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Evaluating User Satisfaction and Perceived Quality of Electronic Health Records in Mississippi

Dakota Chamblee

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Evaluating user satisfaction and perceived quality of
electronic health records in Mississippi

By

Dakota Chamblee

A Thesis
Submitted to the Faculty of
Mississippi State University
in Partial Fulfillment of the Requirements
for the Master of Science
in Industrial Engineering
in the Department of Industrial and Systems Engineering

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2013

Evaluating user satisfaction and perceived quality of
electronic health records in Mississippi

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Electronic Health Records (EHRs) is a health information technology that has already begun to change the way healthcare providers care for patients. EHRs can potentially enhance the quality and efficiency of patient care (Simon et al., 2010); however, some research shows that EHRs do not always do so. The lack of improved efficiency and quality of care can lead to frustrated and dissatisfied users. The effects of different aspects of EHR implementation could affect user satisfaction and perceived quality of EHRs. This study investigates the how time since implementation, training, and leadership affect user satisfaction and perceived quality of the EHR system in clinics in Mississippi. The results of the study indicate that training and leadership have an effect on users' perceived quality and satisfaction with EHRs. These findings reveal that clinics and EHR providers should focus on training and leadership to improve user satisfaction and perceived quality of EHRs.

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CHAPTER I
INTRODUCTION

Background

Electronic health records or EHRs are a type of health information technology that has already begun to change the way healthcare providers care for their patients. EHRs are beneficial for both patients and healthcare providers in many ways. EHRs make it easier for healthcare providers to see a patient's history in one place, which reduces redundant tests, immunizations, and other services. EHRs decrease errors in patient care in many different ways. One way that EHRs decrease patient errors is by alerting healthcare providers to possible drug interactions or other harmful conditions (O'Sullivan et al., 2001). When a healthcare facility transitions from traditional paper-based health records to EHRs, everyone in the facility must adapt and learn new ways to do their jobs. EHRs can potentially improve the effectiveness of patient care in many ways, including patient safety, timeliness, efficiency, and quality of care (Otieno et al., 2008).

Researching EHRs is becoming increasingly important due to public policies that press for the implementation of EHRs in all healthcare facilities by 2014 (Simon et al., 2010). In 2009, the American Recover and Reinvestment Act of 2009 (ARRA) was established. The ARRA included the Health Information Technology for Economic and Clinical Health Act (HITECH), which urged health care providers to show that they use

EHRs and gives health care providers financial rewards for using EHRs (Xierali et. al., 2013).

Problem statement

Although EHRs can increase the efficiency and quality of patient care, it is very important for users to be satisfied with EHRs (Karsh, 2004). User satisfaction and perceived quality of the system are important factors for many reasons. Higher user satisfaction can lead to a more complete and prolonged use of EHRs (Menachemi, et al., 2010). It is important to study and uncover possible reasons why users are sometimes dissatisfied with their EHR system.

EHRs in general are studied often; however, user satisfaction and perceived quality of EHRs has not often been studied in the past. User satisfaction is the user's opinion of who will the EHR improves patient care. Perceived quality is the users opinions on the capability of the EHR system itself. Many studies of EHRs examine the benefits or outcomes of implementing EHRs (Hillestad et al., 2005; Calman et. al., 2012). Most of the studies to measure user satisfaction have been conducted outside of the United States or in hospital settings (Menachemi, et al., 2010). Also, many studies focus on physicians and overlook nurses or receptionists, who often represent a large population of EHR users. This study investigated several factors thought to affect user satisfaction and perceived quality of the EHR system for non-physician users.

Objectives of the study

The objectives of this study were to examine how the time since implementation affected user satisfaction and perceived quality of the EHR system, to examine how

different aspects of implementation affect user satisfaction and perceived quality of the EHR system, and to identify other demographics that might affect user satisfaction and perceived quality of the system. Specific hypotheses include:

1. The level of user satisfaction and perceived quality of the system will be significantly affected by the time since implementation. Longer times since implementation will result in higher user satisfaction and higher perceived quality of the system.
2. The level of user satisfaction and perceived quality of the system will be significantly affected by the amount of training received. Higher amounts of training will result in higher user satisfaction and higher perceived quality of the system.
3. The type of training users received will have a significant effect on the level of user satisfaction and perceived quality of the system. Users who received training from a fellow employee will have higher satisfaction and higher perceived quality of the system.
4. The amount of leadership involvement will have a significant effect the level of user satisfaction and perceived quality of the system. Users who had leaders that were very involved in the implementation process will have higher satisfaction and perceived quality of the system.

Scope & limitations

This study will only examine EHRs in family health clinics in Mississippi. Thus, the findings of the study may or may not be generalizable to certain other populations.

Data will only be collected from non-physicians who volunteer to participate in the study

by completing a survey. Since the data will be collected using a survey, the reliability and validity of the data will depend on the honesty of the participant and the amount of knowledge they have about their EHR system.

CHAPTER II

LITERATURE REVIEW

Importance of electronic health records

Electronic health records (EHRs) are a type of health information technology that could improve the quality of patient care (Jha, et al., 2006). EHRs are used for various tasks including recording patient data, planning patient care, documenting procedures, and assessing the results of care. Some examples of common EHR system providers include eClinicalWorks, McKesson, Cerner, Allscripts, GE/Centricity, and many more (“The Top 20 Most Popular EMR Software Solutions”, 2012). Several screenshots of common EHR systems are shown in Figures 2.1 to 2.3. Many different people within a healthcare facility use EHRs, including physicians, nurses, receptionists, and several others. EHRs are also used in various different levels of healthcare, such as inpatient care, outpatient care, and specialty care (Häyrinen, et al., 2008).

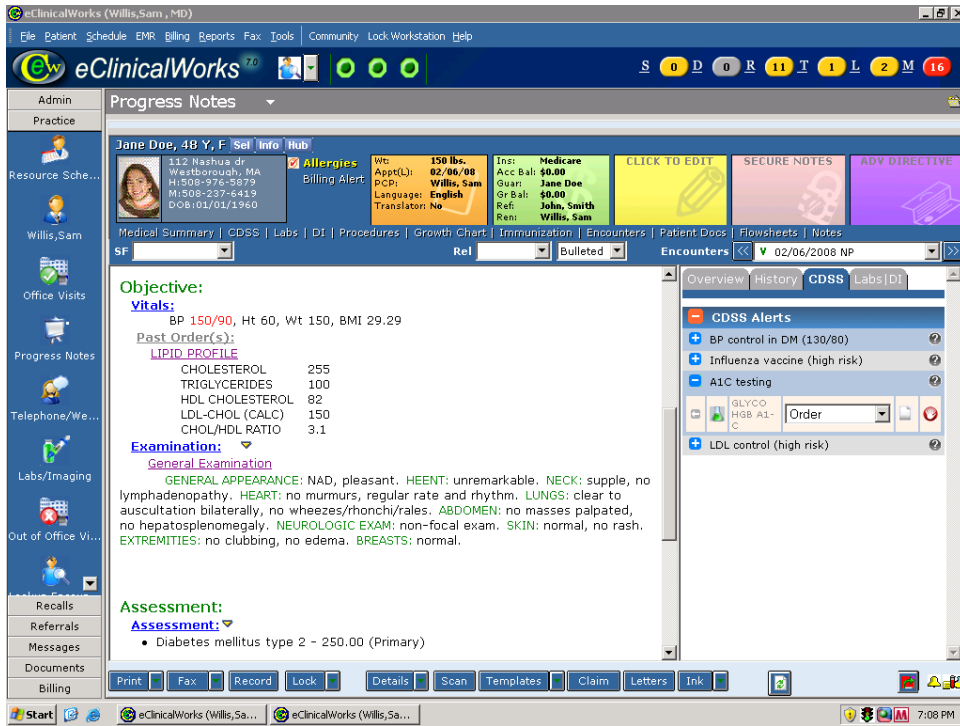


Figure 2.1 Screenshot of eClinicalWorks EHR System (“EMR,” n.d.)

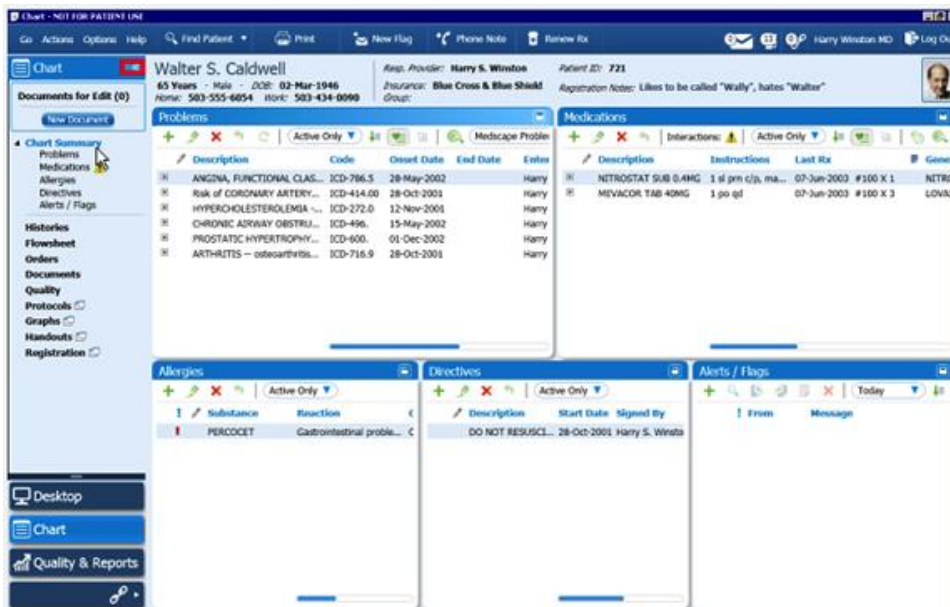


Figure 2.2 Screenshot of GE/Centricity EHR System (“Centricity Practice Management,” n.d.)

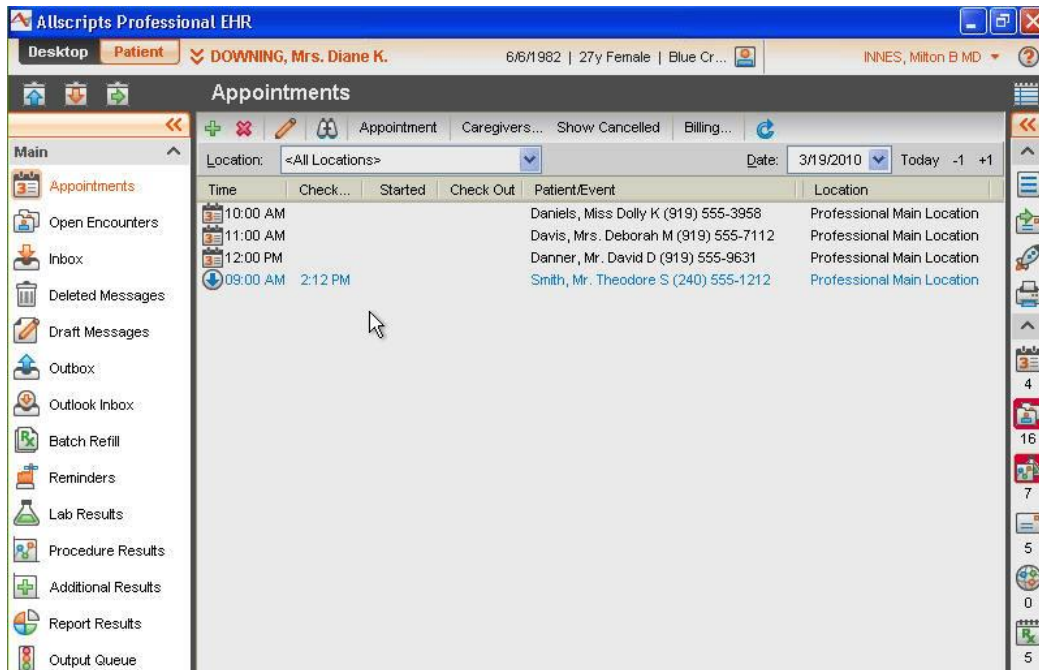


Figure 2.3 Screenshot of Allscripts EHR System (“Allscripts Pro HER Client Screenshots, n.d.)

Although the initial cost of EHRs is substantial, EHRs can potentially save healthcare facilities money over time. In 2011, Fleming et. al. performed a study to examine the financial and non-financial costs associated with implementing EHRs in primary care practices. The cost for implementing EHRs in an average five-physician primary care practice was found to be \$232,279 (Fleming et. al, 2011). The largest areas where primary healthcare facilities benefit from EHR implementation are decreased drug expenditures, more efficient utilization of radiology tests, and decreased errors in billing (Wang et al., 2003).

Cost savings for healthcare facilities are very important, but the benefits of EHRs are not limited to only savings in cost. EHRs can also increase the overall quality of care that the patients receive. Hillestad et al. found that EHRs increase patient safety. EHR

systems use alerts, reminders, and other warnings to alert healthcare workers of possible problems, such as drug interactions and side effects. EHRs help identify or recommend specific care options based on data entered about the patient (Hillestad et al., 2005). For patients with chronic diseases, EHRs can continually help manage the care plan for the patient. EHRs can also allow a patient's records to be shared and updated between different physicians, which can be important for patients that are required to see many different physicians or specialists (Hillestad et al., 2005).

Despite the fact that EHRs generally decrease costs and improve the overall quality of care, the adoption rate of EHRs in healthcare facilities is low (Alder-Milstein, 2010). The adoption rate of EHRs in healthcare should begin to increase due to the HITECH act that presses for the implementation of EHRs in all healthcare facilities by 2014 (Simon et al., 2010). In order for people to want to adopt EHRs, the EHRs must be user friendly and well designed. However, the implementation of an EHR system must also be well designed for the implementation to be successful (Karsh, 2004).

Implementation of electronic health records

Although EHRs have the potential to be beneficial to patients and healthcare workers, implementation of EHR systems can be costly. Implementing an EHR system has two associated costs: costs of the system and costs due to temporary productivity loss (Wang et al., 2003). One study found that the total cost of implementing an EHR system; including training, hardware, and other incurred costs; could range from \$25,000 to \$65,000 per physician (Brooks and Grotz, 2009). Since implementing EHR systems is so costly, it is important to consider factors that could make implementation easier.

The process of implementing EHRs can greatly affect how successful an EHR system is and can often be as important as choosing the system itself (Ludwick & Doucette, 2009). Over time many different factors have been identified that affect the successfulness of EHR implementation. The factors that affect implementation vary slightly depending on the source (Table 2.1).

Table 2.1 Implementation success factors from various sources

	Training/ Support	Time	Leadership	Communication/ Motivation	Goals/ Strategies	Workflow Redesign	Usability of system/ Technology
Brooks and Grotz, 2009	✓		✓	✓	✓		
Karsh, 2004	✓		✓	✓	✓		✓
Leonard, 2004	✓	✓	✓	✓			
Lorenzi et al., 2009	✓	✓	✓	✓		✓	✓
Sanchez et al., 2005	✓		✓	✓	✓	✓	✓

Receiving adequate training is an important factor for the successful implementation of an EHR system. Training should not only be received at the beginning of EHR implementation, but it should also be continued over time (as cited in Keshavjee et al., 2006). Training is costly and time consuming, but it is essential in order for the EHR system to be used efficiently. Health care workers can be trained while converting paper-based records in order to use workers' time more efficiently (California HealthCare Foundation, 2010). Various training strategies can be used. Three specific training topics

that are very beneficial are logic and concept training, features training, and hands-on training (Sanchez et al., 2005). According to Lorenzi et al., training should be concise and should include practice scenarios with the system. The timing of the training is also important. The training should be given close to the time when the technology will be used (Lorenzi et al., 2009).

Time is also an important factor in implementation. When implementing an EHR system, or almost any new technology, there is a technology adoption curve (Leonard, 2004). The technology adoption curve is shown below in Figure 2.1. According to the technology adaption curve, user workload increases at the beginning of implementation, will reach a peak, and then begins to decrease (Leonard, 2004). The time when the workload begins to decrease is usually also the time when the EHR begins to be viewed favorably by most users. Sadly, the amount of time it takes to reach this turning point is not known or easy to identify (Leonard, 2004).

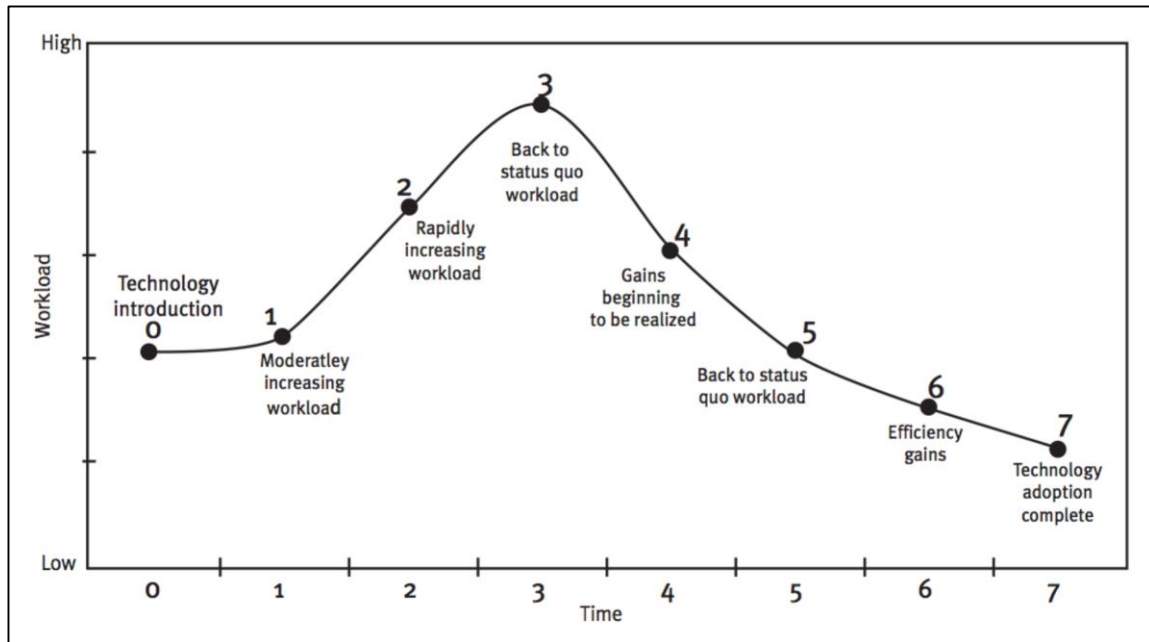


Figure 2.4 Technology Adaption Curve (Leonard, 2004)

Leadership is another important factor for successful implementation of an EHR system. Leaders of EHR implementation should set goals and give future users an idea of what they expect to achieve with the system (Lorenzi et al., 2009). Implementation leaders should be stakeholders who support the implementation of EHR and are highly motivated to make the EHR system successful (Sanchez et al., 2005). Motivation and communication play a large role in decreasing resistance and increasing the likelihood of successful implementation. Leaders should make sure employee input is heard in order for the staff to get involved in implementation (Lorenzi et al., 2009). Leaders must also set clear goals and strategies so that staff members know what is expected of them. This can be accomplished by creating a vision statement that explicitly communicates understandable goals (Lorenzi et al., 2009).

When an EHR system is implemented into a healthcare facility, the workflow should be analyzed in order ensure that the EHR system is incorporated in a beneficial way. The workflow must be re-designed in order for the EHR system to work with all of the other subsystems in the healthcare environment (Karsh, 2004). The EHR system must also be chosen carefully. The system should be easy to use and learn, but still have many features. A system that has high usability will make the users believe it helps them perform better on the job, which will increase the successfulness of implementation (Karsh, 2004.).

Impacts of successful implementation

Successful Implementation of EHRs is very important, because implementation can greatly affect user satisfaction with an EHR system. User satisfaction with EHRs is an important factor to study for many reasons. User satisfaction leads to more long-term and complete usage of all of the EHR system's features. When a user is more satisfied with his or her EHR system, the user's peers are also more likely to be satisfied. This can lead to the adoption of more EHRs in other healthcare facilities (as cited in Menachemi et al., Gabbay & le May, 2004).

Existing studies on user satisfaction

A few studies have been conducted in the United States that measure user satisfaction with EHRs. A study was conducted in Florida that measured physician satisfaction with EHRs (Menachemi et al., 2010). The study surveyed physicians and found that the physicians who had been using their EHR system for more than two years were significantly more satisfied with the system than those who had been using their

system for a shorter period of time. Physicians who had been using EHRs for 2 years or less had a satisfaction score of 1.00 based on a 5-point Likert scale, whereas physicians who had been using EHRs for more than 2 years were more satisfied and had a satisfaction level of 2.78 (Menachemi et al., 2010). Another study examined physicians' and nurses' satisfaction, background, experiences, perceptions of their EHR system, and concerns with their EHR system (Likourezos et al., 2004). Data was collected by surveying emergency physicians three months after EHR implementation. The findings were summarized in a table by the percentage of users that agreed with questions about their EHR system. The study found that in general nurses thought that EHRs were more helpful than physicians did. The percentage of nurses that agreed was higher than the percentage of physicians that agreed for each item (Likourezos et al., 2004).

Many studies of user satisfaction with EHRs have also been conducted outside of the United States. One study was conducted in Kuwait, where EHRs had been implemented in all primary health centers. The study collected data from medical receptionists and found that a majority of the participants found the EHR system satisfying. The study also found that age significantly impacted the participants' negative views of EHRs (Al-Amzi, Al-Enezi, & Chowdhury, 2009). Another study was conducted in Japan that developed and validated a survey to assess nurses' use of EHRs, perceived quality of EHRs, and user satisfaction (Oteino et al., 2007).

Methods of measuring user satisfaction

Previously, many studies have measured user satisfaction with surveys (Al-Amzi, Al-Enezi, & Chowdhury, 2009; Likourezos et al., 2004; Menachemi et al., 2010). One study used a user interaction satisfaction questionnaire that contained sections that

assessed overall user reactions, screen design and layout, terms and system information, learning, and system capabilities (Al-Amzi, Al-Enezi, & Chowdhury, 2009).

In another study of user satisfaction, a questionnaire was used to study nurses and physicians in emergency medicine. The questionnaire contained sections to examine user demographics, user experience with computers, and user perceptions and concerns with EHRs (Likourezos et al., 2004). Answers in the user perceptions and concerns with EHRs section of the questionnaire were given in a Likert scale from strongly agree to strongly disagree.

One group of researchers constructed and validated a survey instrument to measure nurses' use, perceived quality, and satisfaction with EHRs. The final instrument contains 34 questions split into three sections. One thousand six hundred and sixty six respondents from 42 hospitals in Japan completed the survey. The survey was found to have both content validity and construct validity (Otieno et al., 2007).

Existing studies on the quality of EHR systems

Little research exists that specifically examines the quality of EHR systems. Most of the research examines the effects of an EHR system on the quality of patient care (Likourezos et. al., 2004; Menachemi et. al., 2010). One review of the literature did find that the quality of the implementation strategy was just as important as the quality of the EHR system (Ludwick & Doucette, 2009).

CHAPTER III

METHODOLOGY

Experimental overview

This study was designed to examine how different aspects of implementation affect overall user satisfaction and perception of the quality of the EHR system in family health clinics. All of the data was collected by one of two ways: either a paper-based survey that was mailed to health clinics throughout Mississippi or by an online version of the survey.

Independent variables

The independent variables for this study are the time since implementation, the amount of training received, the type of training that was received, and the amount of leadership involved in implementation. The data gathered about time since implementation and the amount of training received was continuous, and the data collected about the type of training received and the amount of leadership involved was categorical. Data was collected about six different types of training: fellow employee training, vendor representative training, web-based training, self-training, ongoing support, and other training. Fellow employee training is any training from a fellow employee that has more experience or knows more about the system than the person receiving training. Vendor representative training is any training received face to face

from a vendor. Web-based training is any training program or tutorial that the user participates in to better understand the system. Self-training is when the user is responsible for learning and familiarizing himself with the system on his own. Ongoing support is any follow-up training received from the vendor that a user seeks out after realizing that they do not know how to use parts or features of the system. Finally, other training is any type of training that is not any of the other training types.

The continuous data gathered about time since implementation and the amount of training received was made categorical by splitting the data into different groups based on the data that was collected. To split the data into different groups, dot plots for each of the variables, shown in Figures 3.1 and 3.2, were examined to see where there was a division in the data. The data for the time since implementation was split into two groups: novice users and experienced users. Novice users are those who had been using EHRs for 1.25 years or less. Experienced users are those who had been using EHRs for more than 1.25 years. The data for the amount of training received was also split into two groups: less trained users and more trained users. Less trained users are those who received 30 or less total hours of EHR training. More trained users are those who received more than 30 total hours of EHR training.

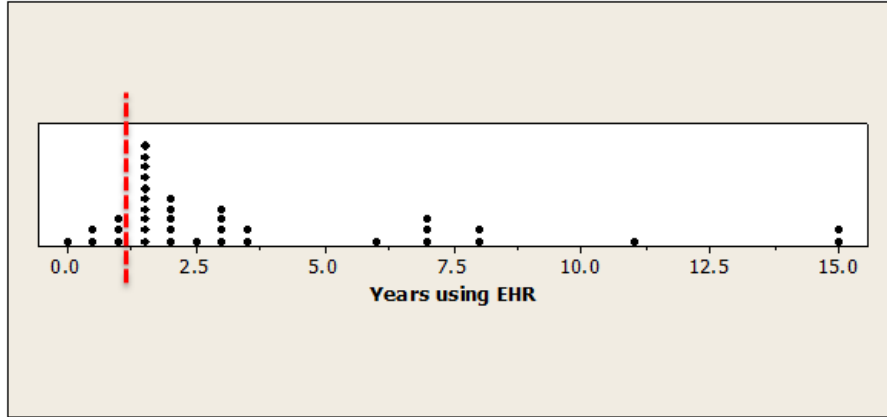


Figure 3.1 Dot plot for time since implementation

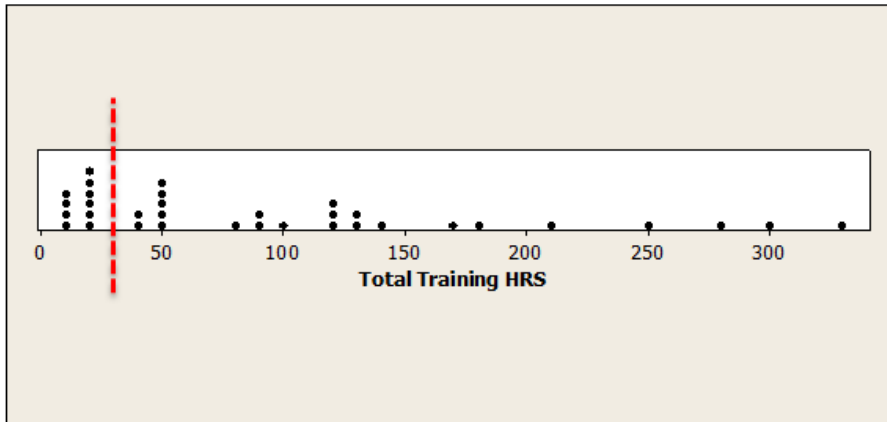


Figure 3.2 Dot plot for amount of training

Dependent variables

The dependent variables for this study were user satisfaction and the perceived quality of their current EHR system. Each of these was measured using a 5-point Likert scale, similar to the one used in an existing survey (Otieno et al., 2007). For each of the variables, the participants were asked to respond to twelve questions. The participant's responses were averaged to give each a single average score for each variable. In other

words, an average overall score was calculated for each of the two dependent variables. A higher score meant that the user was more satisfied or the perceived quality of the system by the participant was higher. The data collected about perceived quality was normally distributed, but the data collected about user satisfaction had to be normalized by using a Johnson transformation.

Protocol

A list of 215 prospective family clinics was created by collecting the names of health clinics in Mississippi from two sources (“Directory of Mississippi Health Facilities,” 2010; “Health Centers And Look-alike Sites,” 2013). Approximately half of the clinics were contacted by phone in an attempt to increase the participation in the study. Not all of the clinics were contacted by phone because of time constraints. The survey was sent to a total of 160 family health clinics. Paper-based surveys were mailed to 87 family clinics, and a link to the survey was emailed to 73 family clinics. Three surveys were included in each paper-based packet that was mailed to a clinic in order to allow more than one employee from each clinic to participate. The surveys were mailed with a postage paid return envelope as well as two informed consent forms and a drawing entry form. The volunteers who participate in the study were entered into a drawing for one of five \$100 Visa Gift Cards. To participate in the study, the packets had to be completed and/or postmarked by June 21, 2013.

Instrument

The survey for this study contained questions about user satisfaction, perceived quality of the EHR system, implementation (time and method), and other demographics.

Questions about user satisfaction and perceived quality of EHR systems came from a previously validated survey (Otieno et al. 2007). Other questions were included in the survey to assess various aspects of EHR implementation, including amount of training received, time since implementation, amount of leadership involvement, and the time it took to implement the system. Three questions about leadership during implementation are included in the survey. These questions assess the users opinion of amount of leadership, amount of communication with leadership, and amount of motivation by leadership. These questions were written based on communication and motivation being important aspects of leadership during EHR implementation (Sanchez et al. 2005). The survey also included questions that gathered demographic data. For example, the survey contained questions about the size of the clinic, characteristics of the user, and characteristics of the system, as this data could possibly lead to the identification other factors that affect user satisfaction level and perceived quality of the system. A copy of the complete survey can be seen in Appendix A.

Participants

The participants had to be non-physician employees of a family health clinic that uses EHRs. For example, nurses, nurse practitioners, nurse's assistants, physician's assistants, receptionists, and any other office workers who routinely use EHRs were asked to complete the survey. A total of 40 people participated in the study. Twenty paper-based surveys were completed and returned from 13 clinics. Since 261 total surveys were mailed and 20 paper-based surveys were returned, the response rate for the paper-based survey was approximately 7.66%. Twenty online surveys were completed, but the total number of clinics that participated in the online survey is not known. Since

73 clinics were emailed the survey and 20 online surveys were completed, the response rate for the online survey was approximately 27.40%. The overall response rate for both versions of the survey was approximately 11.98%. The clinics included in this study had a range from 0 and 5 nurses, nurse practitioners, and doctors. Some of the clinics did not have all job roles filled. . For analyzing the data collected about EHR systems, the EHR systems were categorized into very common and less common based on ratings from 2011 ("The Top 20 Most Popular EMR Software Solutions"). A summary of the descriptive statistics for the demographic data is shown in Table 3.1 and Table 3.2.

Table 3.1 Descriptive statistics for categorical demographic data

	N	Percent
Gender		
Male	2	5.00%
Female	38	95.00%
Job Role		
Nursing	18	45.00%
Administration/Office Worker	22	55.00%
Computer Use Per Week		
1 to 5 hours	18	45.00%
6 to 10 hours	11	27.50%
11 to 15 hours	5	12.50%
16 hours or more	6	15.00%
EHR Use Per Day		
0 to 2 hours	4	10.00%
3 to 5 hours	10	25.00%
6 to 8 hours	17	42.50%
More than 8 hours	9	22.50%
EHR System		
Allscripts*	5	12.5%
eClinicalWorks*	5	12.5%
McKesson/Practice Partner*	4	10.0%
Epic	6	15.0%
NextGen	2	5.0%
Success EHS	6	15.0%
Compugroup	2	5.0%
Sage/Vitera	1	2.5%
Cerner*	1	2.5%
HEHR	1	2.5%
Healthport	1	2.5%
Practice Fusion	1	2.5%
Mastermind	1	2.5%
Glo	1	2.5%
Advanced MD	1	2.5%
Unknown	2	5.0%
EHR System Classification		
Very Common	15	37.50%
Less Common	25	62.50%

* Denotes that the EHR system is included in the very common category

Table 3.2 Descriptive statistics for continuous demographic data

	Mean	Standard Deviation	Minimum	Maximum
Age (years)	45.36	13.55	21.00	68.00
Clinic Age (years)	24.91	15.33	1.00	50.00
Number of Physicians	2.46	1.93	0.00	5.00
Number of Nurse Practitioners	2.40	1.71	0.00	5.00
Number of Nurses	3.48	1.71	0.00	5.00

CHAPTER IV

RESULTS

Descriptive Statistics

The survey included questions that made it possible to evaluate the levels of user satisfaction and perceived quality based on many different demographics and characteristics of the participants. A summary of the mean quality and satisfaction scores based on various factors is shown in Tables 4.1 through 4.3.

Table 4.1 Descriptive statistics for the dependent variables for various participant characteristics (*M* (sd))

	N	Quality	Satisfaction
Overall	40	3.89 (0.70)	3.79 (0.86)
Gender			
Male	2	4.69 (0.33)	4.79 (0.30)
Female	38	3.85 (0.11)	3.73 (0.85)
Job Role			
Nursing	18	3.68 (0.72)	3.51 (0.88)
Administration/Office Worker	22	4.06 (0.66)	4.01 (0.79)
Computer Use Per Week			
1 to 5 hours	18	3.83 (0.63)	3.69 (0.78)
6 to 10 hours	11	4.02 (0.66)	3.93 (0.85)
11 to 15 hours	5	3.87 (0.96)	3.98 (1.04)
16 hours or more	6	3.86 (0.93)	3.64 (1.12)
EHR Use Per Day			
0 to 2 hours	4	3.90 (0.46)	3.65 (1.23)
3 to 5 hours	10	3.73 (0.81)	3.78 (0.87)
6 to 8 hours	17	3.76 (0.80)	3.47 (0.84)
More than 8 hours	9	4.21 (0.47)	4.28 (0.58)
EHR System			
Very Common	15	4.14 (0.57)	4.05 (0.79)
Less Common	25	3.74 (0.74)	3.62 (0.88)
Time Since Implementation			
Experienced Users	25	4.00 (0.67)	3.93 (0.84)
Novice Users	12	3.59 (0.75)	3.38 (0.86)
Amount of Training			
Less Trained	10	4.09(0.59)	3.91 (0.95)
More Trained	24	3.87 (0.76)	3.76 (0.89)

Table 4.2 Descriptive statistics for the dependent variables by type of training received(*M* (*sd*))

	Received Training Type			Did Not Receive Training Type		
	N	Quality	Satisfaction	N	Quality	Satisfaction
Fellow Employee Training	26	3.85 (0.74)	3.81 (0.84)	8	4.21 (0.55)	3.77 (1.13)
Vendor Representative Training	22	3.90 (0.84)	3.60 (1.03)	12	4.00 (0.39)	4.18 (0.40)
Web-based Training	24	3.93(0.74)	3.75 (0.86)	10	3.94 (0.66)	3.91 (1.01)
Self-training	25	3.92 (0.71)	3.73 (0.83)	9	3.99 (0.75)	4.00 (1.09)
Ongoing Support	20	3.72 (0.78)	3.50 (0.98)	14	4.24 (0.47)	4.24 (0.53)
Other	3	3.44 (0.49)	3.61 (0.56)	31	3.98 (0.72)	3.82 (0.93)

Table 4.3 Descriptive statistics for the dependent variables by leadership data

	N	Quality	Satisfaction
Amount of Leadership			
Too Little	4	3.60 (0.64)	3.44 (0.87)
About Right	35	3.89 (0.70)	3.80 (0.87)
Communication with Leadership			
Once in a While	5	3.48 (0.82)	3.48 (0.77)
Sometimes	6	3.94 (0.53)	4.17 (0.54)
Fairly Often	10	3.88 (0.78)	3.88 (0.99)
Frequently	16	3.97 (0.76)	3.76 (0.93)
Motivation by Leadership			
Once in a While	5	3.33 (0.64)	3.07 (0.81)
Sometimes	5	3.63 (0.40)	3.92 (0.58)
Fairly Often	8	4.23 (0.63)	4.38 (0.56)
Frequently	21	3.94 (0.75)	3.76 (0.88)

Hypothesis Testing

Hypothesis 1: The Effect of Time Since Implementation on User Satisfaction and Perceived Quality

An ANOVA was performed using Minitab software to test the hypothesis that longer times since implementation would result in higher user satisfaction and higher perceived quality of the system, using an alpha of 0.10. An alpha of 0.10 is used throughout this study, because the consequences of committing a type I error are low. The results showed that there was not a significant effect on user satisfaction, $F(1,35) = 2.17, p = 0.149$, or perceived quality, $F(1, 35) = 2.84, p = 0.101$.

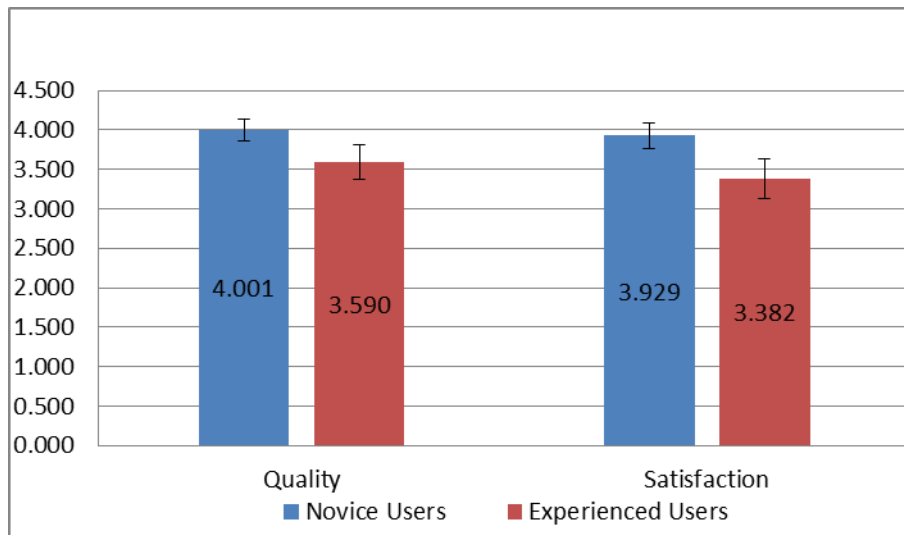


Figure 4.1 Mean scores for dependent variables by novice and experienced users

Hypothesis 2: The Effect of the Amount of Training on User Satisfaction and Perceived Quality

An ANOVA was also performed using Minitab software to test the hypothesis that higher amounts of training would result in higher user satisfaction and higher

perceived quality of the system. The results showed that the amount of training had no significant effect on user satisfaction $F(1, 32) = 0.08, p = 0.778$, or perceived quality of the system $F(1, 32) = 0.69, p = 0.413$.

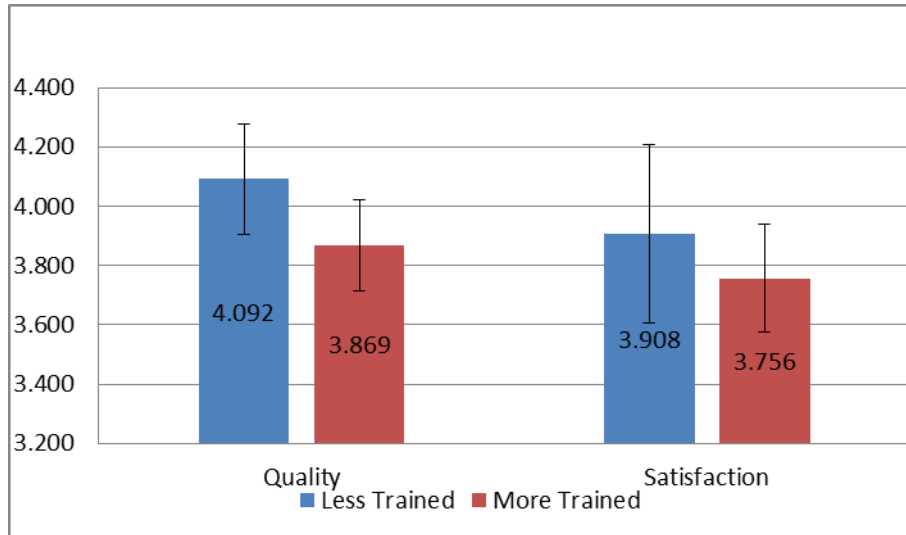


Figure 4.2 Mean scores for dependent variables by less trained and more trained users

Hypothesis 3: The Effect of the Type of Training on User Satisfaction and Perceived Quality

Several ANOVAs were performed using Minitab software to test the hypothesis that users who received training from a fellow employee will have higher satisfaction and higher perceived quality of the system. An ANOVA for each training type was performed to see if whether or not a participant had each type or training had a significant effect on user satisfaction or perceived quality. Of the six types of training included in the study, the results showed that ongoing support was the only type of training that had a significant effect on perceived quality of the system $F(1, 32) = 5.04, p = 0.032$. The results also showed that the only type of training that had a significant effect on user

satisfaction was ongoing support, $F(1, 32) = 5.84, p = 0.022$. Summaries of the means for the dependent variables for each training type are shown in figures 4.3 through 4.8.

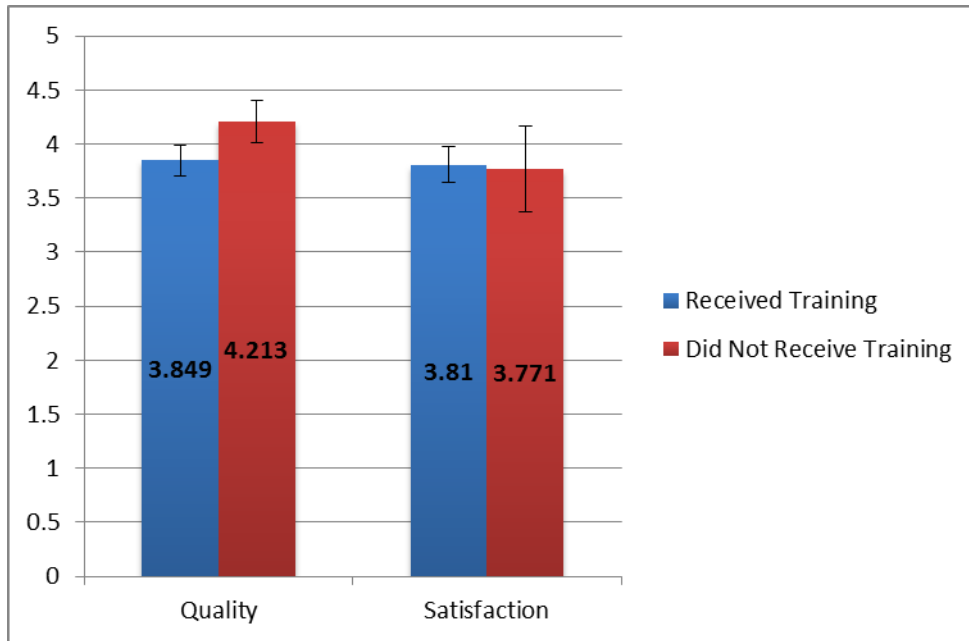


Figure 4.3 Mean scores for dependent variables by whether or not fellow employee training was received

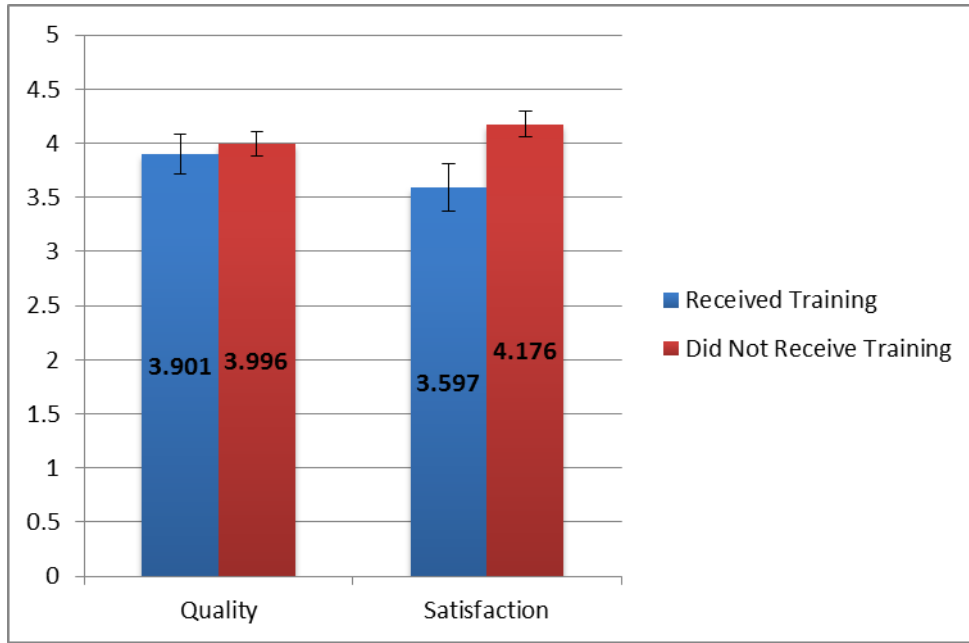


Figure 4.4 Mean scores for dependent variables by whether or not vendor training was received

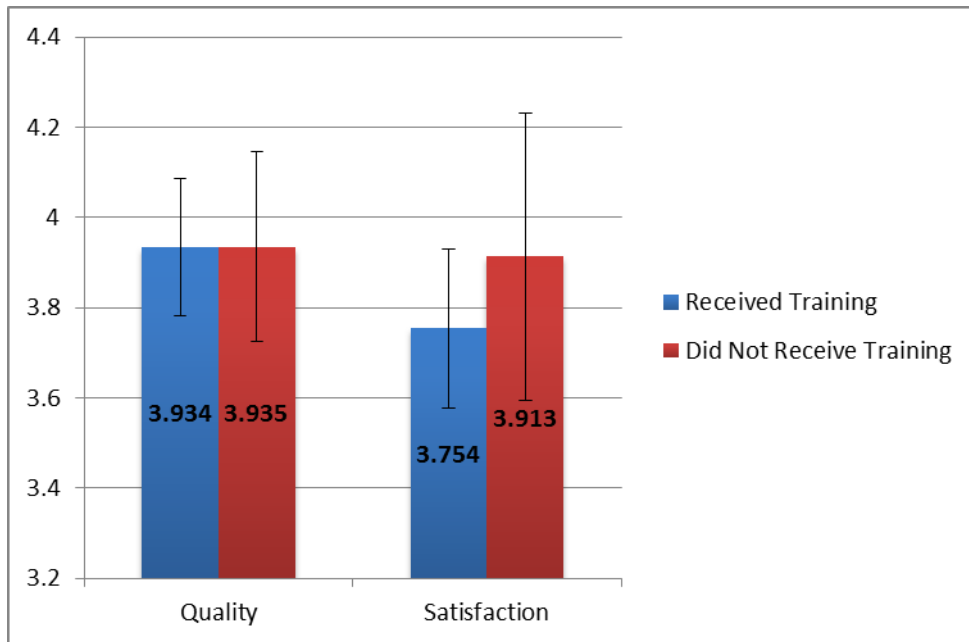


Figure 4.5 Mean scores for dependent variables by whether or not web-based training was received

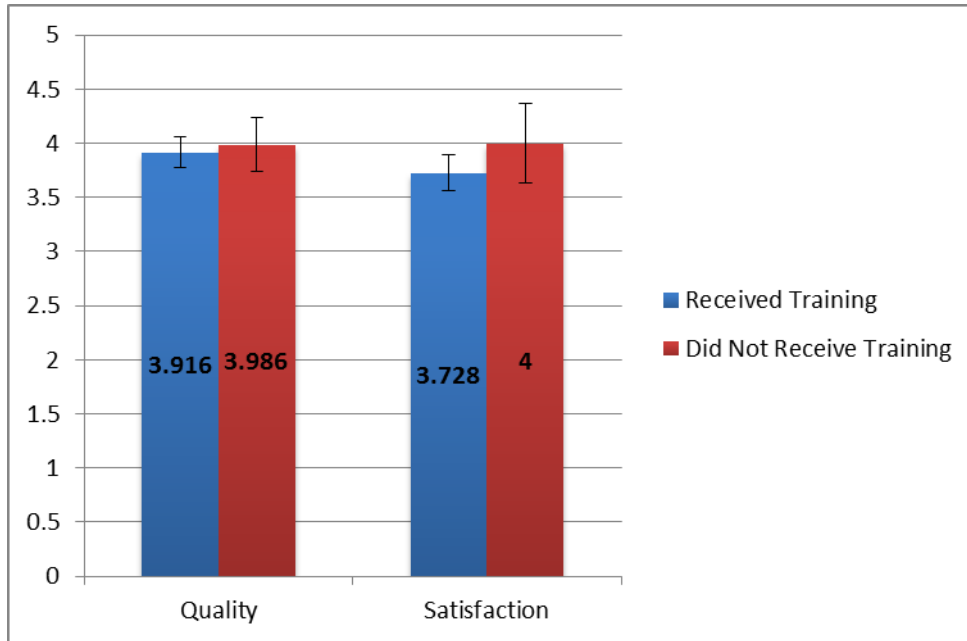


Figure 4.6 Mean scores for dependent variables by whether or not self-training was received

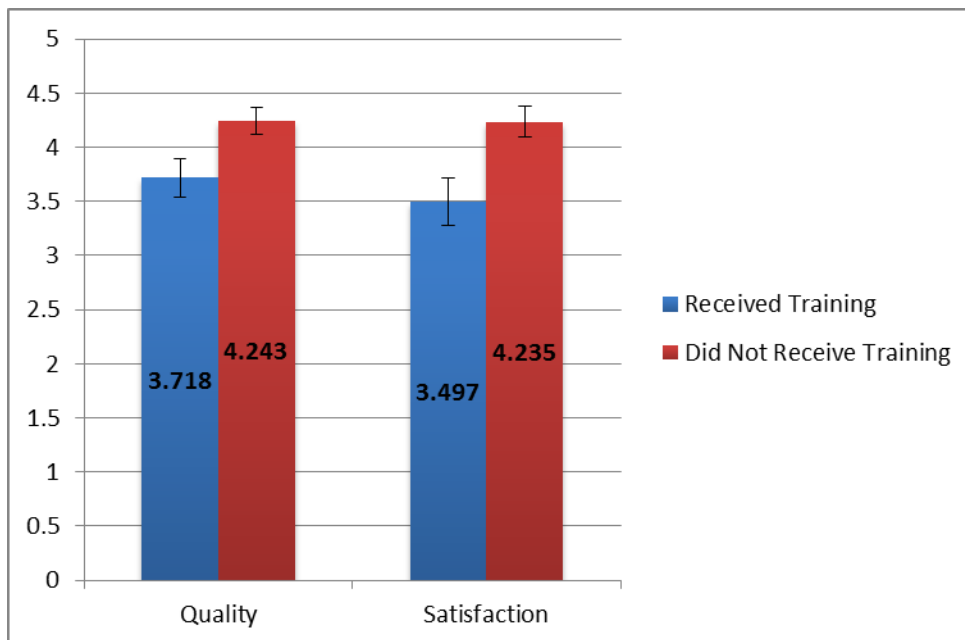


Figure 4.7 Mean scores for dependent variables by whether or not ongoing support was received

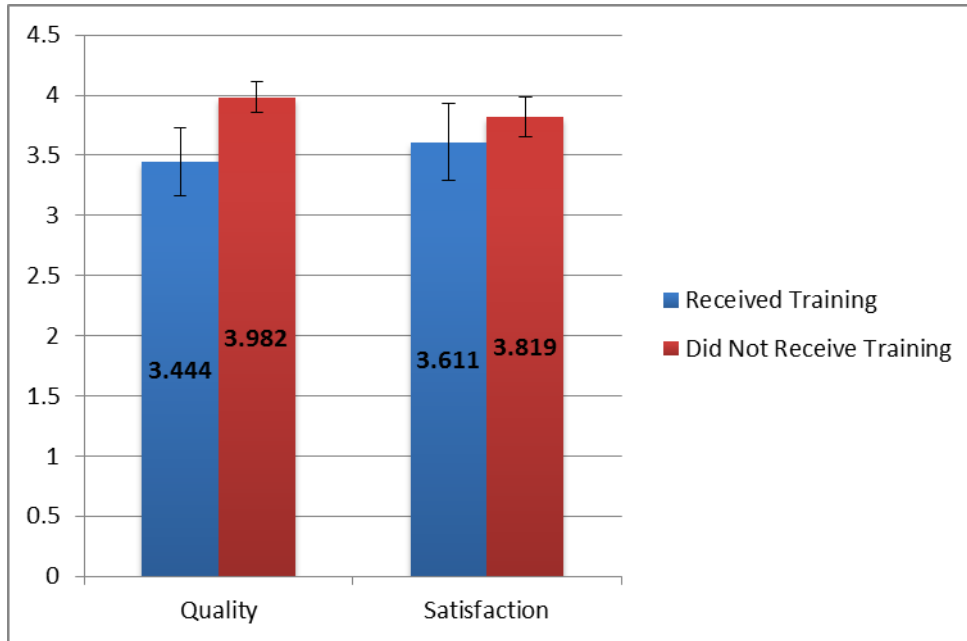


Figure 4.8 Mean scores for dependent variables by whether or not other training was received

Hypothesis 4: The Effect of the Amount of Leadership on User Satisfaction and Perceived Quality

Finally, three ANOVAs were performed using Minitab software to test the hypothesis that users who had leaders that were very involved in the implementation process would have higher satisfaction and perceived quality of the system. The first ANOVA was performed using independent variable data received about the participants' general opinion on the amount of leadership involved in implementation. The results showed that perceived quality was not significantly affected by the amount of leadership involved in implementation $F(1, 37) = 0.61, p = 0.440$, nor was there an effect on user satisfaction $F(1, 37) = 0.68, p = 0.416$.

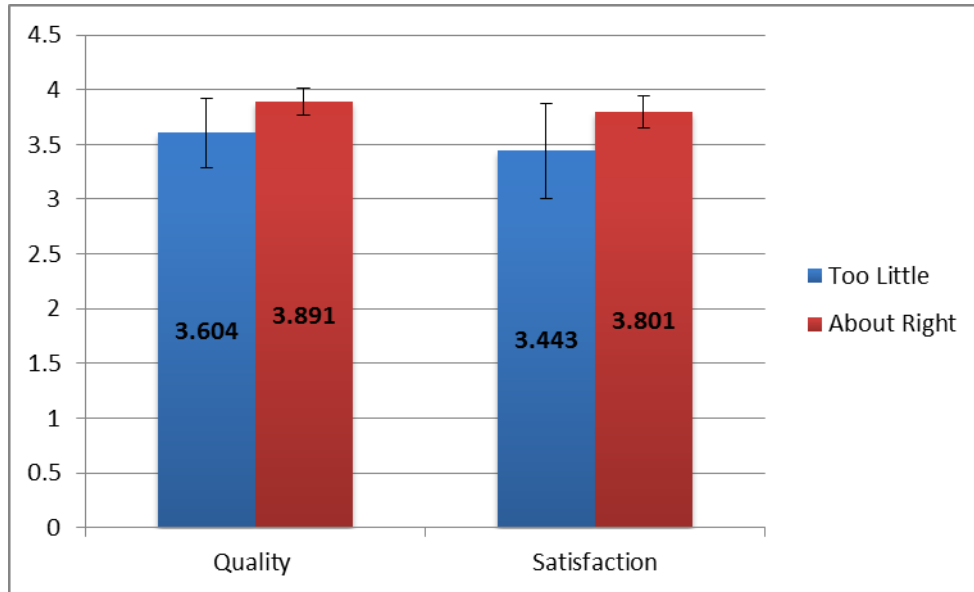


Figure 4.9 Mean scores for dependent variables by amount of leadership

The second ANOVA was performed using independent variable data received about the amount of communication the participants had with leadership during implementation. The results of this ANOVA showed that the amount of communication with leadership did not have a significant effect on perceived quality $F(3, 33) = 0.57, p = 0.642$, or user satisfaction $F(3, 33) = 0.49, p = 0.693$.

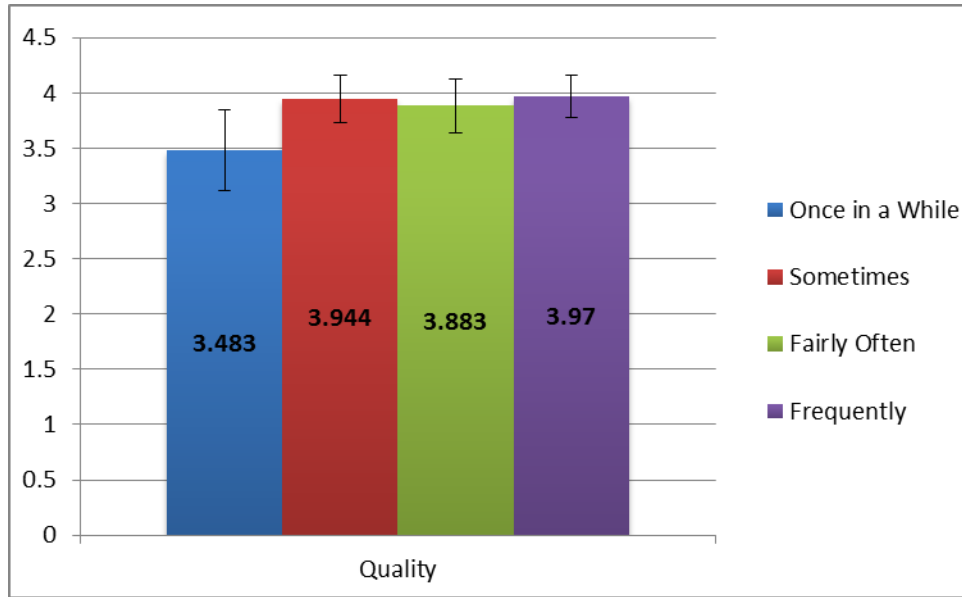


Figure 4.10 Mean scores for perceived quality by amount of communication with leadership

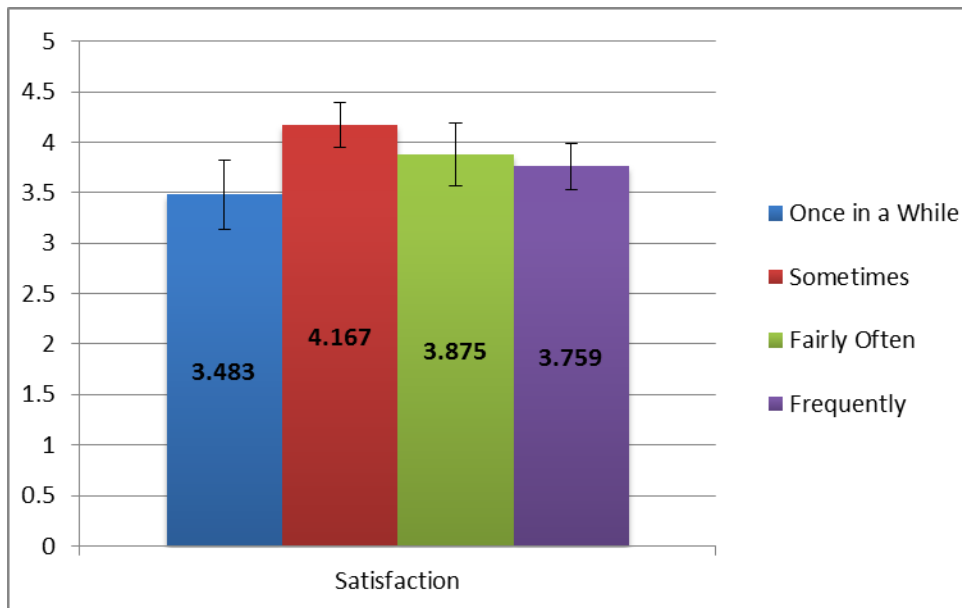


Figure 4.11 Mean scores for user satisfaction by amount of communication with leadership

The third ANOVA was performed using independent variable data received about how often the participants were motivated by leadership. The results of the ANOVA showed that perceived quality was not significantly affected by the amount that participants were motivated by leadership during implementation $F(3, 35) = 2.03, p = 0.128$. The results of this ANOVA also showed that the amount that participants were motivated by leadership did have a significant effect on user satisfaction $F(3, 35) = 2.47, p = 0.078$. Tukey's post-hoc comparison shown in Table 4.4.

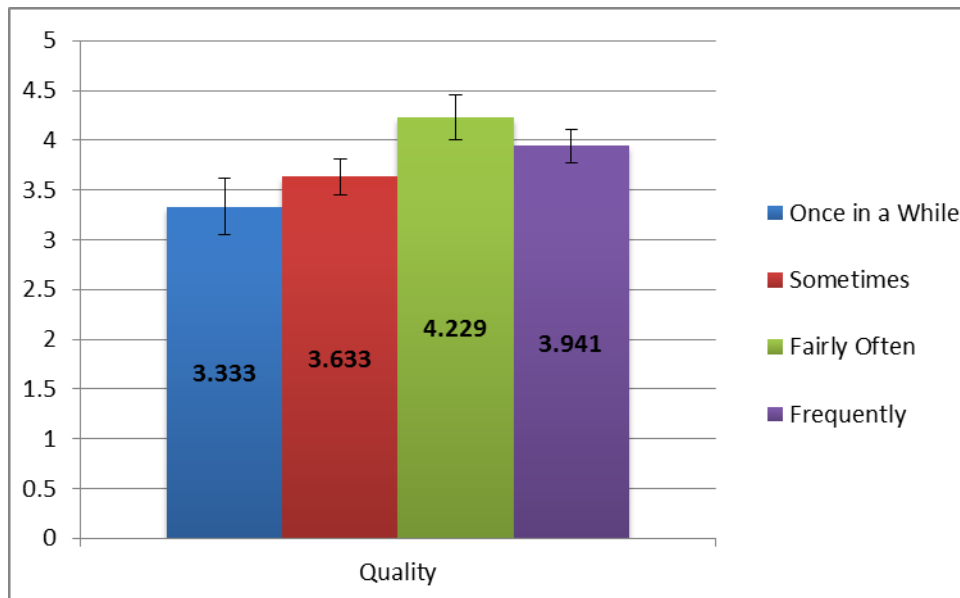


Figure 4.12 Mean scores for perceived quality by how often participants were motivated by leadership

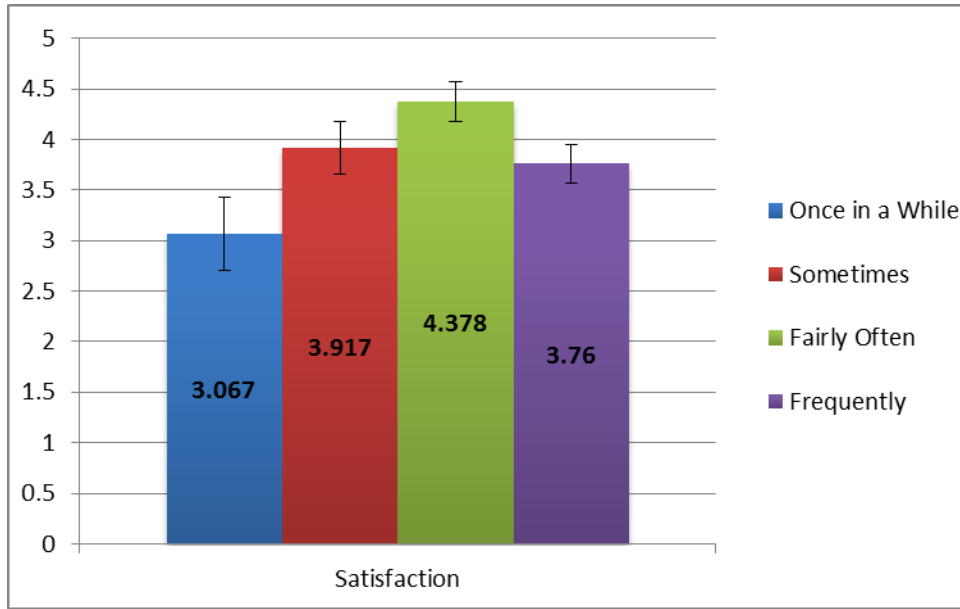


Figure 4.13 Mean scores for user satisfaction by how often participants were motivated by leadership

Table 4.4 Tukey table based on how often participants were motivated by leadership

	Mean Satisfaction	Tukey Group
Once in a While	3.07	B
Sometimes	3.92	A B
Fairly Often	4.38	A
Frequently	3.76	A B

Demographic Data Analysis

After testing the hypotheses, several demographics were analyzed to see if they had significant effects on the dependent variables. Each of the chosen demographics was analyzed using an ANOVA. The data for the participants' job roles was tested, and the results showed that there was a significant effect on perceived quality, $F(1, 38) = 3.14, p = 0.085$, and user satisfaction, $F(1, 38) = 3.30, p = 0.077$. The participants who were nurses had a significantly lower perceived quality and lower satisfaction than the

participants who were administration/office workers. The mean scores for the dependent variables by job role are shown in Figure 4.14. The data for the participants' computer use at home per week was also analyzed. The results showed that computer use did not have a significant effect on perceived quality, $F(3, 36) = 0.16, p = 0.922$, or user satisfaction, $F(3, 36) = 0.39, p = 0.762$. The data for the participants' EHR use per day was analyzed. The results showed that did not have a significant effect on perceived quality, $F(3, 36) = 1.08, p = 0.368$, or user satisfaction, $F(3, 36) = 2.06, p = 0.123$. Finally, the data for the participant's EHR system was analyzed. The EHR systems were categorized into very common and less common based on ratings from 2011 ("The Top 20 Most Popular EMR Software Solutions"). The results showed that the commonality of the EHR system had a significant effect on perceived quality, $F(1, 38) = 3.19, p = 0.082$, but did not have a significant effect on user satisfaction, $F(1,38) = 1.61, p = 0.213$. Participants who used EHR systems that were in the top five most common had a higher perceived quality than those who did not.



Figure 4.14 Mean scores for dependent variables by job role

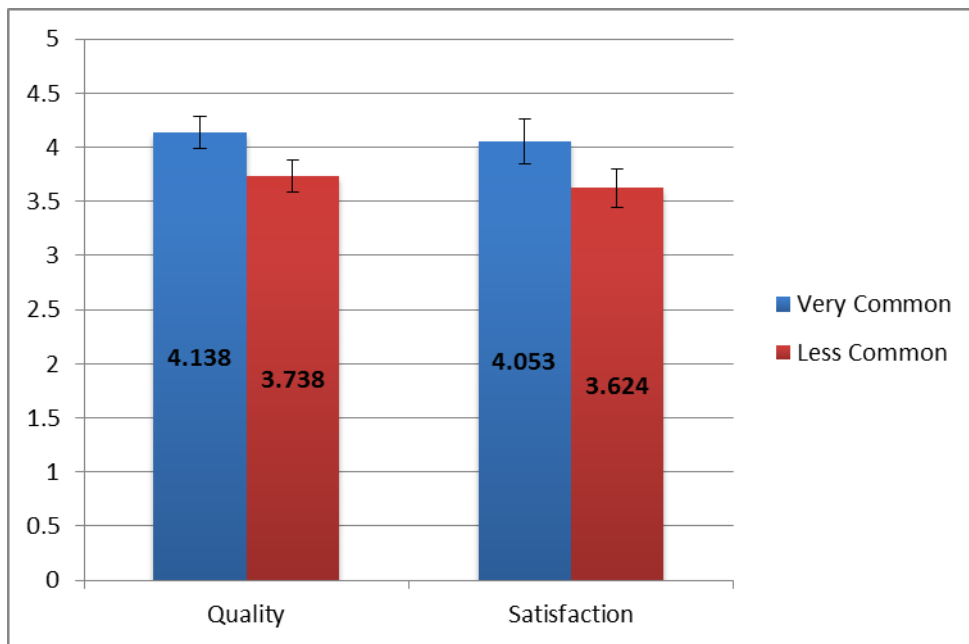


Figure 4.15 Mean scores for dependent variables by commonality of EHR system

CHAPTER V

DISCUSSION

After data analysis, many of the initial hypotheses were not supported. However, two significant effects were found during hypothesis testing: those participants who received ongoing support were less satisfied than those participants who did not receive ongoing support and those participants who were more motivated by leadership fairly often were significantly more satisfied than those participants who were only motivated by leadership once in a while.

Hypothesis one states that that longer times since implementation will result in higher user satisfaction and higher perceived quality of the system. Although hypothesis one was not supported by the findings of this study, the results did show a possible practical difference in perceived quality based on the time since implementation. The mean scores for both dependent variables for experienced users were lower than the mean scores for novice users. These results are contradictory to the hypothesis as well as previous studies. One previous study found that the physicians who had been using their EHR system for more than two years were significantly more satisfied with the system than those who had been using their system for a shorter period of time (Menachemi et al., 2010). One possible explanation for the results found in this study is that nurses who graduated in the past few years were likely taught how to use EHRs in nursing school. This may result in nurses being more satisfied earlier during implementation due to

familiarity with EHRs. Therefore clinics and EHR providers should aim to make users highly satisfied early during implementation because it is not likely that users' perceived quality or level of satisfaction with EHRs would increase over time.

Hypothesis two states that increased training time will result in higher user satisfaction and higher perceived quality of the system. This hypothesis was not supported by the findings of this study. There are a few possible explanations for these results. For example, the training that was received by the participants might have been poor training. If the training was poor, then it is likely that the users would need more training to learn how to use the system. Another possible explanation is that the definition of training may vary from person to person. For example, one person might think that consulting a co-worker for help is considered training, while someone else might not consider it as training. Yet another possible explanation is that some participants may have been familiar with the EHRs before receiving training. The results of this hypothesis test indicate that clinics and EHR providers should focus more on the quality of training than the amount of training.

Hypothesis three states that users who received training from a fellow employee will have higher satisfaction and higher perceived quality of the system. This hypothesis was not supported by the findings of this study. One possible explanation could be that the training that users received from their fellow employees was poor. If the training was poor, the users may have felt that the training was a waste of time and been discouraged regarding the EHR system .

In this study, the participants who received ongoing support as a type of training were significantly less satisfied than those who did not. One proposed explanation is that

EHR users resort to using ongoing support after becoming frustrated that they cannot accomplish a certain task. Resorting to ongoing support is the user admitting that he or she does not know how to properly use a part of the system. Another proposed explanation is that EHR users receive ongoing support that is ineffective or inadequate to help them overcome the problems they are facing. Ineffective ongoing support could be worse and cause the user to become more frustrated than no ongoing support at all. This means that clinics should not rely on ongoing support and should try to thoroughly learn the EHR system through different training methods. EHR providers should also aim to improve their ongoing support systems.

Hypothesis four states that users who had leaders that were very involved in the implementation process will have higher satisfaction and perceived quality of the system. This hypothesis was somewhat supported by the findings of this study. Although the overall amount of leadership involvement did not have a significant effect, participants who were more motivated by leadership were found to be more satisfied than those participants who were only motivated once in a while. This finding was expected because people who are more motivated by their superiors typically try harder to accomplish their goals. For example, a healthcare provider who is being motivated by leadership to learn how to use EHRs will typically try harder to learn about the system. As a result, the healthcare provider will be better at using the system, which leads to higher satisfaction and perceived quality of the system. These results indicate that leadership within the clinics should aim to motivate users more often, because motivation does have a significant effect on perceived quality and user satisfaction.

After analyzing the demographic data, job role was found to significantly affect perceived quality and user satisfaction. The participants who were nurses had significantly lower perceived quality and satisfaction with the system than those who were administration/office workers. This finding is interesting because nurses typically spend more time using EHRs per day than administrators/office workers. One possible explanation for this result is that administrators/office workers do not work with the system enough to experience problems with the system. Another possible explanation is that those in administration may be stakeholders in the system and have an overall higher opinion of the system, because they want it to be successful.

The commonality of the EHR system was found to have a significant effect on perceived quality. Participants who used EHR systems which were in the top five most common had a higher perceived quality than those who did not. This finding was expected, because the most common EHR systems have more customers and are likely rated higher than other EHR systems. Clinics looking for the right EHR system should consider the most popular EHR systems first according to these results.

CHAPTER VI

CONCLUSION

This study aimed to examine the effects of time, training, and leadership on perceived quality of EHRs and user satisfaction with EHRs. The results of the study indicated that training and leadership does have an effect on the user's perceived quality and satisfaction with EHRs. Participants who received ongoing support as a type of training were less satisfied than those participants who did not receive ongoing support, and participants who were more motivated by leadership fairly often were significantly more satisfied than those participants who were only motivated by leadership once in a while. These findings reveal that clinics should focus on leadership that motivates employees to use EHRs. Also, EHR providers should focus on either improving training techniques to decrease the need for ongoing support or improve their ongoing support systems.

Limitations

One limitation for this study is the sample size. A higher sample size might have resulted in a higher number of significant findings. Another limitation is that the data was collected using a survey, so the reliability and validity of the data relied on the honesty of the participant and the amount of knowledge they had about their EHR system. Also, this

study was limited to family clinics and non-physician EHR users. Therefore, the results may not apply to other healthcare settings or other EHR users.

Also, many of the survey constructs were not clearly defined in the survey. Therefore, each participant may have interpreted the survey questions differently. The types of training were not clearly defined and may not be mutually exclusive. The survey didn't include any questions to assess whether training received was initial training or refresher training. Also, whether or not training was received due to software updates was not assessed. The survey did not include any questions to examine whether or not participants received EHR training in college.

Future Work

In the future, the study could be extended to include a higher number of participants. If the study were to be extended, the online survey would most likely be the best option since the response rate was higher for it than the paper based survey. One way the study could be expanded in the future is by adding more questions to get a better idea of the participants' backgrounds. For example, it would be useful to know whether or not the participants received training in college or if the participants ever had to use paper-based health records. It would also be useful to know about the participants' work environments. If a participant is disgruntled with his or her work environment in general, then he or she might view the EHR system more negatively.

Aside from adding questions to the survey, the study could be expanded in the future by observing and interviewing EHR users at different stages of implementation. Interviews would allow the person conducting the interview to clarify constructs that are not clear to the person being interviewed. Interviews and observing EHR users would

also allow the researcher to gather data, such as gestures, tone of voice, and other body language, that cannot be gathered by a survey.

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APPENDIX A
SURVEY

Evaluating User Satisfaction and Perceived Quality of Electronic Health Records in Mississippi: Participant Survey

The purpose of this survey is to gather information about your clinic, your electronic health record system, and how your electronic health record system was implemented. You will be asked to judge the quality of your electronic health record system and your level of satisfaction with electronic health records. The survey has 5 sections and is 6 pages long. It should take about 20 minutes to complete.

Part 1: Demographics

1. In what year were you born? _____

2. What is your gender?
 Male Female

3. What is your ethnic background?
 African American Caucasian
 Native American Other
 Asian Latino/Hispanic
 Pacific Islander

4. In what county is your clinic located? _____

5. How long has your clinic been in operation? _____

6. What is your job role?
 Nurse Practitioner Nurse
 Nurse Assistant Receptionist/Office worker
 Physician's Assistant
Other: _____

7. How many physicians work at the clinic where you work?
 0 1 2 3 4 5 or more

8. How many nurse practitioners work at with the clinic where you work?
 0 1 2 3 4 5 or more

9. How many nurses work at the clinic where you work?
 0 1 2 3 4 5 or more

10. Do you have a computer at home? This includes desktop computers, laptop computers, and tablet devices (e.g. iPad, Kindle)

Yes No

If yes, how many hours a week do you use it?

1 to 5 hours 6 to 10 hours
 11 to 15 hours 16 hours or more

11. Before you used electronic health records at work, how would you rate your overall ability to use technology or computers?

I felt confident with technology and could use it without assistance.
 I needed very little assistance when using technology.
 I needed a great deal of assistance when using technology.
 I could not use technology without assistance.

12. Approximately how many years total years of experience do you have with EHRs? _____

13. Do you have EHR experience other than your current EHR system? For example, did you use EHRs at a previous job?

Yes No

14. About how many hours a day do you use the EHR system?

0 to 2 hours 3 to 5 hours 6 to 8 hours more than 8 hours

Part 2: EHR Details and Implementation

15. What is the name of your current EHR/EMR system?

Allscripts Cerner
 eClinicalWorks Epic
 GE/Centricity Greenway Medical
 McKesson/Practice Partner NextGen
 Sage/Vitera Unknown
 Other/Specify: _____

16. What date (year and month) did you begin using EHRs?

17. About how long did it take for your clinic to transition from paper charts to the EHR system?

3 months 6 months
 9 months 12 months
 1.5 years 2 or more years

18. Please complete the following table by adding the number of hours of each type of training you received.

Type of Training	Number of Hours Received
Training from fellow employee	
Web-based training	
Self-Training	
Training from vendor representative	
Ongoing support	
Other: _____	

19. In your opinion, how much leadership from office managers or other clinic personnel was involved in the implementation process?

Too little About right Too much

20. How often does your leadership communicate with you about your EHR system?

Not at all Once in a while Sometimes Fairly often Frequently

21. How often does your leadership motivate you to use or learn about your EHR system?

Not at all Once in a while Sometimes Fairly often Frequently

22. In your opinion, how was the overall process of implementation?

Very poor Poor Fair Good Very good

23. Please describe your answer from question 17 about your implementation experience

Part 3: Quality

Directions: Think about your current EHR system and all of your experiences with the system. Please rate your EHR system based on each of the following questions. Check the box that corresponds to the degree to which each question applies to you. If you feel the situation never/almost never occurs check the box above number 1. If you feel that the situation always/almost always occurs circle the number 5. There is no right or wrong answer. We want to know your opinion of the quality of the system.

24. How often does the system provide the precise information you need?

Never/Almost
Never 1 2 3 4 5 Always/Almost
Always

25. How often does the information content meet your needs?

Never/Almost
Never 1 2 3 4 5 Always/Almost
Always

26. How often does the system provide reports that seem to be exactly what you need?

Never/Almost
Never 1 2 3 4 5 Always/Almost
Always

27. How often do you think the output is presented in a useful format?

Never/Almost
Never 1 2 3 4 5 Always/Almost
Always

28. How often does the system provide sufficient information?

Never/Almost
Never 1 2 3 4 5 Always/Almost
Always

29. How often is the system accurate?

Never/Almost
Never 1 2 3 4 5 Always/Almost
Always

30. How often are you satisfied with the accuracy of the system?

Never/Almost
Never 1 2 3 4 5 Always/Almost
Always

31. How often is the system user-friendly?

Never/Almost
Never 1 2 3 4 5 Always/Almost
Always

32. How often is the information clear?

Never/Almost
Never 1 2 3 4 5 Always/Almost
Always

33. How often does the system provide up-to-date information?

Never/Almost Always/Almost
Never 1 2 3 4 5 Always

34. How often can you count on the system to be up and available?

Never/Almost Always/Almost
Never 1 2 3 4 5 Always

35. How often is the system subject to frequent system problems and crashes?

Never/Almost Always/Almost
Never 1 2 3 4 5 Always

Part 4: Satisfaction

Directions: Think about your current EHR system and all of your experiences with the system. Please rate your EHR system based on the extent to which it applies to each question. If you feel that the system does not satisfy the question at all, check the box above the number 1. If you feel that the system satisfies the question very well, check the box above the number 5. There is no right or wrong answer. We want to know your opinion of the quality of the system.

36. Do you feel EHR is useful?

Not at All Very Much
1 2 3 4 5

37. Does the computer workstation alter or change your workflow?

Not at All Very Much
1 2 3 4 5

38. Does the lack of staff computer skills impede the use of the EHR system?

Not at All Very Much
1 2 3 4 5

39. Are enough workstations available for use by the staff?

Not at All Very Much
1 2 3 4 5

40. Are computerized documentation well integrated into the workflow?

Not at All Very Much
 1 2 3 4 5

41. Do you feel your performance has improved due to EHR?

Not at All Very Much
 1 2 3 4 5

42. Do you feel quality of your work has improved?

Not at All Very Much
 1 2 3 4 5

43. Do you feel EHR is worth the time and effort required to use it?

Not at All Very Much
 1 2 3 4 5

44. Do you feel quality of information has improved due to EHR?

Not at All Very Much
 1 2 3 4 5

45. Do you feel EHR has been successful in your clinic?

Not at All Very Much
 1 2 3 4 5

46. Do you feel EHR is an important system for your clinic?

Not at All Very Much
 1 2 3 4 5

47. Do you feel safety of patients has improved due to EHR?

Not at All Very Much
 1 2 3 4 5

APPENDIX B
PARTICIPANT MATERIAL

Industrial and Systems Engineering
Mississippi State University
PO Box 9542
Mississippi State, MS 39762

April 22, 2013

Dear Prospective Participant,

My name is Dakota Chamblee, and I am currently a graduate student at Mississippi State University. I have also recently been accepted into medical school, and I am conducting a study for my master's thesis entitled "Evaluating User Satisfaction and Perceived Quality of Electronic Health Records in Mississippi."

The purpose of this study is to determine how the time since implementation of electronic health records (EHRs) and the implementation strategy of EHRs affect overall user satisfaction and perception of the quality of the EHR system in rural health clinics. Your participation in this survey will help us understand what users think about electronic health records.

To participate in this study, you must:

1. Be a non-physician worker in a health clinic that uses electronic health records. Nurses, nurse's aides, medical receptionists, and any others who use electronic health records but are not physicians can complete the survey.
2. Read and sign the enclosed informed consent form. There is also a copy of the consent form included for you to keep for your records.
3. Complete the enclosed survey. The survey is 6 pages long and has 42 questions. It should take you about 20 minutes to complete.
4. Complete the enclosed drawing entry form. The information you provide on this form will be used to enter you into the drawing for one of five \$100 Visa Gift Cards.
5. Place the completed consent form, survey, and drawing entry form into the enclosed postage paid envelope.
6. Mail the completed packet to me. You will be entered to win a \$100 Visa Gift Card.

I look forward to your participation in the study. **For inclusion into this study your return packet must be postmarked by June 21, 2013.** Please contact me at (601) 416-1962 if you have any questions.

Thank you,

Dakota Chamblee

Enclosures (5):

Informed consent (2)
Drawing Entry Form

Survey
Postage Paid Envelope

Researcher Copy: Please sign and return with your subject packet

Title of Study: Evaluating User Satisfaction and Perceived Quality of Electronic Health Records in Mississippi

Name of Researchers & University affiliation:

Lesley Strawderman, Ph.D.
strawderman@ise.msstate.edu
(662) 325-7214

Assistant Professor
Industrial and Systems Engineering
Mississippi State University

Dakota Chamblee
dbc100@msstate.edu
(601) 416-1962
Graduate Research Assistant
Industrial and Systems Engineering
Mississippi State University

What is the purpose of this research project?

The purpose of this study is to determine how the time since implementation of electronic health records (EHRs) and the implementation strategy of EHRs affect overall user satisfaction and perception of the quality of the EHR system in rural health clinics.

How will the research be conducted?

Participants will be asked to complete a survey that contains 42 questions and should take about 20 minutes. Participants may skip any items that they choose not to answer. Participants will return the survey in the enclosed postage paid envelope.

Are there any risks or discomforts to me because of my participation?

There are no known risks or discomforts.

Does participation in this research provide any benefits to others or myself?

Participation in this survey allows participants to provide their perceptions and satisfaction with their electronic health record system.

Is there any incentive associated with participation?

Upon completing and returning the subject packet, participants will be entered to win a \$100 Visa Gift Card.

Will this information be kept confidential?

Personal information that is collected will be separated from the survey responses. Raw survey data will only be available to the project investigators.

Who do I contact with research questions?

If you have any questions about this research project, feel free to contact Dakota Chamblee at 601-416-1962. For additional information regarding your rights as a research subject, feel free to contact the MSU Regulatory Compliance Office at 662-325-3994.

What if I do not want to participate?

Please understand that your participation is voluntary. Your refusal to participate will involve no penalty or loss of benefits to which you are otherwise entitled, and you may discontinue your participation at any time without penalty or loss of benefits.

How many subjects are in the study? 200 participants will be included in the study.

Participant Signature

Date

Investigator Signature

Date

Participant Copy: Please keep this copy for your records

Title of Study: Evaluating User Satisfaction and Perceived Quality of Electronic Health Records in Mississippi

Name of Researchers & University affiliation:

Lesley Strawderman, Ph.D.
strawderman@ise.msstate.edu
(662) 325-7214

Assistant Professor
Industrial and Systems Engineering
Mississippi State University

Dakota Chamblee
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Graduate Research Assistant
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How many subjects are in the study? 200 participants will be included in the study.

Participant Signature

Date

Investigator Signature

Date

Participant Drawing Entry Form

Thank you very much for taking the time to participate in the study. We look forward to reviewing your responses and using them to examine electronic health records.

We will be using this form to enter you for your chance to win one of five \$100 Visa Gift Cards. If you win, your gift card will be sent to the name and address you provide below. Your information will be kept separate from your survey responses.

Name: _____

Street Address: _____

City: _____ State: _____ Zip: _____

You are now ready to send me your complete packet! Remember to include your signed consent form, completed survey, and this completed drawing entry form.

Thank you!

Research Participants Needed!

Take a survey about your experiences with electronic health records and be entered to win one of five **\$100 Visa Gift Cards!**

Please complete the attached survey and consent form, and send it back to me in the prepaid enclosed envelope!

Questions? Contact Dakota Chamblee at (601) 416-1962

APPENDIX C
RAW DATA

Table 6.1 Raw data for demographics

	Birth Year	Gender	Ethnicity	County	Clinic Age	Job Role	Number of Physicians	Number of Nurse Practitioners	Number of Nurses
1	1951	1	0	Holmes	20	5	*	4	5
2	1982	0	0	Holmes	15	5	4	1	5
3	1954	1	0	Holmes	20	3	5	5	5
4	1968	1	1	Humphreys	*	3	2	2	3
5	1981	1	1	Chickasaw	*	3	0	1	2
6	1980	1	1	Holmes	48	1	1	2	2
7	1957	1	1	Holmes	48	5	1	2	2
8	1961	1	1	Lauderdale	*	3	3	5	5
9	1960	1	1	Lauderdale	30	3	5	5	5
10	1958	1	1	Adams	27	5	1	3	2
11	1959	1	1	Wayne	30	1	0	1	1
12	1951	1	1	Marion	30	5	1	2	5
13	1963	1	1	Tippah	10	0	0	1	2
14	1982	1	1	Perry	*	1	1	1	1
15	1962	1	1	Scott	3	1	0	1	1
16	1979	1	1	*	50	1	5	2	5
17	1969	1	6	Marion	*	1	5	3	5
18	1945	1	0	Marion	*	1	5	3	5
19	1966	1	0	Oktibbeha	20	0	1	1	1
20	1991	1	0	Oktibbeha	*	1	1	1	1
21	1961	1	1	Covington	15	5	2	1	4
22	*	1	0	Clarke	30	3	2	2	3
23	1957	1	0	Grenada	6	5	0	0	3
24	1980	1	1	*	50	5	5	5	5
25	1963	1	1	Forrest	50	5	5	5	5
26	1953	1	1	Washington	15	5	1	1	1
27	1959	1	0	*	40	1	5	5	5
28	1954	1	0	Bolivar	47	1	5	5	5
29	1960	1	1	Sharkey	32	5	2	2	2
30	1951	0	0	Hinds	30	5	2	0	2
31	1990	1	1	Lafayette	1	1	5	5	5
32	1987	1	1	Attala	15	3	2	2	5
33	1965	1	1	Attala	15	5	2	1	5
34	1992	1	1	Neshoba	20	1	3	1	2
35	1989	1	1	Lee	10	3	0	2	4
36	1990	1	3	Shelby	*	1	5	5	5
37	1954	1	0	Hinds, Warren, Copiah	40	5	5	5	5
38	1977	1	1	Attala	14	1	2	1	5
39	1971	1	1	Attala	14	1	2	1	5
40	1966	1	0	*	2	0	0	1	0

Table 6.2 Raw data for EHR and implementation details

	Computer Use	Computer Ability	EHR Experience (years)	Other EHR Experience	EHR Use Per Day	EHR System	Date EHR Use Began	Length of Transition to EHR	Implementation Overall
1	3	1	4	1	0	0	1998	1	4
2	1	1	1	0	2	0	*	1	3
3	1	2	3	0	2	0	Mar-10	0	4
4	4	1	1	0	2	10	Mar-11	5	2
5	1	2	3	1	2	10	Jan-12	2	3
6	1	1	1.5	0	2	8	Jan-12	*	3
7	1	2	1	0	2	8	Feb-12	3	3
8	1	1	1.5	0	1	3	Nov-12	1	2
9	2	1	2	0	3	3	Aug-11	1	1
10	1	2	6	0	1	4	Mar-97	3	2
11	1	3	5	0	2	10	Jun-05	3	2
12	2	1	2	0	0	3	May-11	5	2
13	1	2	0.5	0	1	10	Aug-12	0	2
14	2	2	10	1	3	0	*	*	3
15	2	2	1	0	1	10	Jan-10	*	3
16	1	1	2	0	2	6	Sep-11	*	3
17	1	3	5.5	1	2	6	Sep-11	*	2
18	1	2	8	0	2	6	Jun-05	1	3
19	2	1	3	1	2	1	Apr-11	0	3
20	2	1	0	0	2	1	Nov-12	0	3
21	1	2	10	1	1	6	Sep-11	4	3
22	1	1	1	0	3	1	Jun-11	3	3
23	4	1	2	0	2	1	Jan-11	1	2
24	2	1	10	1	1	6	Sep-11	3	4
25	4	1	11	1	3	6	Apr-02	5	4
26	3	2	4	0	0	0	Dec-09	1	3
27	4	3	2	0	1	10	Jan-12	4	2
28	3	2	10	1	1	10	Jan-12	5	2
29	2	2	3	0	3	10	Jul-10	5	3
30	4	2	3	0	1	10	Jan-10	0	4
31	2	1	3	1	1	3	Aug-10	3	2
32	1	1	3	1	3	10	Jan-06	0	3
33	2	1	10	1	3	10	Jan-06	0	3
34	2	1	1	0	3	9	Aug-13	*	3
35	1	1	2	0	3	10	May-12	5	3
36	3	1	1	0	3	5	Aug-12	3	3
37	3	3	3	0	0	1	Apr-13	*	3
38	1	1	7	0	3	10	Sep-07	0	2
39	1	3	5	0	2	10	Sep-06	0	4
40	4	1	1	0	2	10	Feb-12	5	0

Table 6.3 Raw data for training

	Fellow Employee	Web-Based	Self-Training	Vendor Representative	Ongoing	Other
1	30	10	40	16	0	0
2	1	1	1	1	1	0
3	24	0	5	24	0	0
4	5	12	15	5	5	0
5	8	2	10	0	1	0
6	*	*	*	*	*	*
7	8	0	0	80	80	0
8	20	4	20	0	0	80
9	11	0	30	0	10	0
10	10	30	20	40	20	0
11	3	1	2	8	2	0
12	0	0	0	40	50	0
13	2	5	5	3	2	1
14	*	*	*	*	*	*
15	8	8	0	0	0	0
16	*	*	*	*	*	*
17	*	*	*	*	*	*
18	20	0	0	0	0	30
19	0	0	0	16	0	0
20	*	*	*	*	*	*
21	60	0	40	0	30	0
22	10	50	20	40	0	0
23	10	0	100	0	20	0
24	5	10	100	160	50	0
25	0	40	40	200	0	0
26	5	0	0	0	5	0
27	40	40	40	40	50	0
28	16	6	40	20	2	0
29	0	80	80	120	20	0
30	0	0	0	40	0	0
31	216	24	12	0	0	0
32	40	5	20	0	20	0
33	15	20	5	0	5	0
34	2	3	8	2	0	0
35	3	2	4	2	0	0
36	48	48	0	48	0	0
37	*	*	*	*	*	*
38	0	20	10	10	5	0
39	0	12	0	0	0	0
40	0	40	50	40	50	0

Table 6.4 Raw data for leadership

	Amount of Leadership	Leadership Communication	Leadership Motivation
1	1	1	3
2	2	4	3
3	1	4	4
4	1	3	4
5	1	3	4
6	1	1	1
7	1	4	4
8	1	0	2
9	0	1	2
10	1	2	2
11	1	4	4
12	1	3	1
13	1	1	2
14	1	2	2
15	1	3	3
16	1	4	4
17	0	4	4
18	1	4	4
19	1	3	4
20	1	3	3
21	1	3	4
22	1	2	3
23	1	4	4
24	1	4	4
25	1	4	4
26	1	3	3
27	1	4	4
28	1	1	1
29	1	4	4
30	1	4	4
31	1	2	1
32	1	4	4
33	0	4	3
34	1	2	1
35	1	2	3
36	1	3	4
37	1	*	4
38	1	4	4
39	1	3	4
40	0	0	0

Table 6.5 Raw data for quality

	1	2	3	4	5	6	7	8	9	10	11	12
1	4	4	4	4	4	5	5	4	4	5	5	4
2	5	5	5	5	5	5	5	5	5	5	5	4
3	5	5	1	5	5	*	*	*	*	*	*	*
4	3	3	2	3	3	3	3	2	2	2	2	1
5	4	4	4	4	5	4	4	3	3	4	4	4
6	4	4	4	4	4	4	4	4	4	3	4	3
7	3	3	3	3	3	3	3	2	2	3	3	2
8	5	5	4	1	5	5	4	3	5	5	4	2
9	4	4	4	4	4	4	3	4	4	4	4	4
10	4	3	3	3	3	4	4	3	4	4	3	2
11	4	4	4	3	4	4	4	3	3	4	3	2
12	4	4	3	3	3	2	3	4	3	4	4	2
13	3	3	3	3	3	3	3	3	3	3	4	3
14	4	4	4	3	4	4	4	5	4	4	2	4
15	5	5	5	5	5	5	5	5	5	5	5	1
16	3	4	3	5	3	5	5	5	5	5	5	5
17	3	3	3	3	3	3	2	1	2	3	3	3
18	3	4	4	3	3	3	3	3	3	4	4	2
19	5	5	4	5	5	5	5	5	5	5	5	3
20	3	3	3	3	3	3	3	3	3	3	3	3
21	4	4	4	4	4	4	4	4	4	5	4	4
22	5	5	5	4	4	5	4	5	5	5	5	5
23	5	5	4	5	5	*	5	4	5	*	5	4
24	4	5	4	5	5	4	5	5	5	5	5	5
25	4	4	4	4	5	5	5	4	4	5	5	5
26	4	4	3	4	4	4	4	4	4	4	5	4
27	3	3	3	3	3	3	3	3	3	*	3	3
28	2	2	2	2	2	2	2	2	2	2	3	4
29	5	5	5	5	5	5	5	5	5	5	5	4
30	5	4	4	4	4	4	4	5	5	5	*	5
31	4	4	3	3	4	4	3	3	4	4	4	4
32	4	4	4	4	4	4	4	4	4	4	4	4
33	4	4	3	3	3	4	4	3	4	4	4	5
34	5	4	4	3	4	4	3	2	3	4	4	4
35	5	5	4	4	4	5	5	5	4	4	4	4
36	5	5	5	5	5	5	5	5	5	5	5	2
37	4	4	4	4	4	4	4	4	4	4	4	4
38	4	4	4	4	4	4	3	3	3	4	4	4
39	4	4	4	4	4	4	4	4	4	4	4	4
40	4	4	4	4	4	5	4	3	3	5	5	4

Table 6.6 Raw data for satisfaction

	1	2	3	4	5	6	7	8	9	10	11	12
1	5	2	2	4	4	5	5	5	5	5	5	4
2	5	3	4	5	3	5	5	5	5	5	5	5
3	5	1	1	5	3	4	3	5	*	*	*	*
4	4	2	5	2	3	2	3	2	3	2	3	3
5	4	2	2	4	4	4	4	4	4	4	4	3
6	4	4	2	5	5	3	3	4	4	4	4	2
7	3	2	2	3	4	2	2	2	3	3	2	2
8	5	1	3	2	4	5	5	5	5	5	5	4
9	5	1	4	1	3	5	5	5	5	5	5	5
10	4	2	3	5	4	4	4	4	4	4	4	4
11	2	1	2	5	3	1	1	1	3	2	1	1
12	3	1	2	4	4	1	1	1	1	3	2	1
13	4	2	2	3	4	3	3	3	3	3	3	3
14	4	5	5	5	5	4	4	4	4	5	5	5
15	5	5	1	5	5	5	5	5	5	5	5	5
16	5	1	5	5	5	4	5	5	3	5	5	5
17	3	3	4	2	3	2	3	3	3	3	3	3
18	4	2	2	4	4	4	4	4	4	4	4	5
19	5	1	5	5	5	5	5	5	5	5	5	3
20	3	3	3	3	3	3	3	3	3	3	4	3
21	5	1	4	5	5	5	5	5	5	5	5	4
22	5	4	3	5	5	4	5	5	5	5	5	4
23	5	2	4	5	5	5	4	5	5	5	5	5
24	4	2	2	4	5	5	5	4	4	5	5	1
25	5	2	2	5	4	5	5	5	5	4	5	5
26	5	4	4	5	5	5	5	5	5	5	5	5
27	4	1	4	4	2	1	2	3	2	2	5	1
28	2	2	5	4	4	2	1	1	1	1	5	1
29	5	5	4	5	5	5	5	5	5	5	5	5
30	5	5	5	5	5	5	5	5	5	5	5	5
31	4	1	4	4	2	3	3	5	5	5	5	5
32	4	5	4	4	4	4	4	4	4	4	4	4
33	4	5	3	3	5	5	*	4	4	4	5	5
34	4	3	3	3	4	4	3	2	4	4	3	4
35	5	2	5	5	5	5	5	5	5	5	5	5
36	5	5	5	4	5	5	5	5	5	5	5	5
37	4	2	2	5	5	3	3	4	4	3	3	4
38	4	3	2	4	3	3	3	3	3	3	3	3
39	4	3	3	4	4	4	4	4	4	4	4	4
40	5	1	4	5	2	1	1	3	2	1	3	2