The Effects of Organizational Factors on Healthcare IT Adoption Costs:
Evidence from New York Nursing Homes

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Abstract

We investigate how organizational factors influence healthcare IT adoption costs, using new data collected from an EMR adoption experiment conducted in a sample of New York State nursing homes. We find that workplaces characterized by higher levels of employee satisfaction and employee discretion incur lower EMR implementation costs. Our estimates suggest that nursing homes that are one standard deviation above the mean in terms of employee satisfaction and employee discretion measures incur about 10% lower EMR adoption costs than average facilities. Implications for policy makers and managers are discussed.

1. Introduction

Electronic medical records (EMR) have recently received a great deal of attention on the public policy front. Promoted as a key component in the reform of the U.S. healthcare system, EMR adoption is seen by many academics and policy makers as a significant and high priority initiative [1-3]. Congress has recently allocated twenty billion dollars for this task as part of the American Recovery and Reinvestment Act of 2009, and President Obama has gone so far as stating that:

“[T]he economic recovery plan I’m proposing will help modernize our health care system—and that won’t just save jobs, it will save lives. We will make sure that every doctor’s office and hospital in this country is using cutting edge technology and electronic medical records so that we can cut red tape, prevent medical mistakes, and help save billions of dollars each year.” (President Barack Obama, December 6, 2008)

Yet despite this massive push towards the digitalization of most, if not all, of healthcare organizations in the United States within the next five years, there is still much that is unknown about the factors contributing to adoption patterns of EMR (for a similar claim see [4]).

More specifically, research regarding the costs associated with the implementation of EMR has not provided a clear sense of what this effort might entail on the part of organizations and the public agencies funding this initiative. This research has demonstrated wide variation in potential EMR financial benefits [5, 1]. Furthermore, actual adoption of EMR systems has been much slower than anticipated and to date, only a small minority of healthcare organizations has fully operational systems and many EMR initiatives have failed to take root [6-8].

The link made between the adoption of EMR and healthcare reform is a relatively simple one. Proponents maintain that the shift from paper records to electronic ones will decrease costs associated with care through efficiency savings while simultaneously increasing the quality of care by enhancing the accuracy and timeliness of patient care documentation [9-12].

As will be discussed below, however, many of the assumptions underlying this linkage have not yet been adequately tested. Especially notable among these, and relevant for this paper's focus, is the assumption that the efficiency and clinical benefits associated with EMR adoption will outweigh the costs of its implementation. Much of the existing research has focused on the benefits side of the adoption equation with less emphasis on the variables that influence costs in general and variation across organizations in particular. Furthermore, the majority of studies examining the costs and benefits delivered through EMR adoption have focused almost exclusively on the technical and logistical components influencing costs without addressing organizational characteristics that might influence cost patterns.

In this paper we seek to address this gap by examining the role played by two central organizational variables, namely, job satisfaction and employee discretion, in the cost pattern of EMR adoption in 15 New York City nursing homes. The central argument set forth in this paper is that the cost of adopting EMR and thereby overhauling an organization’s information management system is not simply a function of the logistical and equipment costs; but rather is directly related to the organizational
context in which is being implemented. Therefore, in addition to advancing the literature on healthcare IT adoption and implementation costs, our study is related to an extensive literature on the importance of organizational differences in understanding IT success.

The central contribution of the paper is that we test hypotheses relating organizational factors to EMR adoption costs through the development and analysis of new and proprietary data sets, based on a novel EMR adoption experiment that was conducted from 2007-2008 in New York nursing homes. For the study design, a single EMR vendor was charged with implementing the new technology in all of the participating nursing homes, where participants were selected to “hold constant” as many features of the nursing homes as possible, in order to minimize unobserved heterogeneity that would make it difficult to identify the effects of EMR adoption.

Because we focus on the association between organizational factors and EMR adoption costs, the design of this study offers a number of advantages for empirical analysis that are particularly useful for our purposes and that would be difficult to duplicate with traditional archival data sets. For example, a number of potentially confounding influences, such as union membership, geographic location, staffing mix, and wage profile, which could potentially otherwise bias our estimates, are by design very similar across the facilities in our sample. Perhaps most importantly, the EMR system, vendor, and installation and support processes are the same across all installations, mitigating concerns about unobserved differences associated with the technology. Finally, because the study participants were randomly selected to receive the technology, our results are somewhat less subject to criticisms based on the types of selection effects that could arise from only observing adopting firms.

Our data sources from this quasi-experimental study include detailed organizational measures, developed through interviews with hundreds of employees from the nursing homes that participated in the study, as well as a unique and fine-grained measure of EMR implementation costs, based on the contents of a support and training database maintained by the vendor charged with implementing the EMR systems in all of the nursing homes involved in the study. By combining these data with other public-use data sources on nursing home characteristics, we can test how differences in workplace characteristics are associated with differences in the costs incurred by the EMR vendor across the different nursing homes.

We find that the way in which work is organized and the conditions under which frontline staff are employed influence the manner in which EMR is embedded within the organizations, and must therefore be taken into consideration when planning expenditures on this technology. Specifically, we provide empirical support for the hypothesis that organizations with higher levels of job satisfaction and a greater degree of employee discretion will have lower implementation costs. Our estimates indicate that a one standard deviation increase in levels of employee satisfaction or discretion is associated with about 10% lower EMR adoption costs. Support for this proposition has a number of important organizational and public policy implications, which will be discussed below.

### 2. Existing Literature on EMR Adoption

The existing literature on EMR adoption has painted a mixed portrait in terms of the costs and benefits linked to its implementation. On the one hand, researchers maintain that EMR has the potential to transform the manner in which healthcare is delivered and will lead to dramatic cost savings alongside increased quality of care for patients [2, 3]. In an analysis conducted by RAND, Hillestad and colleagues [2] have estimated national efficiency and safety savings that range between $142-$371 billion annually.

On the other hand, empirical evidence has been far from consistent in terms of both the outcomes delivered through this technology and the adoption patterns and trends, especially as they pertain to the costs of digitalizing medical records [9, 1, 4, 12, 13].

A recent comprehensive review of the literature on EMR adoption and use reported very minimal empirical evidence on the cost side of the implementation equation [1]. The authors of that study found that of the dozens of studies examining EMR systems in healthcare organizations, only a handful tracked actual costs of implementation and maintenance and do not provide a sufficient foundation upon which to guide public policy in terms of how to allocate resources to encourage adoption (p. 17).

While the interpretation of empirical evidence regarding costs is still opaque, what is clear from the existing literature is that even where research has provided rigorous and comprehensive assessment of the cost associated with replacing traditional documentation systems with EMR, the scope of the factors considered largely ignores organizational variables. One of the premiere studies of EMR adoption costs and benefits conducted by Hillestad and colleagues [2] for example, modeled the cost of adoption as a sole function of fixed implementation costs, hardware costs, and maintenance related expenses (p. 1105). As noted above, we believe that without accounting for central organizational characteristics, our understanding of implementation
will be incomplete [14]. This paper’s primary contribution is in providing support for the hypothesis that organizational factors have a strong influence on EMR adoption costs. Therefore, it is important to account for organizational variables when projecting the cost of EMR implementations.

3. Hypotheses: The Role of Organizational Factors

The adoption of an EMR system entails a dramatic organizational transformation. The implementation process involves changes to workflow and design [14, 15]. A complete shift in documentation affects almost all aspects of the organization from the frontlines where care is provided, through middle management where documentation and care are supervised, to top management, which is provided with a powerful managerial tool and an abundance of analyzable data. Thus, it is also likely that factors that influence work across the organization will affect the manner in which this workplace innovation is implemented and used. Support for this proposition has a wide array of important implications for the study of EMR, but for the purposes of this paper, it implies that the resources needed to transition from traditional documentation to EMR usage will also be contingent on organizational specific characteristics.

The proposition that organizational level variables affect technological adoption is not new. For example, an extensive literature documents the importance of organizational transformation for understanding IT returns (see [16] for a review of this literature). However, although a large number of studies have related organizational factors to various performance outcomes, few studies have looked at how organizational differences might affect IT implementation costs, in part due to the difficulty in obtaining fine-grained measures of IT implementation costs. Furthermore, despite the current policy discussion regarding healthcare IT spending, there is currently little evidence on the interaction between organizational characteristics and information technology in healthcare. The collection and analysis of new data regarding the determinants of success in IT projects in a healthcare setting, therefore, is likely to be of substantial interest.

In a recent paper examining the organizational characteristics influencing the introduction of EMR in ten nursing homes, Lipsky and colleagues [17] reported wide organizational variation in the readiness and adoption of this technology. The authors found that the variation across organizations with regards to employee relations and other key workplace variables had a substantial effect on the adoption process and on the manner in which nursing homes managed the introduction of the technology. In other words, organizational variation drove adoption variation.

Our paper builds on these findings and attempts to quantify the effect of cross organizational variation on the costs of EMR adoption. For the purposes of this study we focus on two distinct organizational variables, job satisfaction and employee discretion. We do so since both constructs capture different key facets that are likely to influence the EMR implementation process, thereby affecting cost.

Job satisfaction has long been viewed as a dominant workplace construct influencing a host of individual and organizational level outcomes [18]. In the healthcare arena specifically, job satisfaction has been linked to a variety of central outcomes, such as quality of care, burnout, turnover intentions, and organizational commitment [19-21]. Although research has shown that job satisfaction does vary across healthcare organizations due to variation in work practices and working conditions [22, 23], this is an especially important construct in this setting since studies have also demonstrated a relatively high level of job dissatisfaction among healthcare professionals [19].

We argue that the degree of job satisfaction in a healthcare organization will also affect EMR implementation and adoption processes, thereby influencing costs. This proposition is based on two related rationales. First, at the organizational level job satisfaction can be viewed as a proxy for general working conditions. As with any large scale innovation, EMR adoption places an added challenge to the organization, especially at the early implementation phases. It is likely that organizations with less positive working conditions will also have a harder time meeting this challenge alongside other organizational issues. Second, at the individual level, EMR adoption requires additional effort on the part of frontline staff. Employees in organizations that undergo such change must learn new skills, alter the manner in which they work and accommodate broad organizational restructuring. Given these demands at the individual level, it is likely that employees with lower levels of reported job satisfaction will be less motivated and prepared to make these required adjustments and exert additional effort. We therefore hypothesize that greater levels of job satisfaction will lead to reduced EMR adoption costs.

Hypothesis 1: Higher levels of employee job satisfaction will decrease the costs of EMR adoption in healthcare organizations.
In addition to job satisfaction, we also maintain that the manner in which work is organized will also affect EMR adoption costs. One of the most frequently studied workplace characteristics in healthcare is employee discretion, a term we use to describe worker autonomy and individual decision-making authority. Like job satisfaction this construct has been linked to a variety of individual and organizational level outcomes including performance and productivity [24-26]. In the healthcare setting, employee discretion, or the extent to which frontline staff are able to control and direct their own work, has been long viewed as a means of addressing a host of industry challenges, including quality of care concerns and workforce shortage issues [27-29].

In addition to its effects on performance and retention outcomes, we also believe that organizations that provide greater levels of employee discretion will experience a smoother EMR adoption process. As noted above, EMR adoption requires a dramatic reconfiguration in the manner in which employees work. EMR systems also alter the manner in which frontline staff, supervisors and management communicate and interact. These shifts in work design and relational coordination are likely to be affected by the degree to which employees are able to direct their own work. We therefore hypothesize that organizations with greater perceived employee discretion will incur lower EMR adoption costs.

_Hypothesis 2: Higher levels of employee discretion will decrease the costs of EMR adoption in healthcare organizations._

4. Data and Methodology

4.1. Data

Data for this paper were collected as part of a larger demonstration project funded by the State of New York. The demonstration project included the introduction of EMR technology in 22 New York City area nursing homes. The Quality Care Oversight Committee (QCOC) established for this project selected these nursing homes after a rigorous selection process intended to insure a diverse sample of organizations as well as adherence to basic preparedness requirements. For the purposes of our study, 15 of the 22 participating nursing homes were selected at random from the larger population of New York nursing homes.

In order to test the two hypotheses set forth above we combine two separate data sources that were developed for the project. Data for the independent variables, namely job satisfaction and employee discretion, were collected through employee level surveys aggregated to the organizational level. Surveys were administered to frontline healthcare workers in the 15 nursing homes receiving an EMR system.3 Survey data was collected between June of 2007 and July of 2008 by phone through the Cornell Survey Research Institute. We included in the sample for this study all frontline staff from the participating organizations that fell into four occupational categories: a) registered nurses (RNs); b) licensed practical nurses (LPNs); certified nurse’s assistants (CNA’s); and d) allied professionals which included social workers and other support occupations. These occupational groups represent the primary users of the the various EMR system components. In total, we contacted just over 2,000 employees across the fifteen organizations. Of these, 962 completed the survey for a response rate of approximately 48%.

Of the four occupational categories included in our study, 61% of the respondents were CNAs, 17% were LPNs, 16% were RNs and just over 5% were in the allied professionals category. This distribution is representative of the overall composition of nursing homes. 92% of the respondents in our sample were female. With regards to education level, approximately 6% of the respondents had not completed a high school education; 39% had the equivalent of a high school education; approximately 50% had some college level education up to a Bachelors degree; and the remainder had either a masters or PhD level of education. Average job tenure for employees in our sample was just over 8 years with 75% belonging to a union. Just under 80% of the respondents were full time employees and just over 20% were working part time.

Our second source of data for this study was provided by the technology vendor. We related information on organizational characteristics collected through this survey data with a unique measure of IT implementation costs, based on “service ticket” data collected by the IT vendor. To handle training and support requests after EMR implementation, the vendor charged with implementing the system in all of participating nursing homes used a service ticket tracking system to record when nursing homes issue service or problem requests after installation. Quantities of these service tickets, therefore, indicate general levels of support required by individual nursing homes after the initial implementation, and therefore are a measure of costs incurred by the vendor for each nursing home.

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3 Survey data was also collected from employees in five control nursing homes not receiving the technology, but was not used in this analysis.
These service ticket data do not reflect total implementation costs because vendors also face substantial costs before the system goes live. However, service and support represent a substantial part of vendor costs, and may also represent a disproportionate amount of the cost variation among homes to the extent that usage rather than installation determines the effectiveness of the IT system [31].

The service tickets issued by users of the EMR system include problem reports as well as training requests: specific examples of the descriptions associated with some representative service tickets include 1) an employee at the nursing home being unable to log into the system, 2) requests about how to use particular features of the software system, or 3) bug reports associated with either the software or hardware issued by the IT vendor. The service ticket data include issue descriptions as well the time and date on which the ticket was issued.

Supplementary data on the institutional characteristics of individual nursing homes, such as the number of beds and various quality indicators, was collected through the “Nursing Home Compare” dataset available through the US Department of Health & Human Services. Technology usage data, describing the degree to which front-line staff are actively using the technology in day-to-day operations, were also provided by the technology vendor.

4.2. Variables

4.2.1 Dependent Variable

To construct our measure of post-installation support costs for individual nursing homes, we aggregated the number of service tickets issued in each month for each nursing home. Because we do not have descriptions of the dollar costs associated with each of these service tickets, we cannot directly compute how changes in service ticket levels translate to cost differences. However, we can use these data to measure how organizational factors are associated with differences in ticket levels, and therefore in relative costs.

We aggregated tickets to the monthly level because it allows us to account for the differences explained by the substantial variation in monthly usage among nursing homes. Although the temporal resolution of our data would have permitted us to aggregate these tickets to the weekly or even daily level, aggregating our ticket data to the monthly level filters out some of the noise that may occur at a finer level. Furthermore, our results (not shown) are not substantially different when our regressions are conducted at a weekly rather than the monthly level.

We scale this monthly service ticket measure by number of beds in the nursing home to account for nursing home size. Our final measure of monthly IT implementation costs is the number of service tickets per bed per month for each nursing home in our sample.

4.2.2 Independent Variables

Employee Discretion was measured using five Likert scale items. Respondents were asked to rate the level of agreement on a scale of 1-5 (1 being strong disagreement and 5 representing strong agreement) as to whether they: a) have a great deal of discretion in making work related decisions; b) have a lot of say about what happens on the job; c) have a great deal of say over how work gets done; c) have an equal say over how things get done; d) are given the freedom to make important resident care decisions.

Employee Satisfaction was measured using four constructs. Respondents were asked to rate the level of agreement on a scale of 1-5 (1 being strong disagreement and 5 representing strong agreement) as to whether they: a) are satisfied working in their unit; b) satisfied working at this nursing home; c) all in all, satisfied with their job; and d) satisfied with their occupation.

The aggregate discretion measure was constructed as the standardized sum of the standardized individual measures. The aggregate satisfaction variable was constructed in the same way using the individual satisfaction constructs. The Cronbach’s Alphas for the job satisfaction and employee discretion constructs are .77 and .72 respectively.

4.3. Descriptive Statistics and Correlations

In Table 1, we show the means and standard deviations for the most important variables used in our study. The average number of service tickets per month opened by each of the nursing homes in our sample is just over 24, and the average number of beds is about 215, implying an average of about one ticket per month for every 8 or 9 beds in the home.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Mean</th>
<th>Std. Dev.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tickets/Month</td>
<td>24.3</td>
<td>16.8</td>
</tr>
<tr>
<td>Tickets/Bed/Month</td>
<td>.115</td>
<td>.074</td>
</tr>
<tr>
<td>Beds</td>
<td>215.2</td>
<td>215.2</td>
</tr>
<tr>
<td>CNA minutes per res</td>
<td>137.9</td>
<td>27.7</td>
</tr>
<tr>
<td>EMR System Usage</td>
<td>.87</td>
<td>.314</td>
</tr>
<tr>
<td>Satisfaction measure</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Discretion measure</td>
<td>0</td>
<td>1</td>
</tr>
</tbody>
</table>
Correlations among the primary variables used in our analysis are shown in Table 2. As expected, employee satisfaction and employee discretion are very highly correlated within the sample of nursing homes, suggesting that the two measures are reflecting similar constructs that reflect general workplace conditions.

<table>
<thead>
<tr>
<th></th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>1.0</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>2.</td>
<td>.20</td>
<td>1.0</td>
<td></td>
<td></td>
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<tr>
<td>3.</td>
<td>-.12</td>
<td>-.71</td>
<td>1.0</td>
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<tr>
<td>4.</td>
<td>-.11</td>
<td>.12</td>
<td>-.07</td>
<td>1.0</td>
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<tr>
<td>5.</td>
<td>.05</td>
<td>.18</td>
<td>.25</td>
<td>-.26</td>
<td>1.0</td>
</tr>
<tr>
<td>6.</td>
<td>-.24</td>
<td>.21</td>
<td>.02</td>
<td>-.13</td>
<td>.85</td>
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</table>

Correlations are shown using data from the final month. N=15

Figure 1 shows the trajectory of service tickets over time. During the initial adoption phase, the average nursing home opened up about one ticket for every three or four beds in the home. However, the number of service tickets issued appears to decline steadily after adoption.

The primary focus of this paper is to test whether the levels of these service tickets, which reflect implementation support costs, are affected by the nursing homes’ organizational characteristics. In Figures 2 and 3, we plot worker discretion and satisfaction levels against the numbers of service tickets opened by the facility. The scatter plots appear to roughly correspond to Hypotheses 1 and 2, suggesting that homes with better workplace conditions face lower EMR adoption costs. However, this relationship could be spurious if, for example, other nursing home variables, such as size or staffing levels, are closely related to our workplace measures.

In the next section, we describe the regression methods that we use to disentangle these possibilities.

4.4. Regression Model

To test how organizational factors impact IT implementation costs in nursing homes, we embed our organizational measures along with other facility-level control variables in a regression model, where our primary dependent variable, service tickets per bed, is aggregated to the facility-month level.

In addition to including organizational factors as our primary independent variable, we include the extent of technology usage, measured by the degree to which frontline nursing home employees are actively using the new system. Including a usage measure is important because prior research has shown the importance of usage in understanding the impact of new IT systems, especially in the healthcare industry [30]. Because of the detailed tracking information collected by the EMR vendor, we are able to include
usage intensity in our model at a fine-grained level to distinguish between homes that have a small number of service requests and are successfully using the system without problems from those that have a small number of requests because they are not actively using the system.

We also include size variables, measured by the logged number of beds, to account for the possibility that smaller nursing homes may have a systematically easier or more difficult time implementing new IT systems. Finally, we also include a measure of the logged number of CNA minutes per resident, to include differences in staffing levels across nursing homes. Our final regression model can be written:

\[ \text{TicketsPerBed}_i = \alpha_0 \text{OrgFactors}_i + \alpha_1 \text{Usage}_i + \text{controls} + u_i \]

Depending on the specification, we include employee discretion or satisfaction as the relevant organizational measure. The primary purpose of this study is to test the hypothesis that \( \alpha_0 \) is significantly different than zero, which would indicate that organizational factors can be useful in the prediction of IT implementation costs in nursing homes after accounting for other usage and facility-level variables. In all of our regressions, we also include dummy variables to account for the effects of time on the number of tickets being issued in individual nursing homes. Standard errors are clustered on nursing homes to account for correlations among observations for the same facility in different months.

5. Results

Table 1 shows results from our full regression model testing how organizational factors affect the number of monthly service tickets opened per bed. In Column (1), we estimate Equation 1 using employee satisfaction as our primary organizational measure. After accounting for usage and other facility-level factors, employee satisfaction measures are negatively and significantly associated with the number of service tickets per bed (t=2.33), suggesting that EMR adoption costs are lower in facilities with more satisfied employees. Our results are very similar when using our employee discretion measure, which is as expected because our discretion and satisfaction measures are highly correlated. Workplaces with higher levels of employee discretion are associated with lower EMR adoption costs (t=2.29), and the point estimates imply an effect size that is very similar to that suggested by our discretion measure. These results provide empirical support for both Hypotheses 1 and 2.

In column (3), we include both organizational variables along with an interaction term to test if discretion is mediated by job satisfaction. However, the coefficient estimates on the organizational terms in this model do not provide evidence of a mediating relationship, perhaps due the high correlations between our organizational terms and relatively small sample size.

Our estimates indicate that a one standard deviation increase in the degree of worker satisfaction at a firm lowers the number of service tickets per bed by about .014 per month. The average number of service tickets per bed per month across all facilities is about .115, so our point estimate suggests that after controlling for other factors, a facility that is one standard deviation above the mean in terms of workplace conditions incurs over 10% lower costs than facilities with average levels of employee satisfaction and discretion.

A second finding of interest is that our monthly dummy variables explain a substantial amount of variation in IT implementation costs. A test of the hypothesis that the month dummy variables are simultaneously equal to zero is rejected at the \( p<.000 \) level (F(11,11)=61.6). Within a reasonable margin of error therefore, time, usage, size, and various organizational factors appear to be surprisingly informative about the level of EMR adoption support a nursing home will need.

<table>
<thead>
<tr>
<th></th>
<th>Tkts/Bed</th>
<th>Tkts/Bed</th>
<th>Tkts/Bed</th>
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</thead>
<tbody>
<tr>
<td><strong>Discretion</strong></td>
<td>-.014</td>
<td>-.003</td>
<td></td>
</tr>
<tr>
<td>(.006)**</td>
<td></td>
<td>(.013)</td>
<td></td>
</tr>
<tr>
<td><strong>Satisfaction</strong></td>
<td>-.016</td>
<td>-.015</td>
<td></td>
</tr>
<tr>
<td>(.007)**</td>
<td></td>
<td>(.014)</td>
<td></td>
</tr>
<tr>
<td>Disc x Satis</td>
<td>.004</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(.006)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Log(CNA mins)</td>
<td>.111</td>
<td>.036</td>
<td>.043</td>
</tr>
<tr>
<td>(.042)</td>
<td>(.039)</td>
<td>(.047)</td>
<td></td>
</tr>
<tr>
<td>Log(Beds)</td>
<td>-.083</td>
<td>-.097</td>
<td>-.099</td>
</tr>
<tr>
<td>(.020)**</td>
<td>(.027)**</td>
<td>(.026)**</td>
<td></td>
</tr>
<tr>
<td>Usage</td>
<td>.097</td>
<td>.106</td>
<td>.110</td>
</tr>
<tr>
<td>(.022)**</td>
<td>(.021)**</td>
<td>(.021)**</td>
<td></td>
</tr>
<tr>
<td>Observations</td>
<td>151</td>
<td>151</td>
<td>151</td>
</tr>
<tr>
<td>R-squared</td>
<td>0.58</td>
<td>0.59</td>
<td>0.59</td>
</tr>
</tbody>
</table>

*** \( p<.01 \), ** \( p<.05 \), * \( p<.10 \) Standard errors are clustered on facility. Dummy variables are included for month.

Table 3: Regression Results
6. Conclusions

Analysis of these unique data sources provides substantial empirical support for the proposition that organizational characteristics influence the cost of adopting an EMR system. Specifically, our findings document a statistically significant relationship between both job satisfaction and employee discretion and the costs associated with EMR implementation. This paper, therefore, makes an important contribution to the EMR literature in general and to the emerging research on the costs and benefits of EMR adoption. The paper highlights the importance of complementing the traditional analyses of EMR costs, which have relied almost exclusively on “hard” logistical and equipment related costs with an analysis of organizational level factors. It is precisely these organizational variables that may account for a large proportion of the variance in adoption costs and associated outcomes.

Our findings are especially relevant because Congress has authorized unprecedented Federal spending in order to bring about widespread EMR adoption with growing expenditure on the part of private organizations as well as public institutions. Growth in public and private EMR spending enhances the need for accurate and nuanced models that can assist organizations and policy makers in projecting costs and allocating resources. On a public policy level, our findings suggest that broader adoption of EMR systems can be achieved at lower cost if the investments are allocated to facilities with specific organizational characteristics.

Our findings also have implications for organizations and their managers. Healthcare organizations interested in undergoing drastic technological change must evaluate and consider key employee perceptions such as job satisfaction and the degree to which work is organized in a manner that encourages employee discretion. In addition, the relationship between these organizational variables and technology adoption costs suggests that there are additional incentives for managers to ensure positive working conditions and to empower frontline staff.

Finally, our results potentially have implications for technology vendors. First, in devising pricing schedules for their products, vendors may want to consider incorporating an organizational analysis of projected costs. In addition, our findings suggest that beyond assistance on the technological side of the adoption process, firms may also need organizational support. This implies the development of a broader product offering, which includes services targeted at facilitating organizational preparedness.

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9. References


