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Office-based Physician EHR Adoption and Use in Southern US States

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OFFICE-BASED PHYSICIAN EHR ADOPTION IN SOUTHERN US STATES

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ABSTRACT

The paper chronicles exploratory research in the domain of physician electronic health records (EHR) adoption with a view to establishing a foundation for additional research. After reviewing the literature on technology adoption in general and EHR adoption, the paper reviews the adoption and use of EHR by physicians in southern US states to determine if anomalies exist by state or by year. The first major finding is that no differences existed between states. Next, it was discovered that there were statistically significant differences in hospital ERH adoption between two consecutive year pairs (2011/12 and 2012/13). This finding was mirrored physician's ability to send lab results; however, the finding was slightly different in physician's ability to view lab results where the difference was only significant in 2011/12. These findings should be the catalyst for future research to explore the cause of these differences.

Keywords

Electronic health records, office-based physician, technology adoption

INTRODUCTION

The use of electronic health records (EHR) by office-based physicians is USA has increased from 17% in 2008 to 48% in 2013. This nearly three-fold increase offers tremendous opportunities as well as many challenges. The aim of the paper is to review the adoption and use of EHR in southern US states to determine if anomalies exists by state or by year. This foundational research will provide a platform to launch additional research in the future.

TECHNOLOGY ADOPTION

A consideration of the factors that lead an individual or group to adopt an innovation or technology is an endeavor that has filled countless history books dating back to accounts of early man sharpening a stick to make a spear or using fire for warmth. Although the consideration of these factors may cross time and many fields of study, the underlying desire to describe the decision making process can be beneficial to stakeholders if increased rates of adoption of a given technology produce an increased return on investment during the transaction of routine business activity. Understanding the factors that drive the decision to adopt technology affords management the opportunity to stage intervening activities that will promote the implementation of new technology and thus produce desirable outcomes resulting from the guided change in work flow activities (Zhang & Xu, 2011).

When looking at the factors that influence technology adoption with respect to information technology, the question must be considered from the point of view of the decision maker. A decision maker is subject to impressions made by the perceptions of past experiences, opinions of others that the decision maker respects, applied influence by legitimate authority, quality of the technological product, fit of the technology to the job at hand, and the ease of which the technology can be used (Davis, 1989; Venkatesh, Morris, Davis, & Davis, 2003; Yoo & Huang, 2011). It is important to note that the factors listed are all personal perceptions of the situation or environment. In turn, the amount of volitional control possessed by the individual in the decision making process controls the role of decision maker versus influential other played by the participant (Venkatesh, et al., 2003).

Early studies of the decision to adopt technology in the field of information technology began with the work of Davis producing the Technology Adoption Model (TAM) in 1989, and countless others have sought to expand and modify Davis' work over the years in hopes of increasing the model's power to predict the decision making process. Davis (1989) drew on many existing theories from the fields of psychology and management, such as Theory of Reasoned Action (TRA) and Theory of Planned Behavior (TPB), to create a model that predicted the decision to adopt technology as the result of three factors: perceived ease of use, perceived usefulness, and user acceptance.

Perceived usefulness can be thought of as simply how well a decision maker believes a technology will assist in completing a daily activity (Kanthawongs, 2011). Perceived ease of use reflects the decision maker's opinion of how much effort will need to be expended to use a technology (Türel & Johnson, 2012). In some cases this opinion of effort spent to use technology is

relevant to using an alternative or in other cases simply an opinion of the task itself. A few later researchers have made this distinction by offering the observation that some tasks are actually considered fun or entertaining thus offsetting the amount of effort expended. User acceptance reflects the decision maker's opinion of a given technology in question (Wu & Gao, 2011). Subsequent work by Davis and other technology acceptance researchers immediately began modifying user acceptance as a predictor of adoption (Venkatesh, Morris, Davis, and Davis, 2003).

Over time many researchers have considered the factors that influence adoption of technology in many different ways, such as describing societal and technology change that influences opinions, internal and external factors experienced by the decision making, and contextual factors that vary from one work environment to the next (Venkatesh, et al., 2003). With the modification of adding subjective norm as a means of explaining user acceptance the Technology Acceptance Model evolved from TAM to TAM2 and realized an improvement in successful prediction of outcomes by almost 20% overall (Park, 2009). Since the predictors used in the model are based on decision maker perception, subjective norm is used to explain the effect that influential others in the workplace pose to a user perception of a technology. These influential others can be knowing or unwitting influential ranging from a manager expressing a desire to implement a technology, a co-worker complaining over lunch to a champion of a technology showing a cubicle mate how to accomplish a task utilizing the technology for assistance (Favero & Hinson, 2007). Influential others such as champions or critics play a central role in technology adoption because adoption requires a break from the status quo which is challenging for many employees (Rogers, 1995).

Although many of the ideas and predictor variables remain the same under the surface, a new version of predicting technology adoption known as Unified Theory of Acceptance and Use of Technology (UTAUT) is gaining ground among researchers. UTAUT uses performance expectancy, effort expectancy, attitude, social influence, and anxiety as predictors in the decision to adopt technology (Yoo & Huang, 2011). The internal anxiety experienced by the decision maker can reflect nervousness about changing the way things are done, fear that support is insufficient, lack of training, and lack of possessed skills (Polites & Karahanna, 2012).

Managers that wish to lead their workforce toward accepting and adopting a new technology must provide interventions that support favorable changes in the predictor variables known to influence the decision to adopt technology (Favero & Hinson, 2007). In terms of subjective norm or influential others in the workplace, the manager can contribute to a positive disposition of employees toward a technology by openly showing support for the implementation of a technology (Holden & Karsh, 2010). In some cases, the manager should be seen using the technology whenever possible. Early training of employees predisposed to liking a technology will produce champions of the technology in the influential others group. Additionally, these champions can be used as peer trainers for co-workers (Rogers, 1995).

Management can foster support for a technology by providing training opportunities for employees. This will serve to reinforce the acceptance of the technology by management and improve perceived ease of use by allowing employees to practice using the technology (Hall, 2009). Additionally, trainers can identify the usefulness in many areas for the employee thus improving the perception of usefulness (Türel & Johnson, 2012). Depending on the management structure and leadership philosophy of the business, other incentives ranging from rewards to recognition can be used to foster the utilization of a given technology. Additionally, many new and emerging technologies possess factors that influence adoption that are somewhat unique to the technology or field of business that is being entered by the technology (Holden & Karsh, 2010). The healthcare field is definitely an area of business that possesses unique challenges that are not seen in other fields ranging from consideration of human outcomes, specific legislation, and a healthcare culture that has been built over centuries of treating patients (Hamid & Cline, 2013).

ELECTRONIC HEALTHCARE RECORDS ADOPTION

When considering the implementation and utilization of technology supporting Electronic Healthcare Records (EHR), traditional predictors of technology adoption apply such as usefulness of the software to facilitate rapid exchange of information, ease of use for the participants engaging in providing healthcare, security of records, availability of support and training, support of administrators, adherence to regulatory codes and laws, and factors relating to subjective norm (Hamid & Cline, 2013). However, additional hurdles arise once the battle of convincing practitioners to implement has been scaled. The primary obstacles particular to the healthcare industry and EHR adoption are federal regulations, funding solutions, and the time needed to successfully implement EHR solutions. Even experts wary of adoption acknowledge that EHR does create the benefit of rapid dissemination of information and alleviation of healthcare error relative to relying on human memory (Hamid & Cline, 2013).

As EHR systems evolve, the increase in costs has escalated with the addition of functionality and features. One study found that 51% of those surveys listed available funding as a primary barrier to EHR adoption (Wang, Wang, & Biedermann. 2013). Many doctors and hospitals find it difficult to offset rising cost of EHR solutions while still maintaining expected returns on

investment. Even with federal incentives many healthcare providers have difficulty meeting eligibility criteria (Wang, et al., 2013). Due to this observation, it is not surprising that the makeup of clients and their method of paying for services in turn influence the financial decision as well. Simply put, some clients utilize forms of payment that are more lucrative for healthcare providers (Shin, Menachemi, Diana, Kazley, & Ford, 2012).

In many cases when dealing with technology adoption, time is the enemy of successful implementation. Adopters that are forced to make rapid decisions due to legislation or employer mandates are often unwilling adopters of technology and resist to the fullest extent possible (Young. 2010). Employees, managers, and stakeholders generally experience fear of the unknown or change to the established way of transacting daily business processes (Polites & Karahanna, 2012). Fortunately, there is still time to adequately educate, train, influence, and provide funding for potential EHR adopters (Young, 2010).

METHODOLOGY

All of the data used in the project is from the *Health IT Dashboard* which is a US Government *Open Government* initiative developed and maintained by the U.S. Department of Health and Human Services (HHS)'s Office of the National Coordinator for Health IT (ONC). This study focused specifically on the South of the USA; one of the four geographic segments specified by ONC. The South includes the following states: Alabama (AL), Arkansas (AR), Florida (FL), Georgia (GA), Kentucky (KY), Louisiana (LA), Mississippi (MS), North Carolina (NC), Oklahoma (OK), South Carolina (SC), Tennessee (TN), Texas (TX), Virginia (VA) and West Virginia (WV).

This project is focused on three key variables from the National Electronic Health Records Survey conducted by the Centers for Disease Control and Prevention's National Center for Health Statistics. This mail-based survey provides data for each state from 2010 to 2013. National data is available is also available for 2008 and 2009; however, it is not used in our project. For the 2013 data, the nationally representative survey sampled 10,032 office-based physicians and yielded an unweighted response rate of 70%. The researchers believe these three variables provide a good overview of office-based physicians adoption and use of HER. In addition data exists for these three variables for period 2010 to 2013 for all states under view. Many other variables in the dataset are incomplete for that period. The primary interest lies with differences between states or the four-year period and year-on-year differences between to consecutive years. The three variables under review are described below.

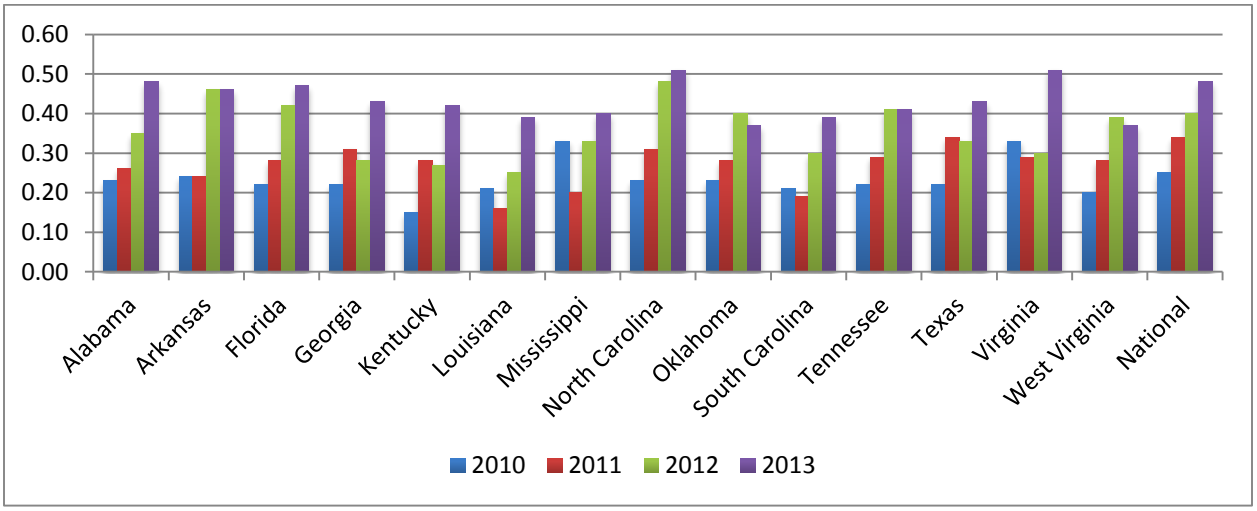

Figure 1 - Adoption of Basic EHRs: Overall Physician Practices

EHR Adoption. The variable full name is Percent of All Office-based Physicians that have Adopted a Basic EHR and the Office-based Physician EHR Adoption and Use (2013) describes it as: "This measure estimates the percentage of all office-based physicians that have adopted a basic EHR. Physicians have adopted a basic EHR system if the computerized system has the following capabilities: patient demographics, patient problem lists, electronic lists of medications taken by patients, clinician notes, orders for medications, viewing laboratory results, and viewing imaging results. Data collection for this measure began in 2008, nationally, and by state in 2010".This variable leads to the first two hypotheses:

H1: Physicians in some Southern states report a significantly lower level of EHR adoption than others.

H2: In some years, physicians in Southern states report a significantly lower increase of EHR adoption than others.

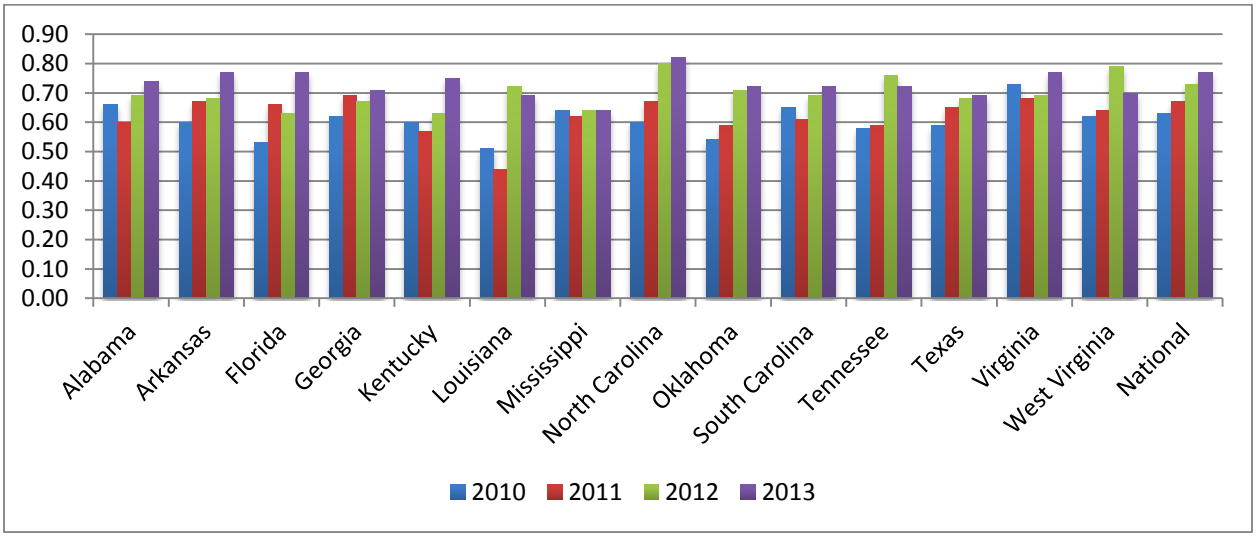

Figure 2 - Percent of Office-Based Physicians with Computerized Capability to View Lab Results

View Lab Results. The variable full name is Percent of All Office-based Physicians with Computerized Capability to View Laboratory Results and the Office-based Physician EHR Adoption and Use (2013) describes it as: "This measure estimates the percentage of all office-based physicians that have an EHR/EMR with the capability to view laboratory results." This variable leads to two hypotheses:

H3: Physicians in some Southern states report a significantly lower capability to view laboratory results electronically.

H4: In some years, physicians in Southern states report a significantly lower increase in capability to view laboratory results electronically than others.

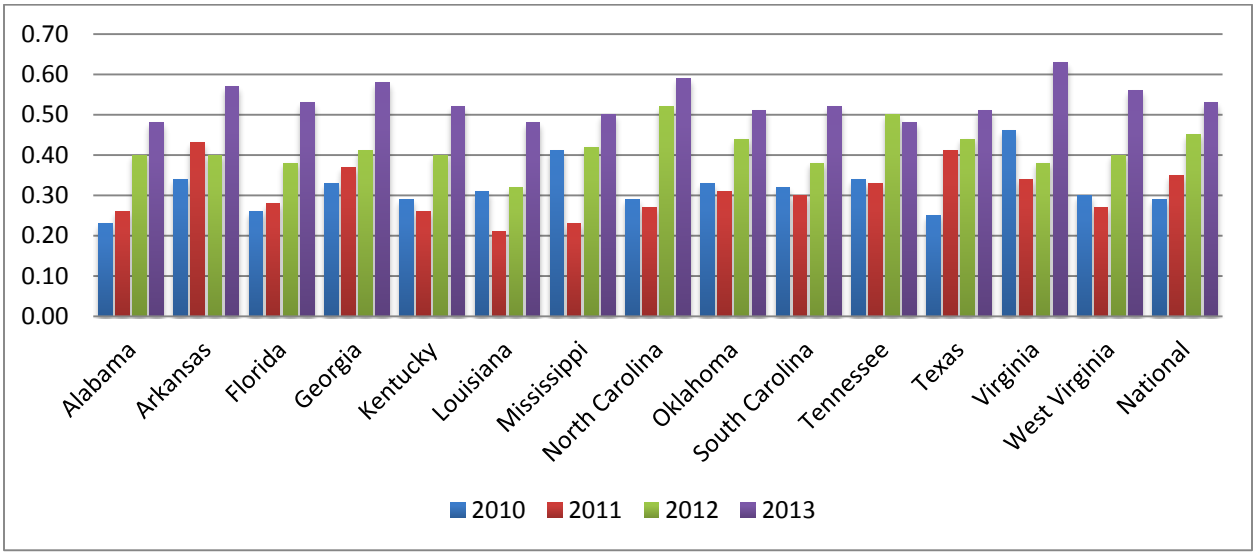

Figure 3 - Percent of Office-Based Physicians with Capability to Send Orders for Lab Tests Electronically

Send Lab Orders. The variable full name is *Percent of All Office-based Physicians with Computerized Capability to Electronically Send Laboratory Test Orders* and the Office-based Physician EHR Adoption and Use (2013) describes it as: "This measure estimates the percentage of all office-based physicians that have an EHR/EMR with the capability to electronically send laboratory test orders." This variable leads to the final hypotheses:

H5: Physicians in some Southern states report a significantly lower capability to send laboratory results electronically.

H6: In some years, physicians in Southern states report a significantly lower increase in capability to send laboratory results electronically than others.

Analysis

The same procedure was followed for each of the six hypotheses. First the data for the states under review was extracted from the Office-based Physician EHR Adoption and Use dataset. Next, the data was converted to a chart to conduct a visually review of the individual states by year. Once the visual review was complete a one-way ANOVA was used to test for differences among 14 states and for the four years under review (2010 – 2013). If a difference was identified, then post-hoc comparison using the Tukey HSD test was conducted to determine which consecutive years or states showed the difference.

H1: EHR Adoption by State. A one-way ANOVA was used to test for adoption percentages among the 14 states. Adoption percentages did not differ significantly at the $p<.05$ level across the 14 states, F (13, 42) = 0.47, p = 0.930.

H2: EHR Adoption by Year. A one-way ANOVA was used to test for adoption percentages over the four-year period (2010 – 2013). Adoption percentages did differ significantly at the $p<.05$ level for the four years, F (3, 56) = 40.73, p = 0.00. Post-hoc comparison using the Tukey HSD test indicated that the mean for 2011 (M = 0.27, SD = 0.053) was significantly different than 2012 (M = 0.36, SD = 0.071) and that the mean for 2012 (M = 0.36, SD = 0.071was significantly different than 2013 (M = 0.43, SD = 0.048).

H3: View Lab Results by State. A one-way ANOVA was used to test for view percentages among the 14 states. View percentages did not differ significantly across the 14 states, F (13, 42) = 0.79, p = 0.671.

H4: View Lab Results by Year. A one-way ANOVA was used to test for view percentages over the four-year period (2010 – 2013). View percentages did differ significantly at the $p<.05$ level for the four years, F (3, 52) = 16.53, p = 0.00. Post-hoc comparison using the Tukey HSD test indicated that the mean for 2011 (M = 0.62, SD = 0.064) was significantly different than 2012 (M = 0.70, SD = 0.054).

H5: Send Lab Results by State. A one-way ANOVA was used to test for send percentages among the 14 states. Send percentages did not differ significantly across the 14 states, F (13, 42) = 0.36, p = 0.97.

H6: Send Lab Results by Year. A one-way ANOVA was used to test for send percentages over the four-year period (2010 – 2013). Send percentages did not differ significantly over the four years, F (3, 52) = 49.49, p = 0.00. Post-hoc comparison using the Tukey HSD test indicated that the mean for 2011 (M = 0.31, SD = 0.065) was significantly different than 2012 (M = 0.42, SD = 0.050) and that the mean for 2012 (M = 0.42, SD = 0.050) was significantly different than 2013 (M = 0.52, SD = 0.046).

CONCLUSIONS

The paper chronicles exploratory research in the domain of physicians EHR adoption with a view to establishing a foundation for additional research. After reviewing the literature on technology adoption in general and EHR adoption, the paper reviewed the adoption and use of EHR by physicians in southern US states to determine if anomalies exist by state or by year. The first major finding is that no differences existed between states. Next, it was discovered that there were statistically significant differences in hospital ERH adoption between two consecutive year pairs (2011/12 and 2012/13). This finding was mirrored physician's ability to send lab results; however, the finding was slightly different in physician's ability to view lab results where the difference was only significant in 2011/12. These findings should be the catalyst for future research to explore the cause of these differences.

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