data collection was approved by Harvard's Institutional Review Board (#F-22593-101) and appropriate confidentiality and data security procedures were followed.

[b] Of hospital respondents, 13 represented hospital systems and 4 represented individual hospitals.

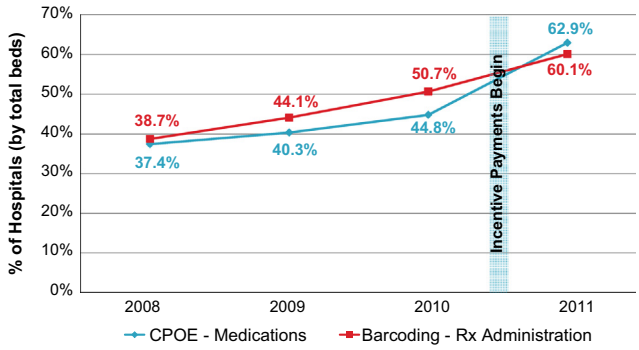

Fig. 1. Percentage of hospitals with function implemented in at least one unit.

3. Study results

The data suggest that large and medium-sized hospitals have made more progress than smaller facilities in their adoption of EHRs. Analysis of the specific functions adopted by hospitals, and discussions with vendors and CIOs reveal much more detail in terms of how decisions have been made, and what is motivating the development and inclusion of individual EHR functions.

When comparing the rates of adoption of CPOE and BCMA in Fig. 1, the influence of the stage 1 criteria begins to emerge. Adoption of medication barcoding progresses steadily from 2008 to 2011, increasing from about 39% in 2008 to just over 60% in 2011 – the first year when incentive payments were available. In contrast, CPOE adoption increased at a more gradual rate, reaching nearly 45% in 2010, but growing by nearly 20 percentage points in advance of incentive payments in 2011. This behavior is consistent with hospitals investing in CPOE in advance of the deadline to attest their compliance with stage 1 of the meaningful use regulations and receive incentive payments.[5] Hospitals required the addition of CPOE functionality to fulfill requirements, but did not cease adoption of additional features.

Qualitative interviews with hospital CIOs revealed multiple differences in hospital behavior depending on the size of facilities and the status of health IT implementation prior to pursuing meaningful use incentive payments.

4. Medium/large and urban hospitals

Among medium and large hospitals, most (94% of respondent facilities) had several EHR elements in place prior to the incentive program and sought to develop their EHR implementations beyond program requirements. In most cases, implementations prior to the release of the stage 1 criteria included some form of clinical documentation, clinical decision support, and BCMA. Meeting the stage 1 criteria most often (for 83% of respondent facilities) required adding CPOE to their existing installations and adjusting their data capture requirements to add new fields and adjust existing fields in accordance with the stage 1 criteria. For facilities planning to adopt CPOE, BCMA was often added alongside their stage 1 efforts as part of a comprehensive solution. With CPOE representing the "higher hurdle," the simultaneous implementation of medication barcoding infrastructure was seen as a beneficial complement with a relatively low marginal cost. As one CIO from a large urban facility noted, "we hadn't done CPOE – that was the only major element. Everything else was… getting the right fields in the right places." Respondents generally commented that the inclusion of CPOE in the meaningful use requirements led them to pursue its adoption sooner than they otherwise would have. "The goal became to attest and get the money as soon as possible," one CIO noted. "Meaningful use gave us the drive of this money as a motivating factor."

Inclusion in the stage 1 criteria helped CIOs convince clinical staff that the transition to CPOE would be worthwhile. With the external published standard indicating that CPOE would eventually be required to maintain Medicare and Medicaid reimbursement, motivating physicians became less of a challenge. "It has taken away some of the push-back you get from the clinical users," another CIO noted. "When you introduce changes into the lives of high-functioning clinicians, you're going to get push-back no matter what, but with the criteria published we don't have to spend as much time explaining the decision [to implement CPOE] as we would have."

CIOs noted several key challenges with their adoption procedures, including challenges in improving usability, limited options available for hospital specialties, and an inability to devote time to focusing on technology that would assist nursing staff. Usability issues were a common refrain when asking CIOs about challenges brought about by meeting stage 1 of meaningful use. CIOs pointed to two factors – limited willingness from vendors to make general usability improvements, and difficulty modifying order sets and structure reporting fields to improve the experience for clinical staff. As one CIO noted:

> The vendors quit working on usability factors – the things we had been asking for to make things work more smoothly, particularly for the doctors. If it wasn't for HITECH, we would have been doing this much more gradually, and it would have been much more measured.

For facilities with existing implementations, many CIOs also suggested that they altered development road maps, delaying improvements to existing functions to ensure stage 1 requirements were met. Several pointed to nursing documentation tools as future targets to improve care delivery, but have chosen to delay their efforts:

> We haven't revisited our nursing documentation, other than to tweak to… support CPOE, in over 10 years. We were so busy doing meaningful use that we didn't have time to look at nursing, and I think that's a shame…. we're not doing things that would be great for nurse productivity, like interfacing IV pumps and monitors into our system. It takes a lot of time and money, and we don't have that.

Additionally, hospitals with active specialty departments pointed to challenges in finding appropriate solutions to meet the unique challenges of specialty care. In particular, hospitals pointed to mental health, physical therapy, and surgery as areas where they found few appropriate solutions.

5. Small and rural hospitals

Among smaller facilities, transitioning to comprehensive electronic health records has come with a different outlook and its own unique set of challenges.[11] In many cases, meaningful use is seen as a ceiling – one which they will struggle to reach and keep pace with as subsequent stages increase requirements. As shown in Fig. 2 below, overall adoption of certified EHRs – those including CPOE – lags for small hospitals (those with fewer than 100 beds, according to AHA classifications) relative to large facilities (those with 400 or more beds). A smaller share of small hospitals possessed either CPOE or BCMA, but the trend of greater increased adoption of CPOE relative to BCMA in the last year prior to incentive payments held similarly.

CIOs of small hospitals suggested that, in most cases, incentive payments provided the impetus for their decision to adopt

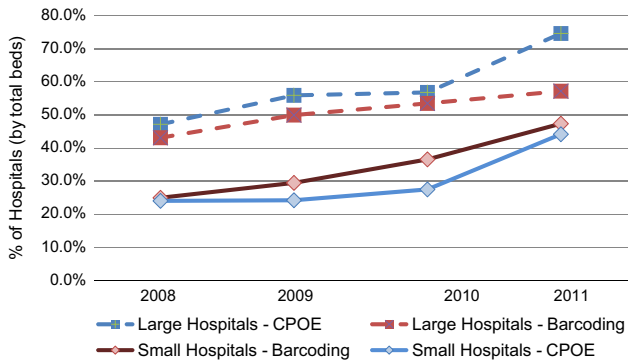

Fig. 2. CPOE and BCMA adoption over time, by hospital size.

comprehensive EHRs. While many had held preliminary discussions about clinical value and cost of implementation, CIOs contacted noted that they had neither the financial nor the staffing resources to implement comprehensive EHRs prior to the introduction of the incentive program and faced internal opposition among clinical staff as to their participation. Given the difficulty they faced in implementing any system at all, they focused predominantly on meeting the minimum threshold of what was required to receive incentive payments:

> I wear probably 4 or 5 hats here. I do pretty much whatever they throw at my desk. So trying to research the EHR companies, setting up meetings, buying all the equipment – nothing else got done. We concentrated solely on Meaningful Use.

Despite not receiving additional incentive payments for its installation or use, many small hospitals continued installing BCMA infrastructure, but our research suggests this occurred in instances when a comprehensive system was pursued, not when piecemeal components were adopted. In other words, when the incremental cost of adding BCMA was lowest, small hospitals carried out its implementation. When smaller hospitals would have to individually source and independently implement the technology, they were less likely to pursue it.

Difficulty persuading physicians to adjust their workflows to incorporate CPOE was a common theme among CIOs of smaller facilities. Many CIOs pointed to the fact that the majority of physicians practicing at their hospitals are not salaried by those facilities as a significant stumbling block when trying to persuade physicians to alter their workflow. Across all discussions, CIOs contended that adoption of EHRs in general, and CPOE in particular, was much less controversial among salaried clinicians, with whom facilities hold more authority. Without the powerful motivating force of hiring and firing ability, however, facilities have had little ability to cajole long-tenured physicians into entering their own orders.

Some placed the blame more squarely on a lack of familiarity with information technology in general. “I have an older physician staff that’s not computer savvy,” one CIO pointed out. “What do you do with people who can’t type?” These CIOs also noted that they expect this trend to change over time, as younger physicians with more experience and training in the use of EHRs specifically (and computers more generally) would lower the barriers to entry. For some rural facilities, workflow now includes a nurse accompanying each physician on rounds, personally assisting them with retrieving information from and entering orders on terminals across the facility. In other cases, physicians maintained their paper charting and nursing staff duplicated these efforts into electronic records, with both sets of records being maintained for at least the next several years.

6. Vendors

Discussions with vendors revealed an industry adjusting to new development incentives in the face of the meaningful use incentive program. Vendors now face a clear incentive to develop some functions which had previously gone ignored and no longer have as strong of a case for other functions excluded from the incentive payment requirements.

Vendors were unanimous in pointing to interoperability, public health reporting, and patient engagement tools as areas where function development was motivated inclusion in the incentive program. One vendor described the change in planning with respect to interoperability:

> As a development area [it] didn’t exist at all before stage 1 [in our company], and now it’s an area that is very, very busy in terms of our effort. Meaningful use forced our hand in terms of putting the financial incentives in place for us to do it.

Similarly, vendors were consistent in their statements that patient data interaction capabilities, which were originally later on their development road maps, were brought forward rapidly to meet stage 1 and 2 requirements. In particular, the abilities to deliver care summaries, for patients to view, download, and transmit their data, and patient portals with secure messaging capabilities were noted as areas where development was accelerated relative to initial planning.

Conversely, vendors pointed to several functions where development plans have been delayed. For example, precise abilities to dictate titrations at the point of order in CPOE functions and interfaces for devices such as automated infusion pumps have been requested by clients, but delayed because of limited development bandwidth. Vendors focusing on the large-hospital market pointed to additional areas of interest which have been deprioritized as both meaningful use and the transition to ICD-10 have dominated developer bandwidth. In particular, vendors suggested two areas where the business case for development was less evident, but for which they see significant need – long-term care (LTC) and shared-savings care models. The growth of long-term care as a key setting has dramatically increased the need for LTC-specific interfaces, but the lack of incentive payments and current interest from financially-strapped long-term care facilities makes development a risk. One large vendor specializing in hospital systems noted, “There’s a real need for it and right now we’re struggling to assess how to do it.”

Larger vendors also pointed to the IT needs of shared-savings models – long-awaited care models such as accountable-care organizations require several tools which are not currently available in typical EHR implementations and are not anticipated by the meaningful use incentive program. Elements such as cross-venue collaboration and provider collaboration, referral management and chronic patient-care management tools are on the long-term agenda for vendors, but are not viable in the short term, despite their benefits in supporting such care models.

7. Discussion

Four key findings stem from this research. First, the meaningful use requirements can serve as either a floor or a ceiling, depending on the abilities of the facility implementing EHRs. For large hospitals, the requirements are a floor, above which further development and customization continues. For smaller hospitals, the requirements are a ceiling, which will be met but not exceeded as the requirements continue to escalate. Second, the increasing focus on meeting the requirements across both hospitals and vendors in the industry risks missing the forest of health care

system change through the trees of meeting discrete requirements. Without further development on the technology needed for population health care and management of shared-savings models, the American health care system lacks the infrastructure for successful health reform. Third, while the meaningful use incentive program has accelerated the development and implementation of some functions, it has also slowed development of other important functions. Fourth, many hospitals have made the economically rational choice to delay implementation of comprehensive EHRs. The lack of a business case for their implementation and use – to date, there is sparse evidence suggesting EHRs are improving hospital profitability – and the difficulties inherent in changing the behavior of a host of entrenched physicians, has led many facilities to judge the benefits as not worthy of the costs.

It may be a result of the unique incentives at work in the hospital industry, but the lack of a business case for development of interfaces with inpatient medical devices and resources for shared-savings models is both surprising and disappointing. Elements such as referral management, cross-setting collaboration, and chronic care management could improve administration of shared-savings models. As it stands, investment in ongoing meaningful use certification and ICD-10 compatibility have, according to vendors, limited the development bandwidth available to improve offerings in this area. Given the extensive prior research and the contemporary statistics suggesting that the industry is likely to consolidate given the presence of federal incentives, the lack of development on these tools is troubling. If the industry is to see alternative care models succeed, population health management tools will be essential to effective implementation.

8. Conclusions

Increased adoption coinciding with the beginning of incentive payments supports findings that many hospitals with EHR expertise were aggressive in bringing their existing EHR installations in line with the stage 1 requirements, or beginning the process of implementing new comprehensive EHRs. The principal impact of the incentive program, therefore, was to accelerate the timeline to adoption and meaningful use for the majority of US hospitals – particularly for functions where the evidence of benefit was clear but clinicians objected to workflow changes, such as CPOE.

While the pace of adoption is slowly increasing, policy makers can look forward to stages 2 and 3 as opportunities to address developments which should be included in the incentive program with the awareness that inclusion will necessitate trade-offs by vendors and hospitals as they develop and implement the technology.

This study has several limitations. Because it relies partially on qualitative interviews with a small subset of US hospitals, it is exploratory and not necessarily representative of all US acute-care hospitals. This study should not be viewed as an exhaustive assessment of how all US hospitals and HIT vendors have responded to the meaningful use incentive program, but rather it is an initial assessment of the effects of the incentive program on development and adoption meant to help inform future policy in this area.

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