A Nationwide Study Exploring the Role of Inhibitors in EMR Non-Adoption

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Need for and Feasibility of Proposed Project

The adoption of Electronic Medical Record (EMR) technology is one of the most significant challenges facing physicians today. This challenge corresponds with pressure from both the federal and state government to encourage (or mandate) the adoption decision. This pressure contributed to the development of The American Recovery and Reinvestment Act (ARRA) of 2009, which distributes $17.0 billion to facilitate widespread adoption and use of health information technology (HIT). The funding provides incentives for early adoption of interoperable HIT, but it also enacts penalties in future years for physicians not demonstrating meaningful use of EMRs (Miller, 2011). Although physicians are knowledgeable about these incentives and are aware of the potential penalties for non-adoption, they have been slow to adopt the technology (DesRoches et al, 2008). Only 9.2% of hospitals have adopted an EMR, while only 2% of U.S. hospitals have EMRs that would allow them to meet the government's "meaningful use" criteria (Jha et al, 2010).

One reason for this low adoption rate is that some physicians question the value of EMRs. According to the 2010 National Progress Report on eHealth, a majority (55%) of respondents believe the value of health IT is not widely understood. Moreover, *The Wall Street Journal* has found that some physicians are skeptical about the ability of EMRs to improve productivity or patient care, and this poses an even greater challenge to determine how to get doctors to "meaningfully use" the systems (Hobson, 2011) once they are implemented. As Sarah Corley, the chief medical officer at NextGen Healthcare, noted, many "hospitals have underestimated how hard it can be to get full participation by staff" (Hobson, 2011). Our research seeks to understand this dilemma: why would these highly trained, intelligent physicians resist the adoption of EMR technology which has been touted to provide numerous benefits?

Stated Objectives

We propose four main research questions: (a) what inhibits non-adopting physicians from adopting EMR technology; (b) what factors can overcome these inhibiting influences to move a physician from a non-adopter to an adopter; (c) what patterns of behavior enable a physician to achieve meaningful use; and (d) beyond meaningful use, are there commonalities of adoption behavior that lead to increased quality of care to patients. Our motivation for pursuing these research questions derives from our desire to better understand the EMR adoption process, which can lead to increased adoption rates and improved quality of health care for all Americans. Our research provides insight into why many physicians are not adopting EMRs by scientifically

evaluating their beliefs about EMRs. We posit that physicians possess rational reasons for resisting the adoption of EMRs. We seek to increase our understanding of the reasons why physicians are not adopting EMRs, so that these particular issues can be targeted to more effectively address this matter. This method constitutes the most efficient way to increase the adoption rate of EMRs, so the physicians can begin to experience benefits from this technology.

Gaps in the Previous Literature

A wide body of literature exists that has studied IT adoption, or the factors which influence an individual's decision about whether to purchase a particular technology. Within the domain of organizational science, a robust series of theories have been developed to explain why users adopt technology. The most prevalent lenses include: Unified Theory of Acceptance and Use of Technology (UTAUT), the Technology Acceptance Model (TAM), the Task-Technology Fit (TTF), and the Perceived Characteristics of Innovations (PCI). All of these theories share a common objective – to explain why a user becomes an *adopter* of a given technology. For example, *perceived usefulness* and *perceived ease of use* have been found to significantly influence adoption (Davis 1989).

While alternative lenses are emerging (including one co-authored by the PI – Schwarz and Chin, 2007), we posit that our extant adoption models cannot explain non-adoption, because historically they were not created to do so. Our current approaches were created to explain the behavior of adoption, not non-adoption. As a result, these approaches have been theorized using symmetric factors. Symmetric factors operate upon a single bipolar continuum – for example, the perception of non-ease of use is the opposite of ease of use. Based upon a wide variety of studies, we know that these symmetric factors are useful in explaining adoption (for example, UTAUT explains 70% of the variance in user intention). However, if a user perceives a system as easy to use, does this necessarily mean that they will still make the decision to not adopt the technology? We argue that focusing on symmetric factors alone does not explain the behavior of non-adoption. Furthermore, by focusing only on the adoption decision, we neglect a set of factors that also exerts a considerable influence on the adoption/non-adoption decision.

Inhibitor theory (Cenfetelli and Schwarz, 2011; Cenfetelli, 2004), however, proposes that factors that predict the decision to not adopt a technology are unique and distinct from factors that predict adoption of a technology.   According to Inhibitor Theory, factors operate either symmetrically or asymmetrically. In contrast to

symmetric factors, asymmetric factors are related in nature but opposite in valence, and exist as two independent unipolar continua. For example, in the context of organizational behavior, it has been found that distrust is not the opposite of trust but is instead an independent, oppositely valenced construct with separate effects (Lewicki, Mcallister et al. 1998). Cenfetelli and Schwarz (2011) utilize the concept of asymmetry to examine the factors that inhibit usage. And Schwarz et al. (working paper) utilizes the concept of asymmetry to examine why consumers reject technologies (in some cases even after an initial trial of usage). Therefore, instead of asking the question "Why do physicians choose to adopt EMR technology?" , we instead ask, "why do physicians choose to not adopt EMR technology?". By examining the phenomenon though the Inhibitor theoretical lens, we seek to discover unique factors that are fundamentally different from simply the opposite or lack of factors that explain adoption. This focus on inhibitors enables us to identify attributes that might otherwise be overlooked in traditional adoption research, and so it uniquely contributes to increase our understanding of the non-adoption of EMR technology.

Extant studies on adoption have demonstrated that the shift can be encouraged through the use of facilitating conditions. For example, within UTAUT, facilitating conditions include having guidance available in the selection of a system, specialized instructions being made available, and a specific individual who is available to assist in answering questions. We submit that facilitating conditions exist as well within the EMR context – e.g. the use of incentives by the federal government, the introduction of a HIE, grants available to increase research on the topic, and other private sector opportunities. However, no research to date has examined the efficacy of these factors. We theorize that facilitating conditions, depending on their perception by the physician can strengthen the enablers (and further encourage adoption) and potentially overcome the inhibiting influences.

Following the initial adoption decision, the confluence of inhibiting factors, enabling factors, and facilitating conditions results in behaviors of usage. Based upon previous research conducted by the PIs, we expect that these a priori views of the technology and the facilitating conditions will influence how a physician utilizes an EMR system. Furthermore, based upon extant studies, we posit that the behaviors of use (or the manner in which a physician utilizes EMR) will lead to differential health outcomes.

Our approach to understanding the factors that are associated with non-adoption has three implications. First, the factors that are associated with non-adoption are not merely those that are in direct opposition to the factors that influence adoption. Thus, a researcher must specifically study inhibitors in order to ascertain the factors that inhibit a physician from adopting an EMR, rather than merely studying the phenomenon from an

adoption/enabler standpoint. Extending this premise further, the second implication is that both adopters and non-adopters hold both adoption and non-adoption factors simultaneously. The decision of whether to adopt or not adopt a technology, therefore, is a composite of both positive and negative attributes of the technology. However, the valence of one set of factors is stronger than the others and therefore can explain the resulting adoption or non-adoption behavior. Third, the valence of these factors can change over time and an individual can shift from an adopter to a non-adopter if the valence and relative strength of these factors changes.

We postulate that our work overcomes three gaps in our understanding of EMR adoption and diffusion. First, previous literature in the EMR field that has studied the adoption decision has viewed it only from the perspective of enabling factors. To our knowledge, no studies have examined the impact of facilitating conditions, nor inhibiting influences. Second, few studies have extended these concepts beyond the initial decision to find different types of meaningful use behavior. We assert that there are different levels of meaningful use that derive from our three categories of factors. Third, the relationship between meaningful use behavior and health outcomes (and the associated impact of the facilitating conditions, enabling factors, and inhibiting factors) has received scant attention. We therefore seek to overcome these limitations.

Based upon our theoretical development, we propose the research model below. We have included the research questions captured by our model with the designation RQ.
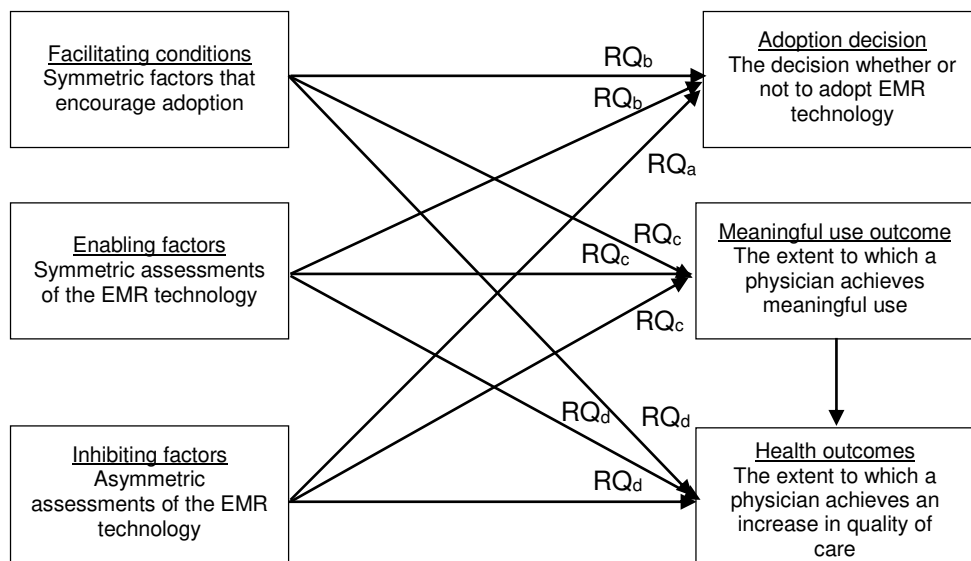
Figure 1. Proposed Theoretical Model

Phase One: Previous Research

The current study is the next phase of our previous work. For our first phase of the research, we partnered with the Louisiana State Medical Society (LSMS) to discover the factors that lead a physician to decide to not adopt EMR technology, including the identification of the factors that constitute unique asymmetric inhibitor factors. Our partnership enabled us to identify 15 physicians across the state of Louisiana who are non-adopters of EMR technology. This sample is varied, representing physicians across different specialties and diverse regions of the state. Thirty minute qualitative interviews were conducted with each of these physicians who are non-adopters of EMR in order to understand their decision to not adopt EMR.

We employed the critical incident technique (CIT, Flanagan 1954), a method designed to elicit direct observations from individuals about their experiences within a specified context. As the approach does not rely upon pre-defined frameworks and is collected from an individual in his/her own words, it is particularly well suited to explore new research areas (Gremler 2004). The approach calls for an individual to respond to a recent incident in the research context and then provide the researcher with the circumstances surrounding that incident. The data that was collected from that incident was content analyzed and inductively classified. In our context, we asked physicians open-ended questions surrounding their decision to not adopt EMR: descriptions of their experiences with the technology; why they chose not to adopt the technology; and what actions they did or did not take as a result. Thus, by eliciting factors (relying upon CIT) from physicians across Louisiana who are non-adopters of EMR technology, we were able to develop a list of factors that contribute to a physician's decision to not adopt EMR. Based upon our identification of the unique set of factors, we then conducted a web-based survey with 300 adopter and 300 non-adopter physicians distributed across the state of Louisiana. The physicians completed the survey by offering their perspectives and rationale for adoption and non-adoption.

Phase Two: The Current Study

We undertook a two-pronged approach to surveying physicians for the current study. First, we purchased a database from an AMA partner organization (Redidata). Using their e-mail blast tool, the survey was distributed to 9,500 physicians across all 50 states. The survey resulted in a 9.5% open rate, yielding an *n* of 107 physician surveys. Next, we contacted 47 medical societies across the United States, providing them with an opportunity to survey their members regarding EMR adoption within their states. Seven medical societies (Arizona, Alabama, Georgia, Mississippi, Oregon, Texas, and Washington) agreed to participate in the study and solicited

participation from their member databases. We have profiled the responses from each of our approaches in the table below. As a result of our comprehensive recruitment approach, 793 physicians across the United States completed our survey.

State	Count	%
Arizona	120	15.1
Alabama	141	17.8
Georgia	86	10.8
Mississippi	20	2.5
Nationwide database	107	13.5
Oregon	200	25.2
Texas	88	11.1
Washington	31	3.9
Total	793	100.0

Profile of Respondents

Our respondents were predominantly male (73%) and white (85%). Nonetheless, there was racial diversity, including physicians who were Asian (4.7%), Hispanic (3.4%), and African American (1.4%). The average age of the physician that completed the survey was 55.85 years old, with 24 years of experience. However, we were able to achieve diversity, with nearly 10% of our respondents under age 40 (9.8%) with 10 years or less of experience (11.9%). The full demographic profile of our respondents is found below.

Demographic Profile of Respondents

Gender	%	Race	%	Age	%	Years of Experience	%
Male	73.1	African American	1.4	Under 30	1.4	10 and under	11.9
Female	22.8	Asian	4.7	31 to 40	8.4	11 to 20	23.7
Declined	4.0	Hawaiian	0.8	41 to 50	18.0	21 to 30	34.9
		Hispanic	3.4	51 to 60	37.5	31 to 40	25.5
		Indian	0.9	61 to 65	17.3	41 and over	4.0
		White	84.9	Over 65	17.3	Declined	8.6
		Declined	4.0	Declined	9.8		

Our respondents were most likely to work in a single (68%) urban (75%) location, where they had most of their patient visits (81% saw more than 75% of their patients at the main site) and worked in a single specialty group or partnership (75%). The physicians were more likely to work in a physician office not attached to a hospital (68%), with nearly one-third working in a hospital (30%). The full practice profile of our respondents is

found below. Our study was open to all specialists and we had over 100 different types of specialists participate in the study.

Practice Profile of Respondents

Location number	%	Patient visits at main site	%	Group Profile	%	Primary setting	%
1	67.7	Less than 25%	1.8	Single specialty	75.4	Hospital, medical-center	29.9
2	20.2	25 to 49%	4.4	Multi-specialty	24.6	Ambulatory surgical center	.5
3 or more	12.1	50 to 75%	12.8			Urgent-care facility	1.5
		More than 75%	81.0			Laboratory or imaging center, outside a hospital	.4

Location profile	%
Urban	75
Rural	25

A physician office not attached to a hospital, or on a medical center campus	67.7

Overall, 72% of our respondents had adopted an EMR solution (we term this group as "adopters"), while 28% had not (we term this group as "non-adopters"). A wide variety of platforms are represented in the adopter group, with over 100 different EMR solutions. Our average adopter has been using their current solution for 4.5 years.

Overview of Factors Influencing Adoption and Non-Adoption of EMR Solutions

During the first phase of our study, we identified three sets of factors, namely: (1) Facilitating conditions, or conditions that encourage adoption of an EMR; (2) Enabling factors, or symmetric assessments of EMR; and (3) Inhibiting factors, or asymmetric assessments of EMR. Within these three sets are specific factors that influence the adoption decision for physicians.

Enabling Factors

Our prior work identified five enabling factors that encourage the adoption of EMR solutions for physicians. These five factors include:

- *Compatibility:* If a physician believes that EMR solutions fit well with how he/she likes to work

- *Ease of use:* If a physician believes EMR solutions is easy to use

- *External integration:* If a physician believes that EMR solutions will facilitate information sharing with external practices/hospitals

- *Internal integration:* If a physician believes that EMR solutions will assist in integrating the data inside of their practice

- *Systems Quality:* If a physician perceives EMR solutions to be of high quality

Inhibiting Factors

Our prior work identified fifteen inhibiting factors that would dissuade the adoption of EMR solutions for physicians. These fifteen factors include:

- *Competence of vendor:* If a physician believes that EMR vendors are competent
- *Complexity:* If a physician believes that an EMR solution takes too much time to complete mechanical operations
- *Cost Estimate:* If a physician perceives that the total cost of EMR solutions is too high
- *Crashes:* If a physician perceives EMR solutions as being subject to frequent problems and crashes
- *Distrust of government:* If a physician distrusts the way in which the federal government will use the data gathered by an EMR solution
- *Distrust of insurance companies:* If a physician distrusts the way in which insurance companies will use the data gathered by an EMR solution
- *Legal framework:* If a physician believes that the legal system has not caught up with the issues related to EMR solutions
- *Loyalty:* If a physician is loyal to his/her current solution to managing medical records
- *Market Complexity:* If a physician perceives the EMR marketplace to be too complex to navigate
- *New Staff Requirement* If a physician believes that EMR solutions will require the hiring of new staff
- *Reliability of vendor:* If a physician perceives that EMR vendors are reliable
- *Staff Time Requirement:* If a physician believes that EMR solutions take too much time for staff to learn
- *Time Requirement:* If a physician perceives that EMR solutions take too much of his/her time to learn
- *Vendor's well-being:* If a physician believes that EMR vendors work for the well-being of their customers

Facilitating Conditions

Our prior work identified eight facilitating conditions that would dissuade physicians from adopting EMR solutions. These eight factors include:
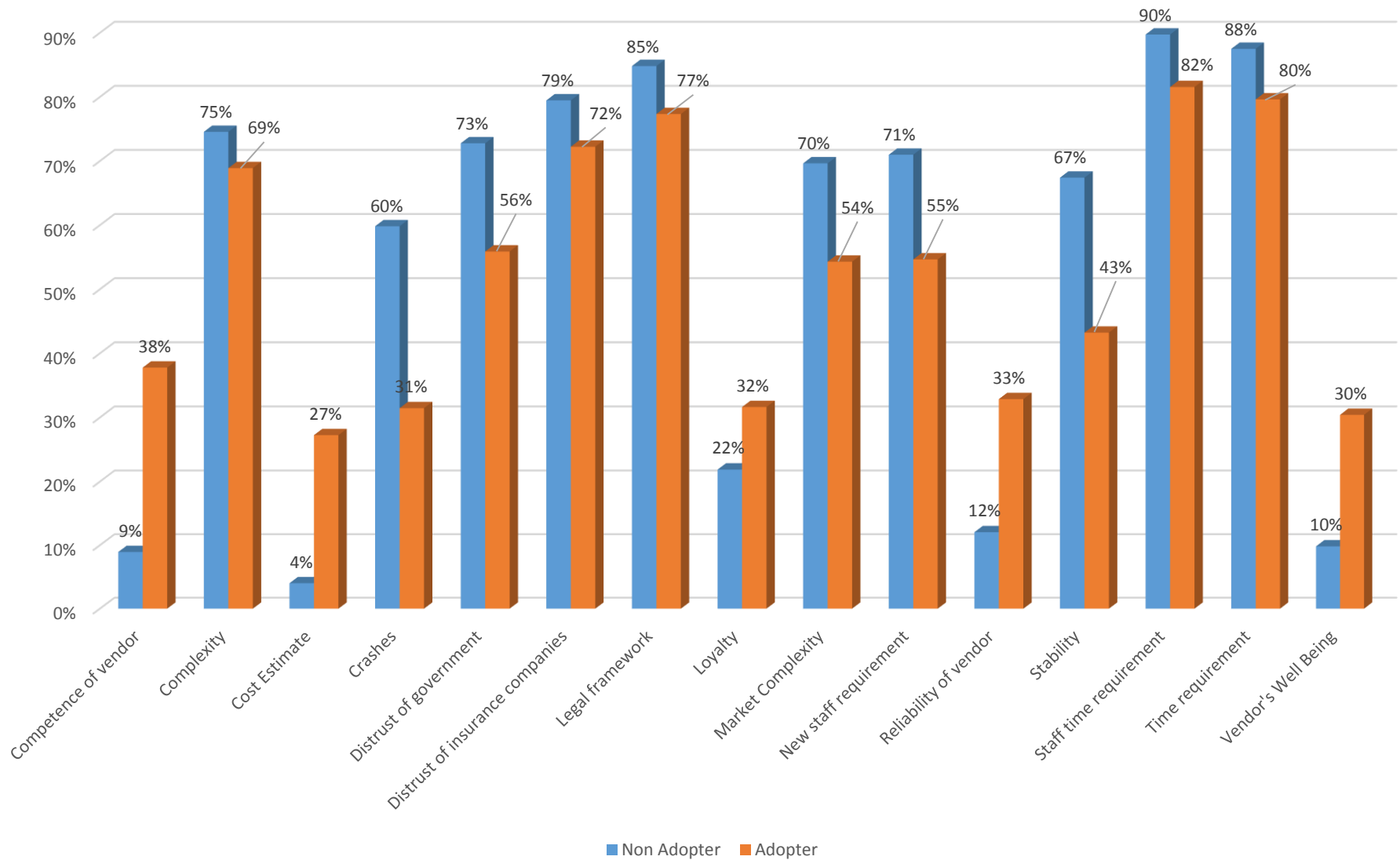
- *EMR Adoption Pressure:* If other physicians in the area have adopted EMR solutions
- *EMR Success Pressure:* If other physicians in the area have adopted EMR solutions and have benefited greatly

- *Competitive pressure:* If other physicians in the area offer similar services

- *Penalties from Federal Government:* If the penalties from the federal government for not adopting an EMR solution will play a critical role in the adoption decision

- *Penalties from insurance companies:* If the penalties from insurance companies for not adopting an EMR solution will play a critical role in the adoption decision

- *Penalties from State Government:* If the penalties from the state government for not adopting an EMR solution will play a critical role in the adoption decision

- *Pressure from hospitals:* If hospitals with whom a physician exchanges patient data have adopted an EMR solution

- *Pressure from other practices:* If other practices with whom a physician exchanges patient data have adopted an EMR solution

Research Question a: What inhibits non-adopting physicians from adopting EMR technology?

Our first research question is what inhibits non-adopting physicians from adopting EMR technology. To address this question, we contrasted the views of the inhibiting factors of adopters and non-adopters. Specifically, we contrast the percentage of adopters and non-adopters which are in agreement to each of the inhibiting factors. By understanding the gap, we can gain insight into what is inhibiting non-adopting physicians. On the following page, we have included a graph depicting the differences between adopters and non-adopters with respect to the fifteen inhibiting factors. We can see significant differences between these two groups that helps us to understand what is inhibiting non-adopting physicians from adopting EMR technology.

Perceptions of Inhibiting Factors

Factor	Non Adopter	Adopter
Competence of vendor	9%	38%
Complexity	75%	69%
Cost Estimate	4%	27%
Crashes	60%	31%
Distrust of government	73%	56%
Distrust of insurance companies	79%	72%
Legal framework	85%	77%
Loyalty	22%	32%
Market Complexity	70%	54%
New staff requirement	71%	55%
Reliability of vendor	12%	33%
Stability	67%	43%
Staff time requirement	90%	82%
Time requirement	88%	80%
Vendor's Well Being	10%	30%

The results demonstrate the following gaps between adopters and non-adopters:

- Over one-third of adopters (38%) perceive their vendors to be competent, yet less than one in ten non-adopters perceive EMR vendors to be competent (9%)

- Three-quarters of non-adopters (75%) believe that EMR solutions are too complex to use. Adopters agree, with 69% of adopters agreeing that their solution is too complex

- Only 4% of non-adopters believe that the total cost of EMR solutions is reasonable, while 27% of adopters agree

- Six in ten (60%) non-adopters believe that EMR solutions crash frequently, yet only one-third of adopters (31%) have experienced frequent crashes with their specific EMR solution

- Both adopters and non-adopters distrust the government's role in pushing EMR with 73% of non-adopters and 56% of adopters indicating distrust of the government

- Both adopters and non-adopters distrust the insurance companies and how they will use the data from EMR solutions, with 79% of non-adopters and 72% of adopters expressing distrust with insurance companies

- Both adopters and non-adopters do not believe that the legal system has not caught up with the new challenges that EMR will bring – 85% of non-adopters and 77% of adopters do not believe the legal framework is in place

- Both adopters and non-adopters did not express loyalty to their current solutions – 22% of non-adopters are loyal to their current use of a paper-based workflow, and only 32% of adopters consider themselves loyal to EMR

- Both adopters and non-adopters believe that the EMR marketplace is too complex – 70% of non-adopters and 54% of adopters perceive the marketplace as being too difficult to navigate

- Both adopters and non-adopters calculate one of the costs of EMR as having to hire new staff to support their EMR solution – 71% of non-adopters believe that an EMR solution will require new staff and over half of adopters have had to hire new staff (55%)

- Non-adopters do not believe that vendors are reliable (12%); one in three adopters perceive their current vendor as reliable (33%)

- Two-thirds of non-adopters (67%) do not believe that EMR solutions are stable; 43% of adopters perceive their current solutions as unstable

- Both adopters and non-adopters believe that one of the costs of EMR will be the time required for staff and themselves to learn how to use the technology. Non-adopters argue that the cost of time for staff (90%) and themselves (88%) will be significant – an experience that adopters have found to be true (82% of adopters have found the staff time as being significant and 80% as their own time)

- Only one in ten non-adopters believe that vendors work for their customer's best interest (10%) – adopters agree, with nearly one in three adopters (30%) finding that vendors do work for their customer's well being

These findings demonstrate a gap between adopters and non-adopters. However, these findings (by themselves) do not enable us to understand which of these factors are the most salient to differentiate between adopters and non-adopters. To assist us in understanding the significance of these factors, we ran a partial correlation between our outcome (i.e. the adoption decision) and our factors (i.e. the inhibitors). In our analysis, we controlled for the state in which the physician lived and operated. The results demonstrate that the most significant inhibitors for physicians are (in order):

1. Cost
2. Distrust of government
3. Stability
4. Crashes
5. Distrust of insurance
6. The physician and staff requirement
7. Market complexity
8. The reliability of the vendor
9. The new staff requirement
10. The vendor operating in the well-being of the physician
11. The lack of a legal framework to catch up

The three non-significant drivers are the competence of the vendor, loyalty to the current solution, and the complexity of the EMR solution.

Inhibitors	Correlation
Cost Estimate	.370 (p < 0.000)
Distrust of government	-.316 (p < 0.001)
Stability	-.289 (p < 0.003)
Crashes	-.285 (p < 0.003)
Distrust of insurance	-.230 (p < 0.017)
Time Requirement	-.220 (p < 0.023)
Staff Time Requirement	-.214 (p < 0.027)
Market Complexity	-.211 (p < 0.030)
Reliability of vendor	.204 (p < 0.036)
New Staff Requirement	-.198 (p < 0.042)
Vendor's well-being	.193 (p < 0.047)
Legal Framework	-.191 (p < 0.050)
Competence of vendor	.135 (ns)
Loyalty	.060 (ns)
Complexity	.036 (ns)

Research Question b: What factors can overcome these inhibiting influences to move a physician from a non-adopter to an adopter?

Our next research question is what inhibits non-adopting physicians from adopting EMR technology. To address this question, we contrast the views of the inhibiting factors and facilitating conditions of adopters and non-adopters. Specifically, we contrast the percentage of adopters and non-adopters which are in agreement to each of the enabling and inhibiting factors. By understanding the gap, we can gain insight into what is inhibiting non-adopting physicians.

The first set of factors that we examined are enabling factors. In the chart below, we see a split between adopters and non-adopters in three of the five enabling factors:

- 41% of adopters believe that EMR solutions are compatible with their workflow, while only 11% of non-adopters agree.

- 42% of adopters perceive EMR solutions as being easy to use, while only 13% of non-adopters agree

- 52% of adopters believe that EMR solutions are of high quality, while only 9% of non-adopters do

In the area of data integration, however, adopters and non-adopters agree:

- 40% of adopters believe that an EMR solution can integrate the various data inside their practice – a sentiment shared by 37% of non-adopters

- 26% of adopters believe that an EMR solution will assist in their ability to integrate with external partners such as physicians or hospitals – 14% of non-adopters agree

Perceptions of Enabling Factors
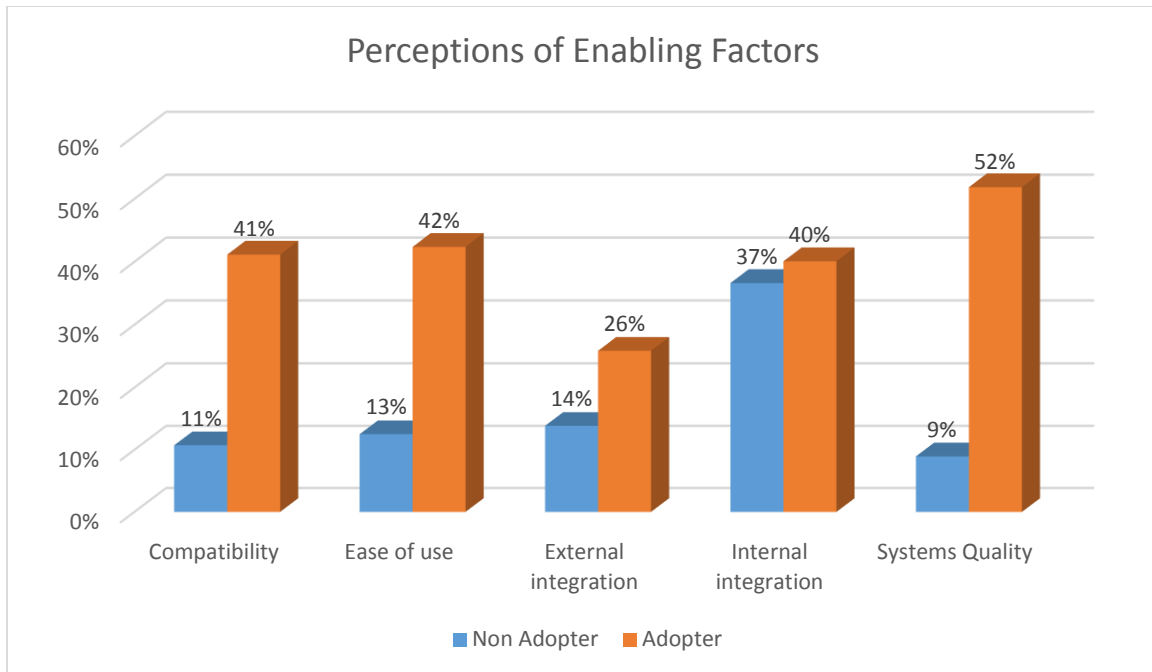
While these differences reveal the perceptual differences between adopters and non-adopters, this approach (by itself) does not enable us to understand which of these factors are the most salient to differentiate between adopters and non-adopters. To assist in understanding the significance of these factors, we ran a partial correlation between our outcome (i.e. the adoption decision) and our factors (i.e. the enablers). In our analysis, we controlled for the state in which the physician lived and operated. The results demonstrate that the only significant distinguishing factors between adopters and non-adopters are: quality, compatibility, and ease of use.

Enabler	Correlation
Systems Quality	.482 (p < 0.000)
Compatibility	.370 (p < 0.000)
Ease of use	.270 (p < 0.005)
External integration	.106 (ns)
Internal integration	.046 (ns)

The next set of factors that we examined are facilitating conditions. Facilitating conditions are those "levers" that can be used to facilitate adoption. Similar to our preceding analysis, we display both the percentage

of physicians who agree with the conditions (presented in the chart below) and the correlations (in the table below). The results are as follows:

- Six in ten adopters (61%) and one-third of non-adopters (33%) have *heard about* other physicians in their area who have adopted an EMR solution and benefited greatly. This facilitating condition is the most significant in driving adoption.

- Few of the physicians (5% of non-adopters and 21% of adopters) have *actually seen* other practices in their area adopt EMR technologies; yet among those that do, there is a significant relationship between this pressure and adoption

- Nearly six in ten (57%) adopters and one-third of non-adopters (34%) exchange data with other practices that have adopted an EMR technology, and there is a significant relationship between this condition and adoption

- While physicians report that penalties from the state government and insurance companies will not play a critical role in adoption, there is a small (yet significant) relationship between the presence of this factor and adoption

- Neither adopters (45%) nor non-adopters (40%) report that the penalties from the federal government will be a significant driver of adoption, and there is not a significant correlation between these penalties and adoption

- Both adopters (71%) and non-adopters (67%) are being pressured from hospitals; however, there is not a significant correlation between the presence of this factor and adoption

- Both adopters (59%) and non-adopters (49%) are being pressured competitively by physicians offering services similar to their own, yet there is not a significant correlation between competitive pressure and adoption

Perceptions of Facilitating Conditions
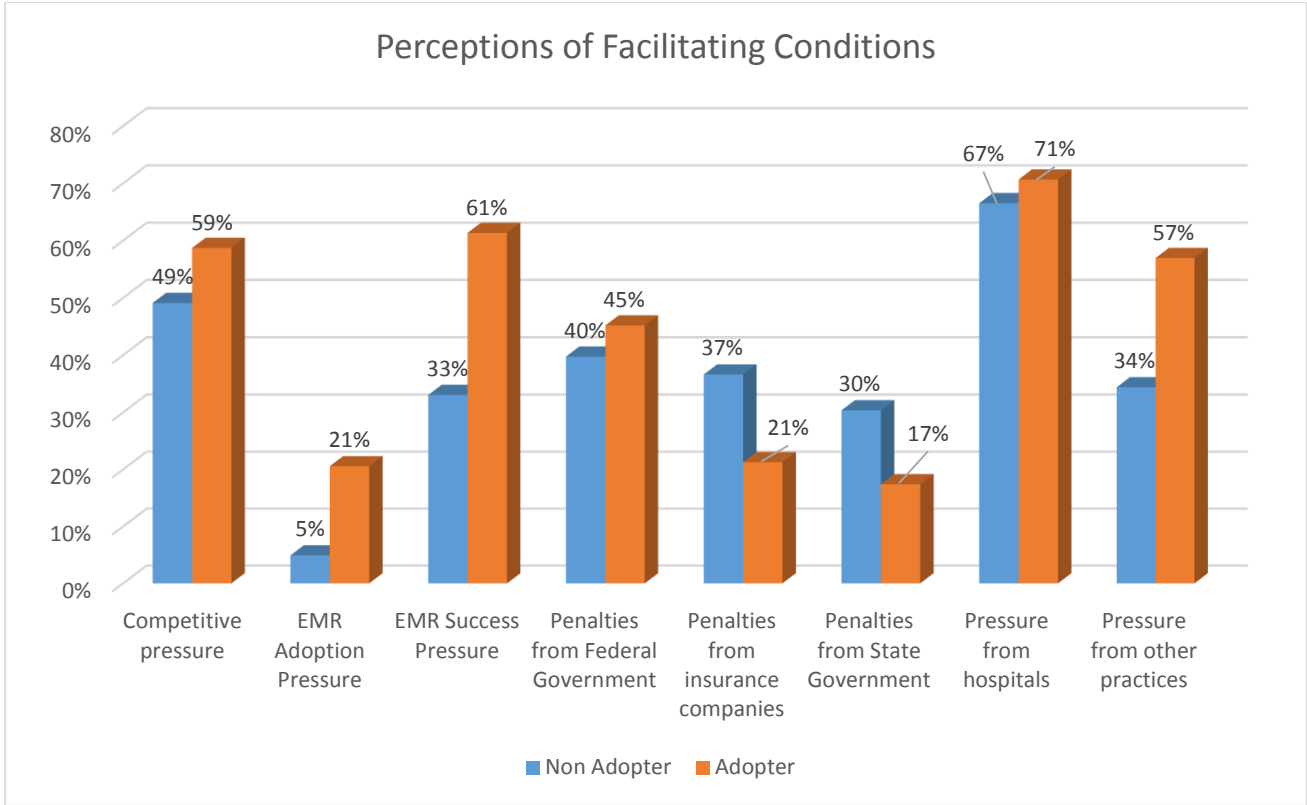
Facilitating Conditions	Correlation
EMR Success Pressure	.305 (p < 0.001)
EMR Adoption Pressure	.316 (p < 0.001)
Pressure from other practices	.294 (p < 0.002)
Penalties from insurance companies	-.256 (p < 0.008)
Penalties from State government	-.234 (p < 0.016)
Competitive pressure	.140 (ns)
Penalties from Federal government	-.131 (ns)
Pressure from hospitals	-.001 (ns)

Research Question c: What patterns of behavior enable a physician to achieve meaningful use?

The next research question addresses meaningful use. Among our adopter physicians, one in five physicians had not yet achieved meaningful use (22.1%), with nearly 60% having achieved Stage 1 (59.9%). The remaining group (17.9%) had achieved Stage 2 of meaningful use.

Stage	%
Not yet achieved meaningful use	22.1
Stage 1	59.9
Stage 2	17.9

To first address research question c, we profiled those physicians who had achieved stage 1 and stage 2 to determine the length of time that it took to achieve these stages. We found that physicians who had achieved Stage 1 had done so within 4.4 years, while Stage 2 took 5.5 years to achieve. To give us a better sense of how long a physician should take to achieve these stages, we analyzed the 95% confidence interval around the mean. Based upon this analysis, we can predict that Stage 1 takes between 3.9 and 4.8 years and stage 2 takes between 4.6 and 6.4 years.

Stage	Average Length of time	95% Confidence interval	
		Lower Bound	Upper Bound
Stage 1	4.4 years	3.9	4.8
Stage 2	5.5 years	4.6	6.4

Next, we were interested in the factors that predict meaningful use achievement. Utilizing meaningful use as our outcome variable and the enablers, inhibitors, and facilitating conditions as our independent variables, we conducted a discriminant analysis (graphically depicted on the following page). A discriminant analysis is intended to determine the factors that discriminate between outcome variables (i.e. those factors that *discriminate* one outcome from another). As part of this analysis, we calculated the territorial map plot which demonstrates the boundaries of the various categories. A discriminant analysis is then interpreted by determining the independent variables that exist within the territory of the outcome variable. The independent variables that exist in a closer geo-location to the outcome variable are more influential than those further away. This approach yields the following results:

Physicians not yet achieving meaningful use: Physicians who have not yet achieved meaningful use are under pressure from hospitals that have embraced EMR technologies, but the complexity of the marketplace and the time required to master the EMR solution are inhibiting the achievement of stage 1. The competence of the vendor is also a significant inhibitor to physicians that have not yet achieved Stage 1, as physicians perceive that these vendors are restricting their ability to be successful.

Physicians in Stage 1: Physicians who have achieved Stage 1 have done so due to the competitive pressure that they perceive from other physicians – i.e. it is a competitive move. They have also heard of other physicians achieving some success, which has played a role in facilitating their movement to Stage 1. They have selected stable EMR solutions that are relatively easy to use, yet they still have concerns over the role of the federal

government and insurance companies and have expressed doubts that their vendors will be reliable over the long-term.

Physicians in Stage 2:   Physicians who have achieved Stage 2 have selected an EMR partner that offers a system that is compatible with their workflow and is of high quality. Physicians in Stage 2 have begun wrestling with the question of external integration and have begun to see the benefits internal to their practice from integrating data. This has come with a great deal of staff time, however, and they have concerns moving forward over how the data will be used by insurance companies and concerns that the legal framework has not yet caught up with the new reality of EMR.

Predicting Meaningful Use Achievement
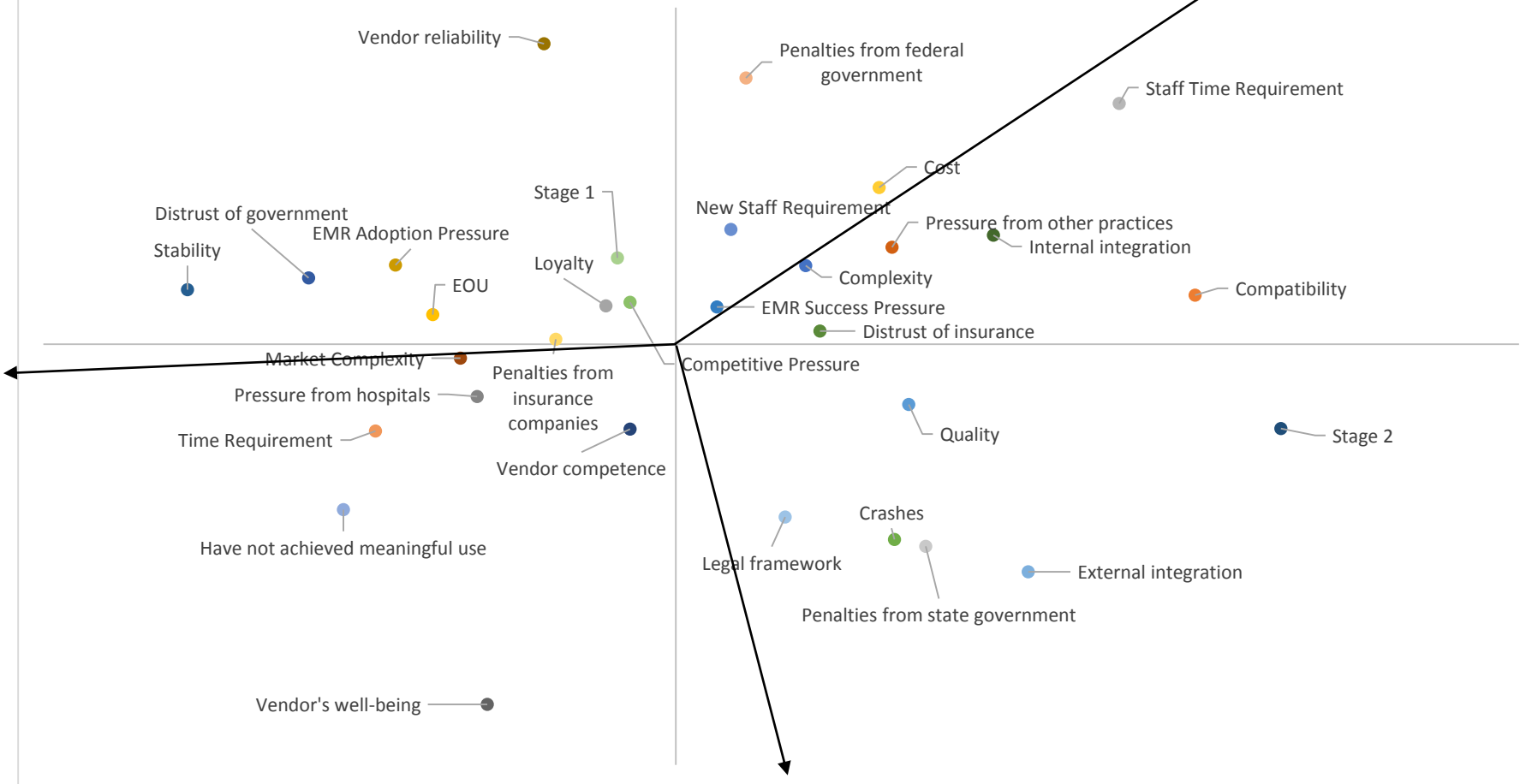
Research Question d: Beyond meaningful use, are there commonalities of adoption behavior that lead to increased quality of care to patients?

Our final research question investigates outcomes beyond meaningful use. Derived from previous studies, we studied ten specific outcomes derived from EMR. These benefits are outlined in the chart below; for adopters, we asked if they had achieved these outcomes, and for non-adopters, we were interested in determining if they believe that achieving these benefits is possible. The majority of the physicians indicated that:
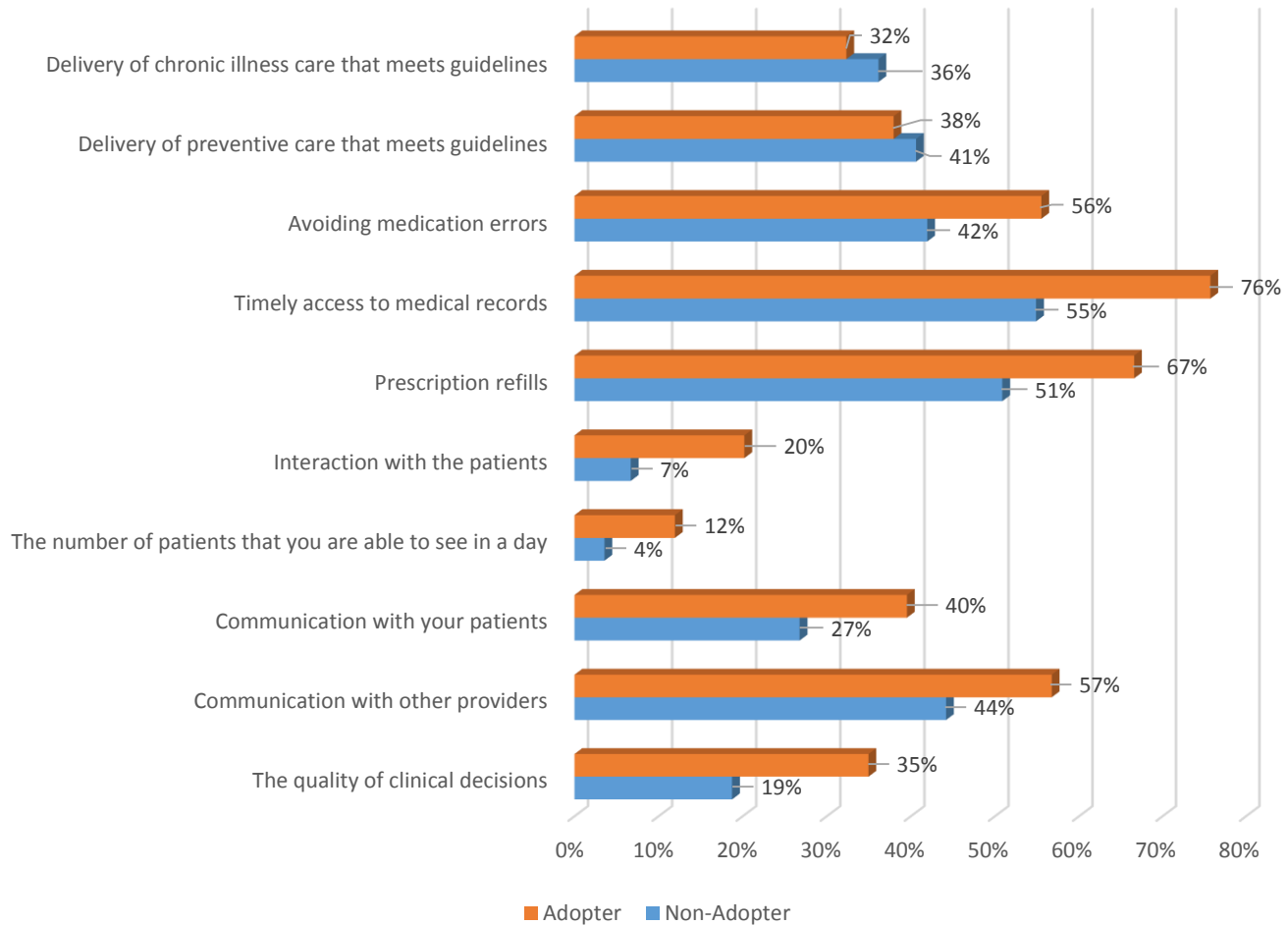
- The most significant outcome that both adopters (76%) and non-adopters (55%) believe will be achieved through EMR is timely access to medical records. Adopters are discovering that this is occurring and non-adopters agree that this is likely.

- The second most significant outcome that both adopters (67%) and non-adopters (51%) believe will be achieved through EMR is to facilitate easier prescription refills.

- The internal and external integration challenges (discussed above) lead adopters (57%) and non-adopters (44%) to agree that communication with other providers is a benefit to using EMR; although, as we have discussed, both groups acknowledge that this is not yet fully realized.

- The last outcome that a majority of our physicians agree is possible through EMR involves the avoidance of medication errors – both adopters (56%) and non-adopters (42%) forecast this as a benefit.

However, a majority of physicians do not predict the following benefits of EMR:

- Communication with patients (40%/27% adopters/non-adopters)

- The delivery of preventive care (38%/41%, adopters/non-adopters)

- The quality of clinical decisions (35%/19% adopters/non-adopters)

- The delivery of chronic care (32%/36% adopters/non-adopters)

- Better interaction with patients (20%/7% adopters/non-adopters)

- An increased number of patients that a physician can see in a day (12%/7% adopters/non-adopters)

The analysis is depicted graphically below.

Benefits Achieved from EMR

Benefit	Adopter	Non-Adopter
Delivery of chronic illness care that meets guidelines	32%	36%
Delivery of preventive care that meets guidelines	38%	41%
Avoiding medication errors	56%	42%
Timely access to medical records	76%	55%
Prescription refills	67%	51%
Interaction with the patients	20%	7%
The number of patients that you are able to see in a day	12%	4%
Communication with your patients	40%	27%
Communication with other providers	57%	44%
The quality of clinical decisions	35%	19%

Based upon the above, we next investigated how long it would take to achieve these benefits. We divided our adopter group for each of the 10 benefits into two groups – those who had achieved the benefit versus those that had not. We then analyzed the length of time that they had their EMR solution implemented. The results are displayed in the table below.

Benefit	Average (in years)	95% Confidence interval	
		Lower Bound	Upper Bound
The quality of clinical decisions	6.2	5.5	6.9
Improved communication with other providers	5.4	4.9	5.9
Improved communication with your patients	5.9	5.3	6.6
Increased number of patients that you are able to see in a day	6.7	5.3	8.0
Improved interaction with the patients	6.7	5.7	7.8
Prescription refills	5.1	4.7	5.6

Timely access to medical records	5.2	4.8	5.7
Avoiding medication errors	5.3	4.8	5.8
Delivery of preventive care that meets guidelines	5.7	5.0	6.3
Delivery of chronic illness care that meets guidelines	5.8	5.0	6.6

Physicians indicate that the first benefits they experience are the ease of prescription refills (5.1 years), the timely access to medical records (5.2 years), the avoidance of medical errors (5.3 years), and improved communication with other providers (5.4 years). Medium term benefits include the delivery of preventive (5.7 years) and chronic (5.8 years) care through a better communication with patients (5.9 years). The long-term benefits achieved include better decisions (6.2 years), interaction with patients (6.7 years) and, finally, an increased number of patients that are able to be seen (6.7 years). Overlaying the length of time that it takes to achieve Stage 2 of meaningful use (5.5 years), our findings indicate that the short term benefits are able to be achieved during Stage 1 of meaningful use, but the medium and long-term benefits only come through Stage 2 achievement.

Finally, we were interested in discovering what led to achievement of these ten benefits. As our focus was upon adopters, we eliminated the inhibitors from analysis and focused only on the enablers and facilitating conditions and analyzed the partial correlation (controlling for the state in which the physician resides) between the enablers and facilitating conditions and the achievement of the benefits.

In the table below, we have highlighted the most significant driver of the benefit. This analysis demonstrates that:

- Different benefits require different facilitating conditions and enablers

- Quality and compatibility are the most salient drivers

- Penalties play a less salient role in achieving the benefits from utilizing EMR (a theme our research discovered in the previous question) than seeing evidence of success from other physicians

- Getting data exchanges in place will facilitate the achievement of benefits; however, (as discussed previously) physicians are skeptical that this can/will be achieved

The full results are found in the table below.

	The quality of clinical decisions	Improved communication with other providers	Improved communication with your patients	Increased number of patients that you are able to see in a day	Improved interaction with the patients	Prescription refills	Timely access to medical records	Avoiding medication errors	Delivery of preventive care that meets guidelines	Delivery of chronic illness care that meets guidelines
Quality	0.569 (p < 0.000)	0.602 (p < 0.000)	0.492 (p < 0.000)	0.356 (p < 0.000)	0.514 (p < 0.000)	0.504 (p < 0.000)	0.490 (p < 0.000)	0.490 (p < 0.000)	0.503 (p < 0.000)	0.415 (p < 0.000)
Compatibility	0.662 (p < 0.000)	0.578 (p < 0.000)	0.579 (p < 0.000)	0.610 (p < 0.000)	0.653 (p < 0.000)	0.379 (p < 0.001)	0.454 (p < 0.000)	0.462 (p < 0.000)	0.430 (p < 0.000)	0.443 (p < 0.000)
Ease of Use	0.571 (p < 0.000)	0.535 (p < 0.000)	0.564 (p < 0.000)	0.423 (p < 0.000)	0.519 (p < 0.000)	0.421 (p < 0.000)	0.399 (p < 0.000)	0.479 (p < 0.000)	0.457 (p < 0.000)	0.433 (p < 0.000)
Internal integration	0.419 (p < 0.000)	0.534 (p < 0.000)	0.497 (p < 0.000)	0.335 (p < 0.003)	0.347 (p < 0.002)	0.306 (p < 0.006)	0.564 (p < 0.000)	0.339 (p < 0.002)	0.378 (p < 0.001)	0.348 (p < 0.002)
External integration	0.445 (p < 0.000)	0.432 (p < 0.000)	0.420 (p < 0.000)	0.312 (p < 0.005)	0.414 (p < 0.000)	0.211 (p < 0.062)	0.414 (p < 0.000)	0.403 (p < 0.000)	0.397 (p < 0.000)	0.364 (p < 0.001)
Competitive Pressure	0.184 (ns)	0.174 (ns)	0.065 (ns)	0.003 (ns)	0.005 (ns)	0.076 (ns)	0.092 (ns)	0.042 (ns)	0.135 (ns)	0.111 (ns)
EMR Adoption Pressure	-0.08 (ns)	-0.074 (ns)	0.003 (ns)	-0.104 (ns)	-0.17 (ns)	-0.014 (ns)	0.093 (ns)	0.077 (ns)	-0.028 (ns)	-0.015 (ns)
Pressure from other practices	0.124 (ns)	0.116 (ns)	0.062 (ns)	-0.009 (ns)	0.057 (ns)	0.062 (ns)	0.215 (p < 0.057)	0.237 (p < 0.035)	0.23 (p < 0.042)	0.259 (p < 0.021)
Pressure from hospitals	-0.042 (ns)	-0.053 (ns)	-0.08 (ns)	-0.127 (ns)	0.012 (ns)	-0.151 (ns)	0.004 (ns)	0.100 (ns)	0.05 (ns)	0.039 (ns)
EMR Success Pressure	0.416 (p < 0.000)	0.449 (p < 0.000)	0.515 (p < 0.000)	0.403 (p < 0.000)	0.577 (p < 0.000)	0.412 (p < 0.000)	0.334 (p < 0.003)	0.306 (p < 0.006)	0.248 (p < 0.027)	0.309 (p < 0.006)
Penalties from federal government	-0.348 (p < 0.002)	-0.276 (p < 0.014)	-0.213 (p < 0.06)	-0.279 (p < 0.013)	-0.374 (p < 0.001)	-0.231 (p < 0.041)	-0.482 (p < 0.003)	-0.259 (p < 0.021)	-0.282 (p < 0.012)	-0.359 (p < 0.001)
Penalties from state government	-0.309 (p < 0.006)	-0.310 (p < 0.005)	-0.226 (p < 0.045)	-0.23 (p < 0.041)	-0.369 (p < 0.001)	-0.301 (p < 0.007)	-0.386 (p < 0.000)	-0.322 (p < 0.004)	-0.33 (p < 0.003)	-0.315 (p < 0.005)
Penalties from insurance companies	-0.244 (p < 0.030)	-0.235 (p < 0.037)	-0.236 (p < 0.036)	-0.254 (p < 0.024)	-0.371 (p < 0.001)	-0.213 (p < 0.06)	-0.344 (p < 0.002)	-0.299 (p < 0.007)	-0.229 (p < 0.042)	-0.268 (p < 0.017)

Conclusions

The adoption of Electronic Medical Record (EMR) technology constitutes one of the most significant challenges facing physicians today. Over the past year, we have followed the journey of adoption across the nation by investigating the challenges and opportunities presented to physicians as they attempt to adopt this new technology. Through our analysis, some significant themes have emerged:

1. Institutional distrust is strong. We have found, both through these analysis and our own interviews with physicians, that there is a significant distrust towards the federal government and insurance companies in pushing EMR technology. Physicians have lamented to us, privately, that if EMR technology was so beneficial, physicians would have already adopted this technology without the need of pressure from external institutions. Our results demonstrate that institutional distrust is a significant barrier.

2. The business model is a structural challenge confronting adoption. The constraint of cost in adopting EMR is not simply a one-time investment, but represents a significant and on-going cost confronting physicians. Yet, the focus on one-time, up-front money to encourage adoption does not recognize that shrinking payments will squeeze a physician as he/she struggles to adapt to the increased demands upon staff (and their own) time to see the benefits of EMR.

3. Meaningful use and benefit achievement are not necessarily linked, nor automatic. Our results indicate that achieving meaningful use and deriving the benefits from EMR are not correlated; instead, they represent two independent outcomes. These two benefits do not necessarily derive from the simple adoption of EMR, but rather through the complex re-configuration of the practice to align the workflow of the practice with that of the EMR.

4. Adoption, meaningful use, and benefit achievement are driven by social networks, not institutional mechanisms. Our results show that physicians are looking to their peers to discover if EMR solutions are worthwhile and not from the institutions pressuring them to adopt (c.f. theme #1). We would encourage institutions seeking to push EMR adoption to work with the physicians to understand their concerns and then engage this network rather than simply pushing adoption down using a top-down approach.

5. Vendors need stronger regulation. Physicians are largely negative towards the EMR marketplace and the vendors that are operating within the market. Our results show that physicians do not view the EMR vendors as competent and reliable, nor do they perceive them as working in the best interest of the physician. We suggest that stronger regulation and focus be placed upon the vendors, in order to give physicians more comfort with the marketplace.

6. Information exchanges are critical, but need standards that require vendors to operate within the exchange. Physicians agree that the exchange is a pathway towards achieving the benefits, but remain skeptical that these exchanges will work with the vendors that they are using. The lack of standardization upon a common data structure that is vendor-neutral has been a key inhibitor, and we encourage the industry to arrive at a standard that allows competition to focus upon the features of the technology and less upon the standards underlying the exchange.

7. Physicians see the operational, but not strategic benefits of EMR. An analysis of the potential benefits of EMR reveals that physicians see the benefits of prescriptions and information exchange, but do not foresee how EMR will lead to better clinic decisions, nor better management of care. The latter represent more strategic, rather than operational, benefits.

8. The legal framework surrounding EMR needs updating. Physicians cited the lack of updates to the laws regarding EMR as a significant barrier, and it was salient in every analysis that we conducted.

We conclude by thanking the Physicians Foundation, the Louisiana State Medical Society, and the physicians that participated in our study. Without your support, this report would not have been possible. We look forward to continuing this area of study as we move towards 2014 and beyond as physicians continue to digitize their records using EMR.

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The first investigator is Dr. Andrew Schwarz Ph.D., the Milton J. Womack Developing Scholar an Associate Professor of Information Systems in the E. J. Ourso College of Business at Louisiana State University. His research interests focus on medical informatics, the adoption of new technology, IT-business alignment, and IT outsourcing. Previous research by Dr. Andrew Schwarz has been published in MIS Quarterly, Information Systems Research, the Journal of AIS, the European Journal of Information Systems, and others top-tier journals. Based upon an analysis of IS academics from around the globe, from 2007 to 2012, Dr. Andrew Schwarz was in the top 2% of all IS researchers in the world in terms of productivity in top tier journals, with most of those publications focusing upon IT adoption. Prior to his career in academia, Andrew was a consultant in the market research industry, working on projects for Fortune 100 companies on topics related to market segmentation, brand imaging, and brand awareness.

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