The Twenty Billion Dollar Bet:
How did the HITECH Act change electronic health record adoption?

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Dedication

This thesis is dedicated to my mother and father. Without their support through all of my education, this thesis would not have been possible.

Abstract

In 2009, the HITECH Act provided a subsidy for hospitals to adopt Electronic Health Records (EHR). The Act intended to induce implementation by all types of hospitals. Studies prior to the Act found that larger urban hospitals or hospitals in a system were more likely to adopt than other types of hospitals. This study analyzes whether hospitals with those characteristics still have a higher probability of adoption. To examine my hypotheses, we created a novel data set. The new data set merged the Center for Medicare and Medicaid Services and American Hospital Association data together, which permitted us to analyze which types of hospitals have received an incentive payment. The results show that the pre-HITECH Act patterns do not persist after the Act; the HITECH Act's goal of promoting adoption by all types of hospitals is met.

Keywords: Electronic Medical Records, Health Information Technology, Hospitals

JEL Codes: I10, O14, M15, C10, H32

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1. Introduction

In the recent estimates from the OECD, healthcare expenditures account for 17.9% of GDP in the United States, or each year, United States citizens spend $8,233 per capita on healthcare (OECD 2012). While America has the highest levels of spending in the developed world, the United States also reports a life expectancy of at least 1.2 years less than the average for the OECD countries (OECD 2012). Therefore, Americans spend more on their healthcare yet have life expectancy. One proposed way to reduce healthcare costs and improve the quality of medical care in the United States is the implementation of electronic health records (EHRs). The Center for Medicare & Medicaid Services (CMS) states that EHRs, sometimes called electronic medical records (EMRs), allow healthcare providers to record patient information electronically, instead of using paper records. Moreover, EHRs encompass more than just electronic records; they create new ways for providers to improve quality of care. In theory, EHRs will improve care because the EHRs will create a system of checks that every patient must go through. This system of checks could help reduce the number of preventable medical errors. Since EHRs could improve quality of care and possibly decrease a hospital's costs in the future, Congress enacted the Health Information Technology for Economic and Clinical Health Act (HITECH Act), which is part of the American Recovery and Reinvestment Act of 2009. According to the United States Department of Health and Human Services, the HITECH Act provided $20.6 billion dollars in subsides for eligible professionals and hospitals to adopt EMRs. The HITECH Act has a goal of promoting EHR adoption to all types of hospitals (The Committee on Ways and Means 2009).

For hospitals to receive an incentive payment from the CMS, a hospital has to attest to “Meaningful Use”. A hospital meets stage 1 “Meaningful Use” if they meet 14 core objectives, 5 of 10 menu set objectives, and 15 clinical quality measures. See Appendix A & B. Having the capability to check for drug-drug and drug allergy interaction checks is an example of a core objective, and incorporating clinical lab results as structured data is a menu set objective. Furthermore, to be an eligible recipient of the subsidy, a hospital has to receive payment under the Inpatient Prospective Payment System, be a critical access hospital, or a Medicare Advantage hospital. The CMS states that the Inpatient Prospective Payment System sets forth a payment system for the operating costs of acute care hospitals and is otherwise known as Medicare Part A. A critical access hospital is a hospital in a rural area with 24-hour emergency services. Furthermore, critical access hospitals (CAHs) must have no more than 25 inpatient beds and be located more than 35 miles away from the nearest hospital (15 miles for mountainous terrain) (CMS 2012). Medicare Advantage and Health Maintenance Organizations (HMO) have very similar traits, and Medicare Advantage is also called Part C.

According to the CMS, a qualified non-critical access hospital’s incentive payment, regardless of payment year, is the product of three factors: the initial payment, their Medicare Share, and a transition factor. The initial payment for all hospitals is a base of 2 million dollars and $200 for every discharged patient between 1,150 and 23,000 discharges within the hospitals fiscal year. For the second factor, a hospital will use the formula in equation (1) to calculate their Medicare Share.

$$Medicare\ Share = \frac{\#\ of\ IP\ Part\ A\ Bed\ Days + \#\ of\ IP\ Part\ C\ Bed\ Days}{Total\ IP\ Bed\ Days \times \left(\frac{Total\ Charges - Charges\ \text{Attributable}\ to\ Charity}{Total\ Charges}\right)} \quad (1)$$

, where IP stands for Inpatient. "The removal of charges attributable to charity care in the formula, in effect, increases the Medicare Share resulting in higher incentive payments for hospitals that provide a greater proportion of charity care" (CMS 2013). Lastly, the Transition Factor discounts the payment based on the year the hospital started the incentive program and the number of years in the program. Table 1 shows the Transition Factor bases on the year a hospital started the program (x-axis) and the number of years in the program (y-axis).

In all, a hospital's yearly incentive payment from Medicare will be $Incentive\ Payment \times Medicare\ Share \times Transition\ Factor$. A hospital can also receive another incentive payment from Medicaid. The formula for the Medicaid payment is very similar to the Medicare calculation. Since this study only focuses on the data for Medicare incentive payments, the formula for Medicaid's incentive payment will not be explained in more detail.

"Eligible acute care inpatient hospitals are defined as "subsection (d) hospitals" – which are hospitals that are paid under the hospital inpatient prospective payment system (IPPS)" (CMS 2013). The calculation for the incentive payment just explained above is for all acute care inpatient hospitals, but the above calculation does not include CAHs.

CAHs have a different formula. Equation (2) describes how their payment differs from IPP and Medicare Advantage hospitals.

$$CAH\ Incentive\ Payment = Total\ Reasonable\ EHR\ Cost\ \times (Medicare\ Share + 20\%) \quad (2)$$

According to the CMS, Total Reasonable EHR Costs are reasonable cost of the purchased EHR technology (excluding interest), and the Medicare Share is the same for CAH and eligible acute care hospitals. The formula for CAHs does not have a transition factor because CAH receive all of their reimbursement in one frontloaded payment. According to Beaulieu (2013), CAHs view the upfront incentive payment as an acceleration of capital reimbursement and an implicit expectation that the technology should be utilized to improve patient services. Furthermore, the CMS designed the payment to follow how CAHs are normal reimbursed by Medicare that is to cover all the reasonable costs of a service provided.

The literature on whether EHRs improves quality of care does not have solid findings on the magnitude of a EHRs effect on quality of care, but Miller and Tucker (2011) found that a 10 percent increase in births at a hospital with EMRs decreased neonatal deaths by 16 per 100,000 births. The study also computed a back of the envelope calculation that estimated the cost of an EMR system was approximately $531,000, per baby's life saved. Another study by Encinosa and Bae (2012) used patient level data to test whether EMRs reduce the rate of patient safety events. A patient safety

event is an avoidable event or a medical error. They find that EMRs do not reduce the rate of patient safety events, but after a patient safety event occurs, Encinosa and Bae (2012) discover that EMRs reduce the chance of death by 34%. Therefore, this empirical study claims that EMRs help rescue patients from medical errors but EMRs don't reduce patient safety events.

Studies have found mixed results on whether or not EMRs reduce a hospital's costs. Although many of the studies have endogeneity problems, a more recent NBER study by Dranove et al. (2012) has taken into account a hospital's proximity to information technology, and found that when a hospital is in a more IT intensive location, the implementation of electronic medical records reduces a hospital's costs by 3.4% annually after 3 years. The paper also found that hospitals in locations with weak IT support had increased costs.

Kaxley and Ozcan (2007) researched the characteristics that lead to a hospital's adoption of an EMR system. One of the main results is that hospitals with a health system affiliation have a greater probability of adopting EMRs than hospital without a system affiliation. More specifically, hospitals in a centralized system are 16 times more likely to adopt EMRs than a hospital without a system affiliation. They also found that hospitals in urban areas are approximately three times more likely to adopt EMR than hospital in rural areas. Kaxley and Ozcan (2007) is a stepping stone for the analysis in this paper. Their research occurred in 2007, before the HITECH Act, and later research has not looked at the change in EMR adoption since the HITECH Act. This paper will look at how the HITECH Act has changed the organizational and environmental determinants of

EHR adoption. Similar to results prior to the HITECH Act, it is expected that hospitals receiving payments from the CMS will be more likely to be from urban areas, in a system of hospitals, and be teaching institutions.

This paper will provide three core contributions to the literature. First is that this paper examines which hospitals have received incentive payment from the CMS to see if the patterns in hospital characteristics associated with EHR adopters still persists following the HITECH Act. No previous studies have analyzed this. The second is that Jeffery McCullough and I developed a novel data set for this analysis, which combines the CMS incentive payment and the AHA survey data. Third is that I provide results on whether the goals of the HITECH Act have been accomplished. According to the Committee on Ways and Means, a committee of the United States Congress, the goal of the HITECH Act was to have at least 70% of hospitals adopt comprehensive electronic health records by the year 2019. Furthermore, the HITECH Act aimed at spurring adoption in all types of hospitals. Therefore, the goals of the HITECH Act will be met if the types of pre-HITECH Act EHR adopters are not more likely to adopt than other types of hospitals. The conclusions about whether or not the goals were met will be the largest contribution to the literature from this paper.

The paper is organized as follows. Sections 2 will look at the theory and framework. Section 3 describes the data. Section 4 presents the empirical methods used in this paper. Section 5 provides the results. Finally, Section 6 presents the conclusions.

2. Theory & Framework

Similar to Kaxley and Ozcan (2007) on the determinants of EMR adoption, this paper will use the Resource Dependency Theory to model the hospital's decisions. Aldrish and Pfeffer (1976) developed Resource Dependence Theory. Their paper explained that organizations are not able to internally generate all resources or functions essential to maintain their organization, thus they will seek relationships with others to obtain the necessary resources. According to the dependency perspective, the environment doesn't constrain an organization to one structure for survival. Therefore, organizations can take many different structures and adopt new actions to survive. The model also allows organizations to actively manage their decisions. Aldrish and Pfeffer's theory laid out the ground work for social exchange theory, which is a social psychological and sociological perspective that explains human behavior as a function of its payoff (International Encyclopedic of Marriage and Family 2003). Furthermore, it has typically been used to describe the outsourcing of Information Technology. This theory models the hospital's decision to adopt an EHR system well because hospitals do not obtain the necessary resources to implement their own electronic health records and usually need assistance to implement EHRs. Secondly, the model allows for differently structured hospitals to adopt, which happens in practice because both non-profit and for-profit hospitals adopt EHRs. Finally, hospitals must take an active role in deciding if they wish to implement EHRs because the systems are extremely costly. While Resource Dependency Theory doesn't restrict a hospital to be a fixed structure to adopt an EHR system, this paper expects that the probability of adoption is higher in a couple structures.

The remaining parts of this section will apply Resource Dependency Theory to examine my hypothesized structures that relate to adoption.

Hospitals with a greater number of beds may be more likely to possess the necessary workforce to run and manage the complex EHR systems, thus a larger hospital may more easily ascertain economies of scale. Furthermore, the workforce in large hospitals might already include IT personnel, which would allow a hospital to adopt EHR technology more easily because they would not need to hire IT workers. Since larger hospitals usually have more financial resources, they may be more ready to adopt EHR technology in the short run, too. Thus, my first hypothesis is:

H1: Larger Hospitals will be more likely to receive incentive payments than smaller hospitals.

Similar to larger hospitals, a hospital in a system should be more likely to adopt EHRs because a system affiliation could give a hospital superior financial stability. Similar to larger hospitals, an organization in a system could attain economies of scale because the system will increase the number of patients in one EHR system. Lastly, being in system will allow the EHR technology to communicate between hospitals within the system. Hospitals without a system cannot transfer data without considering the legal ramifications of not protecting a patient's identity, thus non-system hospitals have a smaller likelihood of transferring data between hospitals. Since non-system hospitals are less likely to transfer data, they will not capture reduced costs and improved care from economies of scale, and they will be less likely to adopt than hospitals with a system affiliation. The corresponding second hypothesis is:

H2: Hospitals with a system affiliation will be more likely to have received incentive payments.

Teaching hospitals are on the forefront of innovation, specifically technological innovation. Therefore, teaching institutions should be more likely to implement an EHR system than non-teaching institutions. Also since teaching hospitals are sometimes associated with universities, the additional resources a university has might allow a teaching hospital to handle software issues more easily than other hospitals. The third hypothesis is:

H3: Teaching Intuitions will have a higher probability of receiving the incentive payment.

Since rural or critical access hospitals are usually smaller hospitals with less financial resources, they should be less likely to adopt EHR technology. Furthermore, the incremental part of the incentive payment or $200 for every discharge between the 1,150th and 23,000th discharge, may create a disincentive for rural hospitals to adopt because rural hospitals have fewer discharges than larger urban hospitals. This disincentive may not exist for critical access hospitals because their incentive payment differs from all other types of hospital's reimbursement. A CAHs payment consists of the allowable cost of the EHR system multiplied by the hospital Medicare share of inpatients days. The corresponding forth hypothesis is:

H4: Rural and/or Critical Access Hospitals will be less likely to receive the subsidy.

Many studies have found that non-profit hospitals have a greater probability of adoption compared to for profit hospitals. This could be true because non-profit hospitals internalize the externality of quality of care while for-profits focus more on the financial side, thus if EMRs really improve quality, non-profits may adopt more rapidly than for profit hospitals. Lastly, the fifth hypothesis is:

H5: Non-profit hospitals have a greater probability of adopting EHR technology than for-profit.

3. Data

To analyze whether or not the pre-HITECH Act patterns still had a greater likelihood of adoption, we created a novel dataset, which included data from the Center for Medicare and Medicaid Services (CMS) and the American Hospital Association (AHA) annual survey. The CMS dataset allowed us to examine who has received an incentive payment, and merging the CMS and AHA datasets permitted us to analyze which types of hospitals have received an incentive payment. The CMS data has detailed records on every hospital that has received a Medicare payment for 2011 or 2012. For this paper, a hospital has attained "Meaningful Use" if they have received an incentive payment in either 2011 or 2012. First, CMS data was merged with the IT supplemental Survey. The data from the IT supplemental Survey allowed us to create a proxy variable for "Meaningful Use" before the HITECH Act was drawn up. The survey questions matched the "Meaningful Use" core objectives are all of the core objectives, except objectives 7, 9, 10, 11, 12, 13, and 14; Appendix A displays all the "Meaningful Use" Core Objectives. Since the IT survey was taken in 2007, this paper assumes that hospitals

were not able to reasonably assume additional financial help would come in the form of a subsidy. Therefore, a hospitals decision to adopt EHR technology reflects the patterns from other studies before the HITECH Act.

After merging the CMS and IT supplemental Survey, this paper added in each hospital's characteristics from the AHA dataset. Since this study hypothesized that larger hospital would be more likely to receive an incentive payment than smaller hospitals, this paper follows standards created by the California Department of Health Services. A large hospital has more than 270 licensed beds, and a small hospital has less than 95 licensed beds. In all, the final dataset had a sample size of 2,518 hospitals. The sample size was smaller than the more than 6,000 AHA dataset because only 2,518 hospitals responded to the IT supplemental survey. Moreover, this analysis only looked at acute care hospitals, thus this study dropped all long-term care and federal hospitals from our analysis. The proxy variable for the "Meaningful Use" gives us a snapshot of EHR adoption levels pre-HITECH Act. According to the sample in this paper, 13.7% of hospitals obtained "Meaningful Use" in 2007. This level of adoption is similar to the Office of the National Coordinator of Health Information Technology's (ONC) 2008 estimate of 13.4% in a 2012 brief.

4. Empirical Methods

This paper uses a Probit regression to analyze how the HITECH Act has changed the patterns in hospital characteristics of adopters. The data utilized in this empirical analysis will be the merged data described in the Data section. Equation (3) displays the first specification used in this analysis.

$$Incentive\ Payment\ Recipients$$

$$= \beta_1 2007\ "Meaningful\ Use"_i + \beta_2 Non\ Profit_i + \beta_3 Teaching\ Status_i + \beta_4 System\ Member_i + \beta_5 Rural_i + \beta_6 CAH_i + \beta_7 Payer\ Mix_i + \beta_8 Scope_i + \beta_9 Number\ of\ Beds_i + \varepsilon_i \quad (3)$$

In this specification, CAH_i is the variable for critical access hospitals. 2007 "Meaningful Use" is the proxy variable for a hospital obtaining "Meaningful Use" prior to the HITECH Act. A "System Member" is a hospital that is in a system of hospitals. "Scope of Services" gives us a high level snap shot of the services offered at the hospital. Moreover, the variable is the ratio of inpatient days a hospital has to the number of outpatient days a hospital has. Therefore, the "Scope of Services" will explain variations in the services offered, and if a hospital utilizes more outpatient services, they might be less likely to adopt because the outpatient services cannot exploit the EHRs as effectively. The "Payer Mix" variable is the percentage of the Medicare paid inpatient days a hospital has.

A second specification will remove the proxy variable to test whether any patterns in hospital characters exist while not controlling for past EHR experience.

$$Incentive\ Payment\ Recipients$$

$$= \beta_1 Non\ Profit_i + \beta_2 Teaching\ Status_i + \beta_3 System\ Member_i + \beta_4 Rural_i + \beta_5 CAH_i + \beta_6 Payer\ Mix_i + \beta_7 Scope_i + \beta_8 Number\ of\ Beds_i + \varepsilon_i \quad (4)$$

Then this analysis will perform a third specification with interaction terms between all variables in equation (1) and the proxy variable. The third specification will test if the explanatory variables have a statistically significant effect knowing that the hospital had prior experience with EHR technology. Interacting all of the independent variables with the proxy variable for "Meaningful Use" prior to the HITECH Act will over specify the model, but the interaction model was only meant to test whether any of the interaction estimates are close to significant.

$$Incentive\ Payment\ Recipients = \beta_1 2007\ "Meaningful\ Use"_i + \beta_2 X_i + \beta_3 (X_i * 2007\ "Meaningful\ Use"_i) + \varepsilon_i \quad (5)$$

X_i is the vector of explanatory variables from first specification.

Finally, this study will perform an analysis on the sample of 2,518 hospitals. The analysis will be a detailed look into the levels of EHR adoption or "Meaningful Use", specifically looking at types of hospitals that had low number of adopters. For example, the study by Kazely and Ozcan (2007) stated that rural hospitals were less likely to adopt an EMR system than urban hospitals. Additionally, hospitals with a system affiliation were more likely to adopt an EMR system than hospitals without a system affiliation.

5. Results

Table 4 reports the percent of non-federal acute hospitals that have attained "Meaningful Use". Furthermore, Table 4 compares pre-HITECH Act (2007) to post HITECH Act (2012). The estimates for the percent of non-federal acute hospitals that have adopted EHRs by the ONC are 13.4% in 2008 and 34.8% in 2011, which are very similar to the estimates in this paper of 13.7% in 2007 and 37.2% in 2012. The HITECH Act incentivized hospitals to adopt EHRs because the percent of hospitals that have obtained "Meaningful Use" has more than doubled. Furthermore, the HITECH Act seems to have influenced all types of hospitals, not just large urban hospital. The subsidy has allowed hospitals with less financial resources to adopt the technology. Among rural hospitals, 12.9% of hospitals adopted EHRs in 2007 and now 36.8% of rural hospitals have adopted, thus subsidy allowed financially resource poor hospitals to adopt EHRs. Table 4 explains how the HITECH Act affected mutually exclusive rural, urban, and critical access hospitals.

As seen in Table 4, urban hospitals still have slightly higher levels of adoption, but all three types of hospitals have seen an increase in the number of hospitals that have met "Meaningful Use" standards. Furthermore, rural hospitals had the largest percent change from 2007 to 2012 (a 182.03% increase compared to a 170.63% increase for urban hospitals). While the goal of promoting adoption seems to be met, CAHs still lag behind the Prospective Payment System (PPS) hospitals. All Hospitals that receive payment from Medicare or Medicaid are PPS hospitals, with the exception of CAHs. As seen in Table 2, Critical Access Hospitals are statistically 5.6% less likely to adopt EHR

technology than non-CAHs. Moreover, the percentage change of the adoption levels for CAHs was only 164.34% increase, compared to a 170.63% increase for urban hospitals.

Since CAHs are statistically less likely adopt and have a much smaller growth rate than PPS hospitals, CMS' goal of promoting adoption by all types does not seem to be met. CMS even tried to incentivize CAHs to adopt by calculating their incentive payment more favorably. The payment was supposed to cover most of the cost associated with the implementation of the EHR technology. This result was a huge conundrum. Why did CAHs not start installing EHR technology when the incentive payment would cover all reasonable costs of adoption? According to a joint study by Healthland and Eide Bailly, a leading provider of comprehensive healthcare information systems as well as a certified public accounting and business advisor firm, respectively, many CAHs are not taking the traditional EHR implementation path. CAHs use managed hosting services or lease the EHR software. The white paper states that managed hosting services may be covered, but their maintenance cost will not be covered. Furthermore, the Medicare reimbursement payment will not cover leasing of EHR technology (Healthland and Eide Bailly). This divergence from the normal EHR adoption could be a reason for the lower adoption level according to the Medicare incentive payment data.

Another reason for lower CAH adoption could be uncertainty under which costs will be considered reasonable costs. As equation (2) shows earlier in this paper, one of the main determinants of a CAH's reimbursement is the reasonable cost of implementation. The Altarum Institute conducted an analysis on the reasonable cost portion of the CAH incentive payment, and the study concluded that there exists a gray

area in what is a reasonable cost. The paper states that “Determining reasonable costs is not a simple matter. There is considerable concern over the extent to which reasonable cost remains undefined, as the interpretation of the term “necessary to administer” varies” (Altarum Institute). Therefore, CAHs have an extremely difficult task of deciding whether or not to implement. The uncertainty under what will be considered a reasonable cost causes the implementation of EHR technology to become much more risky. Furthermore, since CAH receive their entire cost of implementation in one incentive payment. They must analyze what their adoption will cost; if they do not correctly predict what the cost of adoption will cost, their actual cost of implementation could vastly outweigh their predicted cost. This additional uncertainty could create more risk for a hospital with less financial means, which could lead a CAH to not adopt because such a large financial risk could bankrupt a critical access hospital. In Kahneman and Tversky’s famous paper on prospect theory, they describe “how people overweight outcomes that are considered certain, relative to outcomes that are merely probable.” The two authors label this the “Certainty Effect”, and their theory could explain why CAHs do not adopt. CAHs undervalue the returns they get from adopting because the outcomes are very uncertain. Therefore, the confusion over which costs can be used causes additional risk for hospitals, which will induce CAHs to undervalue their outcome and not adopt.

The percent of hospitals that meet the “Meaningful Use” criteria is currently higher for hospitals in a system than hospitals not in a system. The percentage of hospitals with a system affiliation that adopted EHRs was 13.4% in 2007 and 38.5% in 2012, compared to 14.1% in 2007 and 35.6% for hospitals not in a system. Hospitals in a

system saw a much larger growth rate or percent change. System affiliated hospitals had a 187.31% increase, compared to a 152.48% increase for hospitals with no system affiliation. While the grow rate for hospitals without a system affiliation were lower, this may have been a result of a higher adoption rate in 2007. Additionally, as Table 2 shows system hospitals are statistically no more likely to adopt EHR technology than hospitals not in a system of hospitals.

The levels of EHR adoption by teaching hospitals and non-teaching hospitals saw a similar increase in "Meaningful Use". All three types of ownership (non-profit, for-profit, and government), have similar increases in EHR adoption. They started at approximately 13% in 2007 and increased to roughly 37%. Lastly, the HITECH Act did not encourage larger hospitals to adopt EHR technology, compared to smaller hospitals.

All in all, the types of hospitals that were predominately adopting EHRs before the HITECH Act were large, urban hospitals with a system affiliation, but after, the Act encouraged all types of hospitals to implement EHRs, there doesn't seem to be a stereotypical hospital that adopts EHRs more than other types of organizations. The next couple of paragraphs will use an empirical analysis to prove that the HITECH Act achieved its goal of promoting adoption by all hospitals.

Using a Probit regression, where the dependent variable is hospitals that have received an incentive payment, this regression will analyze whether a certain type of hospitals has a greater probability of adoption. The proxy variable for use prior to the subsidy will be included to examine the change in adoption since the HITECH Act. Only one variable was significant at the 1% level and that variable was the proxy variable for

"Meaningful Use" prior to the subsidy. Having "Meaningful Use" prior to the HITECH Act increases a hospitals probability of receiving an incentive payment by approximately 14%. The variable for critical access hospitals was significant at the 5% level, and if a hospital is a critical access hospital, then that hospital was 5.6% less likely to receive an incentive payment, compared to a urban hospital. A critical access hospital could be less likely to receive the subsidy because their incentive payment calculation is different than all other hospitals. The number of licensed beds at a hospital was marginally significant at the 10% level. If a hospital increases the number of beds by 100, they are less likely to receive an incentive payment by .012%. While the variable for the number of licensed beds was significant. The estimated average marginal effect was very small.

Since most of the variables are not significant at even the 10% level, the results from the regression write a story similar to the results from the analysis on the change in percentage of hospitals that achieved "Meaningful Use" from 2007 to 2012. One of the significant variables, the number of licensed beds a hospital has is significant at .00012 or an average marginal effect every close to zero, and secondly, since the CMS calculates the incentive payments for critical access hospitals differently, they might be less likely to adopt than non-critical access hospitals.

The third column of Table 2 shows the regression without the proxy variable for "Meaningful Use" in 2007, or the second specification models the hospitals that receive an incentive payment without controlling for prior experience in EHRs. The results are extremely similar to the first specification (column 2); the only significant variables for both models are the number of licensed beds a hospitals has and the status of critical

access. The sign on the variable for the number of beds flipped from positive with the proxy variable to negative without the proxy, but since the estimate is near zero, this change is not huge. Otherwise, the direction of all the estimated coefficients is the same; the magnitudes on the coefficients are similar. In summary, the HITECH Act seemed to stimulate adoption to all types of hospitals, except for critical access hospitals. The interaction model confirms the conclusions from the first two specifications because all of the interactions are insignificant; the model is in Table 3.

6. Conclusion

Results from previous studies stated that larger hospitals in urban area and hospitals in a system of hospitals had a greater probability of adopting than other hospitals. These studies were performed before the HITECH Act; they assumed that hospitals didn't know that financial support would later come. Then the HITECH Act came and had goals of reaching a level of 70% adoption by hospitals by 2019. Additionally, the Act aimed to induce implementations by all types of hospitals. This study concludes that the goal of encouraging adoption by all hospitals was met because the determinants of EHR adoption disappeared. EHR adoption has reached a level of 37.2% for 2012, thus the goal of reaching 70% adoption by 2019 is still attainable. Hospitals with a smaller probability of implementing EHRs seemed to have one common trait. They had less financial resources. Therefore, smaller rural or critical access hospitals needed additional resources to adopt; the HITECH Act provided aid for them, thus more hospitals implemented EHRs.

This analysis has some limitations. The proxy variable for "Meaningful Use" is self-reported. Additionally, the IT Supplemental Survey only had 2,518 respondents, thus hospitals that responded to the survey could be more or less likely to adopt EHRs. In all, the proxy variable could have selection bias because not all hospitals responded to the IT Supplemental Survey. To further this analysis, we could find a better proxy variable for "Meaningful Use" prior to the HITECH Act. Furthermore, this study only performed an analysis on the incentive payment data for Medicare, and it did not include data from Medicaid. The EHR incentive program for Medicaid is run by each state independently, thus to use the Medicaid data, we would have to obtained permission from each state. The collection and compilation of the Medicaid incentive payment data could future this research, and a study with the Medicare and Medicaid data could give a more complete picture of the current adoption levels.

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Table 1: Transition Factor

	Fiscal Year				
	2011	2012	2013	2014	2015
2011	1.00				
2012	0.75	1.00			
2013	0.50	0.75	1.00		
2014	0.25	0.50	0.75	0.75	
2015		0.25	0.50	0.50	0.50
2016			0.25	0.25	0.25

NOTES: Transition Factors are one part of the incentive payment calculation, except for CAHs. Table 1 shows the Transition Factor based on the year a hospital started the program (x-axis) and the number of years in the program (y-axis).

Table 2: Determinants of receiving an incentive payment

Dependent variable: Hospitals that have received an incentive payment		
Variable	**Average Marginal Effect (With Proxy)**	**Average Marginal Effect (Without the Proxy)**
"Meaningful Use" 2007	0.140 ***	-
Teaching Hospital	0.065	0.175
Government Hospital	-0.018	-0.047
For-Profit Hospital	-0.016	-0.043
# of Licensed Beds	0.0001 *	-.0003*
System Member	0.025	0.024
Hospitals Share of Medicare Inpatients	-0.034	-0.024
Hospitals Share of Medicaid Inpatients	-0.008	-0.001
Critical Access	-0.056 **	-.05**
Rural	-0.027	-0.03

NOTES: *1% significance, ** 5% significance, *** 10% significance
Table 2 displays the marginal effect for the first and second specification from the Empirical Methods section. Furthermore, the Average Marginal Effect (With Proxy) column uses equation (3); the Average Marginal Effect (Without Proxy) uses equation (4).

Table 3: Interaction Specification Regression Results

Variable	Coef.	Std. Err.	z	P>|z|
"Meaningful Use" proxy	0.611	0.519	1.180	0.239
Teaching Hospital	0.094	0.125	0.760	0.450
Government Hospital	-0.066	0.078	-0.840	0.399
For Profit Hospital	-0.067	0.085	-0.790	0.430
# of Beds	0.000	0.000	-1.290	0.198
System Member	0.106	0.059	1.790	0.073
Medicare Payer Mix	-0.117	0.253	-0.460	0.643
Medicaid Payer Mix	0.028	0.262	0.110	0.915
Critical Access	-0.138	0.085	-1.620	0.105
Rural	-0.005	0.075	-0.060	0.952
Teaching Hospital*"Meaningful Use" proxy	0.478	0.325	1.470	0.142
Government Hospital*"Meaningful Use" proxy	0.106	0.208	0.510	0.611
For Profit Hospital*"Meaningful Use" proxy	0.154	0.230	0.670	0.501
# of Beds * "Meaningful Use" proxy	0.000	0.001	-0.860	0.391
System Member*"Meaningful Use" proxy	-0.277	0.161	-1.720	0.086
Medicare Payer Mix * "Meaningful Use" proxy	0.170	0.723	0.240	0.814
Medicaid Payer mix * "Meaningful Use" proxy	-0.272	0.743	-0.370	0.714
Critical Access*"Meaningful Use" proxy	-0.109	0.230	-0.470	0.636
Rural*"Meaningful Use" proxy	-0.520	0.210	-2.470	0.013
Constant	-0.295	0.183	-1.610	0.108

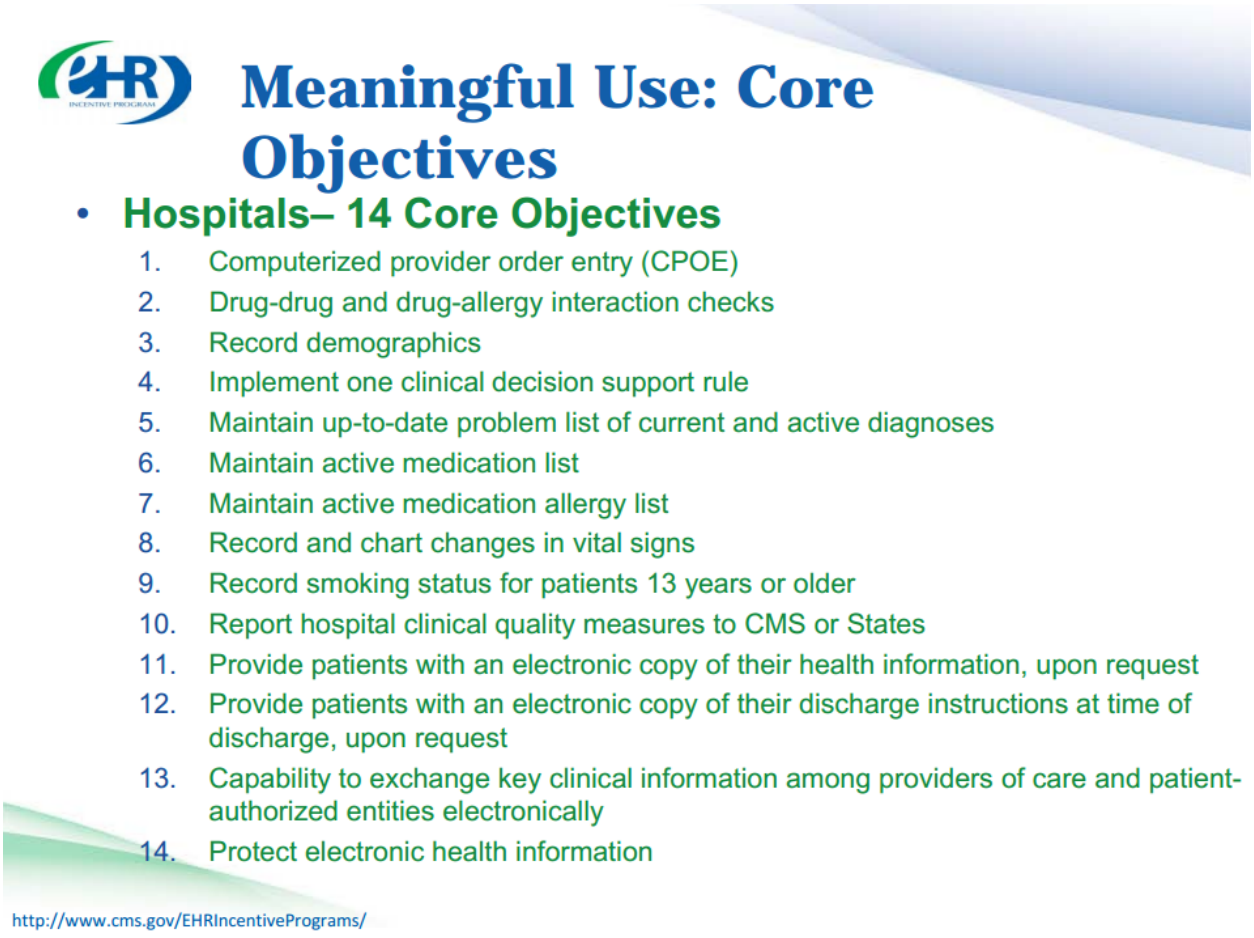
NOTES: Table 3 displays the Probit results for the third specification from the Empirical Methods Section. More specifically, the third specification uses equation (5).

Table 4: Percent of non-federal acute hospitals that have attained "Meaningful Use" -2007 vs. 2012

	"Meaningful Use" 2007	"Meaningful Use" 2012
All Hospitals	13.7%	37.2%
Type of hospital		
Rural	12.80%	36.10%
Urban	14.30%	38.70%
Critical Access	12.90%	34.10%
Size of Hospital		
Small	12.90%	36.20%
Medium	13.70%	38.50%
Large	15.34%	37.00%

NOTES:*Small Hospitals < 95 licensed beds, Medium Hospitals 95-270 licensed beds, Large Hospitals > 270 licensed beds
Table 4 illustrates the percentage of nonfederal acute hospitals that have attained "Meaningful Use" for 2007 and 2012.

Appendix A: "Meaningful Use" Core Objectives



Appendix B: "Meaningful Use" Menu Objectives