DEVELOPMENT OF AN ELECTRONIC HEALTH RECORD SURVEY INSTRUMENT

THESIS

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Agustin Moreno, B.S.

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DEDICATION

This thesis is dedicated to God, my family, friends, and the entire faculty in the Health Services Research Department at Texas State University-San Marcos.

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DEVELOPMENT OF AN

ELERCTONIC HEALTH RECORD

SURVEY INSTRUMENT

by

Agustin Moreno, B.S.

Texas State University–San Marcos

May 2005

SUPERVISING PROFESSOR: CHARLES JOHNSON

ABSTRACT

The primary objectives of this study were to develop an instrument to measure the employee attitudes toward a new Electronic Health Record (EHR) in a hospital by examining expected efficiency gain, changes in processes, and employee understanding of patient improvements in clinical decision support. Understanding that an EHR should help take care of patients instead of just paper, this study focused upon how the EHR enhances the patient/clinician relationship. Furthermore, this study examined how the EHR adds value to the organization and improves the quality of care.

The study employed research methods, including interviews with current employees and clinicians, and analysis of employee attitudes for the

development of a survey instrument. Several iterations of the survey instrument contributed to the revision and refinement of the instrument. These iterations included both quantitative statistical analyses of several draft instruments and qualitative focus group input by hospital employees involved with early stages of an EHR implementation Data in this study were analyzed with factor analysis.

CHAPTER 1

INTRODUCTION

Patient care has become increasingly complex with the widespread use of advanced technologies in healthcare. Historically, patient records have been stored in paper form, consuming space and increasing the time for delivery of patient care. Healthcare providers must keep track of a staggering amount of information and their failure to do so can have detrimental effects on patient care. A recent report by the Institute of Medicine estimates that as many as 98,000 people die in any given year from medical errors in hospitals alone (Institute of Medicine, To Err is Human, 1999). That constitutes more fatalities than from motor vehicle accidents, breast cancer, or AIDS. Add the financial cost to the human tragedy, and medical errors easily rise to the top ranks of urgent, widespread public problems. Medical errors are seldom caused by carelessness or lack of effort. Approximately 95% to 98% of errors in medical care are "systems errors", meaning that they are characteristics of equipment, procedures, job designs, or communication systems used in healthcare (Physicians Micro Systems, 2001).

An Electronic Health Record (EHR) is part of the solution to this dilemma. An EHR is designed to bring the management of patient data into the information age. It is intended to replace the paper-based medical record throughout the healthcare setting. Adapting to this new technology involve

not only changing a technical system, but the management of that system as well, causing implementation hurdles for the healthcare setting.

For a healthcare setting to find success in adapting and implementing an EHR there has to be compatibility between the employees and the EHR system. During the design of any new EHR, the primary focus during development is on the technical needs of the healthcare setting. It is not unusual to ignore human factors such as experience, expectations, or education. Human factors play an important role during development because developers can see how employees will behave psychologically in relation to the new system. The incompatibility of these systems and the healthcare setting should not be attributed to technical difficulties, but the lack of consideration to the employee's attitudes.

Published research literature suggest that patient care is being positively affected by EHR systems, but few of these studies address the impact on employee's attitudes who use these systems for improving patient care (Marshall, 1999). Thus, this researcher is interested in studying how employee attitudes towards an EHR system may effect its implementation.

The primary objectives of this is study are to develop a survey instrument to measure the employee and physician attitudes toward a new Electronic Health Record (EHR) in a hospital by examining expected efficiency gain, changes in processes, and employee understanding of patient improvements in clinical decision support.

Understanding that an EHR should help take care of patients instead of just paper, this instrument will focus upon how the EHR enhances the patient / clinician relationship. The relationship between the patient and clinician forms the foundation of health care. This relationship is the vehicle for exchanging information, feelings, and concerns, a factor in the success of treatment, and an essential component in the satisfaction of both patient and clinician.

While some aspects of the changing health care system, such as an emphasis on health promotion and attention to the outcomes of care may encourage and strengthen patient-clinician relationships, increased reliance on technology has the potential to inhibit the capacity of practitioners to develop and demonstrate effective, caring relationships with their patients.

Furthermore, this study will examine how the EHR adds value to the organization and enhances the quality of care.

Location of the Study

Central Texas Medical Center (CTMC), San Marcos is a 113-bed acute-care general hospital and is part of the Adventist Health System, which operates 37 hospitals all over the United States (About AHS, 2005). The hospital is committed to improved performance and has recently acquired new information technologies as a step towards creating a paperless environment in the hospital (About AHS, 2005).

Research Objectives

The objective of this study is to develop an instrument to measure employee attitudes toward the implementation of a new EHR system. Essentially, this first base-line measurement will help determine if the survey instrument is an appropriate and reliable tool to measure employees' attitudes before the implementation of the EHR Future studies will follow in which this survey instrument will be used during the "go-live" phase of the new EHR.

Significance of the Study

This study is based on the premise that it is important to explore the impact of employee attitudes towards the implementation of an EHR system that will be an integral part of patient care in the hospital. When healthcare facilities make the decision to switch from current paper based systems to an EHR system, the impact on patient care will be determined from the end users of this system - the employees. Understanding how the hospital employees perceive an EHR in their healthcare setting results in the proper attention to the needs of the employees who must adapt these systems to their daily routine.

The literature researching the impact on employees' attitudes and stress factors during EHR implementations in the healthcare industry is limited. Few examples of actual projects have been undertaken and their outcomes measured since EHR implementations are recent changes for healthcare. There is limited information on how the implementation of a new EHR system affects employee's attitudes towards patient care or how these

attitudes can be monitored, and measured (in terms of their effectiveness) over longer periods of time. It is important and necessary to continuously look for improvements and to make changes in the EHR to increase the quality of patient care.

This study will also benefit CTMC because it gives the hospital an opportunity to see how employees and clinicians feel about using this system to improve patient care and reduce medical errors.

Limitations of the Study

The study may be constrained by expectations from the hospital implementation team to meet the deadlines of each phase and the stress of working on regular duties plus the extra work load of helping develop a survey instrument. This study was done very early in the process of implementation. Most respondents in the study are new to the idea of using an EHR and lack adequate knowledge about the EHR. If the study was performed after the respondents had some education or training about the EHR, they would have probably been in a better position to answer the questions. At the time when the study was done, there was no other reliable and valid instrument with which to compare this instrument for proper construct validity. If there is a reliable and validated instrument, both instruments could have been distributed and the results compared. This study only examines the attitudes of the employee's towards the EHR. There are other factors that have a role to play in successful implementation such as the budget, physical space and the implementation strategy.

CHAPTER 2

LITERATURE REVIEW

The Statistic Heard Around the Community

An estimated 98,000 patients die each year from medical errors that are preventable (Hagland, 2003). The Institute of Medicine (IOM) in Washington, DC presented this statistic; it will become a rallying cry within the medical community for the use of IT technology to reform healthcare. This interest has become a means for accelerated development in patient safety initiatives in hospitals, along with the IT tools to support and facilitate them (Hagland, 2003). After the release of the IOM report "To Err is Human", the movement to reduce medical errors in the health care industry has been slow to realize results Hospitals are struggling to rework care processes to optimize the use of IT tools, overcome clinician resistance to automation, and find the funding needed to buy or develop new systems (Hagland, 2003). Stakeholder organizations are laying the groundwork in the medical community where patient safety innovation is expected to catch fire in the next few years.

In the above article, Carolyn Clancy, MD, director of the AHRQ clearly pushes for an EHR by stating that there's no question that clinicians, healthcare organizations, and patients, frankly, are unaware of the problems.

She also goes on to state that the enthusiasm for EHR adoption is good news but the bad news is the need for change requires the transformation of workflow and care processes. IT has the power to build patient safety redundancy into a system. These safeguards require some human factor engineering.

The trajectory of the patient safety movement remains unclear Hagland (2003) points out though there is one general agreement, "if the healthcare facilities fail to show progress in safety towards patients, they will be judged by consumers, media, policymakers, and tax payers".

Need for Improvement

As medical organizations grow in size and complexity, there is a need for information management tools to improve both the quality of medical care and business efficiency. These needs for improvement in information management, either financial or administrative, are the driving force in medical organizations. An example of this need is provided in a study in which Divian (2004) provides an examination of Governance as a driver of Information Technology (IT) applications in healthcare, and relevant standards applied to the healthcare industry.

In his study, Divian asserts that government regulations are driving the IT solutions, and examines governance as an instrument of IT change, security and privacy of individually identifiable medical information and electronic signatures; provides a comparison of various popular healthcare information system models; and completes the paper with a focused

discussion of business benefits of automating paper-based systems to an electronic medical record.

Gains and Problems with an EHR

The healthcare industry has also been slow to adapt new technologies. EHR implementations in a local health care setting can provide swift and complete documentation of patients in seconds, yet the industry is not taking proper precautions to avoid potential problems associated with its implementation. Divan (2004) outlines the potential problems associated with an EHR implementation. The medical care industry is driven by accurate information capture and processes, with all of this being collected by some IT system. Patient information records have typically been stored in paper form, consuming space and increasing the time for delivery of patient care. Cumbersome information retrieval and sharing define the most common problems faced in such an environment (Divian, 2004).

The potential gains to the healthcare industry will allow for fast patient information retrieval at any point. For instance, Divan (2004) provides an example of how appointments can be scheduled and managed over the web with ease and automated reminders sent to patients. Billing is another way an EHR can benefit a healthcare facility.

With any new technology, there are gains and roadblocks. Change itself is potentially threatening to any individual or company. New technology requires changing the way current processes work and reeducation. Another

roadblock is efficiency. Is the price of the EHR worth the impact on patient care efficiency? Will the system improve the overall financial performance of the hospital? Is the EHR worth the cost to improve patient care? A fundamental roadblock is the transition from paper to electronic records. Most clinics or hospitals face the monstrous issue of transferring the paper records into the EHR system The final roadblock is the choice of the EHR The uncertainty of possibly picking the wrong EHR from the market that is flooded with many different EHR systems Lack of management support and financial assistance is also stated as a roadblock for a clinic to face when implementing an EHR.

According to Cimino (1999), an ideal EHR should provide complete, accurate, and timely data, alerts, reminders, clinical decision supports, medical knowledge, communications, and other aids at all points of care for all healthcare professionals at all times. However, he states that these promised functions are far from being realized in current EHR systems, and the resistance from healthcare professionals is still strong. With the rapid advancement of information technology and the explosive growth of electronic medical information over the past decade, a natural happening in healthcare has been the implementation of comprehensive EHR systems (Cimino, 1999). These systems have the potential to make significant differences in healthcare, but current EHR's still pose many non-trivial problems that will prevent them from being commonly accepted in the healthcare industry (Cimino, 1999).

A fundamental issue for the EHR to succeed is usability. Cimino (1999) presents the issues from different but complementary perspectives. One issue that can hamper EHR success, from a systems function perspective, is cognitive overload This happens because of badly designed interfaces and information overload that demand extra cognitive resources on the part of the users Another issue is the lack of adequate task and user analyses in the design phase of any EHR The end users of an EHR are the employees. Any IT system needs to be designed with the user in mind, not necessarily the business. Interface barriers pose as problems between subsystems. Another, maybe the most important issue, is using the "paper chart" metaphor for designing an EHR. EHR and paper-based medical records are cognitive artifacts, and they are both parts of distributed systems in which users interact with artifacts and among themselves (Cimino, 1999). To design a system from scratch using old paper forms can a daunting and tedious task. Without proper time and research, a system can be designed wrong and fail at implementation. Any organization needs to examine the technical as well as the managerial side of an EHR. Is the system being designed with the end users in mind? Are human factors such as experience or emotions being considered when designing the system? These are questions that need to be asked during a design of any system.

Instruments

Cork, Detmer and Friedman designed and validated an instrument to measure physicians' use of, knowledge about and attitudes toward computers.

This instrument is a survey that measures four attributes; Computer use, Self reported computer knowledge, Computer feature demand, and Computer optimism. The survey was developed as a questionnaire based on the instrument developed by Teach and Shortliffe To develop the instrument, a six-member group experienced in medical informatics and measurement techniques engaged in an item-design process and conceptualized the above-mentioned attributes. Analysis was carried out on the responses of 771 full-time academic physicians from across five academic medical centers in the United States. The dimensionality of each scale and degree of association of each item with the attribute of interest were determined by principal components factor analysis

with orthogonal varimax rotation. Items that had weak association were deleted.

The reliability of the resulting item set for each attribute was then determined using Cronbach's alpha coefficient. Content validity was addressed through the development process since experts constructed this survey. Construct validity was established in part through the factor analysis and in part through a set of correlational analyses that were done. The design and validation of this instrument seems to be among the most

comprehensive and complete, with reliability and validity being well established. Only criterion related validity was not established, probably because of the unavailability of a proper external standard to compare with.

Marshall (1999) examined the attitudes of clinicians in a large HMO toward the effect of the EHR on quality of outpatient care. The study was carried out through a survey of Kaiser Permanente Northwest clinicians in Oregon. The clinicians were measured regarding the effects of a "Results Reporting" System (RRS) and an online charting and ordering system on the overall quality of patient care and other care-related indices.

The research method in the study consisted of performing a cross-sectional study using semi-structured interviews and a survey. The participants of the study were the physicians and affiliated clinicians from the clinics. Interviews were also conducted with department heads, consisting of open-ended questions about the effect of the EHR on patient care. The rating system used ranged from using nominal data types such as from "much worse" to "much better". Also, using a ten point scale, clinicians were asked to rate the effort required to use these systems and their importance to patient care.

The results of the study showed that the clinicians scored near the mean on using both the RRS and EpicCare The clinicians also felt that both components of "results reporting" and "online charting" are beneficial, but the RRS component was perceived as having the greater impact on patient care and patient-clinician interaction. The clinicians also felt there is greater

benefit with the use of a Results Reporting System than with an online charting and ordering component. The results of this study show that the most important contribution the EHR offered was the ability to retrieve critical information such as lab results, prescribed medications, and dictated reports at the point of care (Marshall, 1999)

Pramod (2003) developed a survey instrument to measure pre-implementation attitudes of users toward an EHR The objective of this study was to adapt a survey instrument to measure attitudes of end users towards the implementation of an EHR, establish the reliability and validity of the instrument, and to determine which human factors are important to the implementation. The survey was used in six clinics (Pramod, 2003).

The instrument in the 2003 study by Pramod was based on the Schultz and Slevin instrument used in 1975 for the implementation of another type of innovation in an organization. The main change in the instrument was the replacement of the instrument application titles from "Forecast" to "EHR". The instrument underwent pre-testing by a committee that consisted of physicians, nurses and graduate students and was found adequate for the study. Final form of the instrument consisted of seventy-five questions measured on a five-point Likert scale. Reliability of the instrument was established by calculating Cronbach's alpha for internal insistency for each of the seven factors: performance, interpersonal, changes, goals, support / resistance, client / implementer, and urgency. Validity of the instrument was determined using three specific criteria: content validity, criterion validity, and construct

validity. The original instrument developed by Shultz and Slevin was factor analyzed therefore offering that this instrument has construct validity. The thesis did not further address this issue. An ANOVA model was used to examine significant differences. The model included fixed and random models. The fixed effects were Ready/Control and Job Title The random effect was Location. The ANOVA factors were Ready/Control, Location nested within Ready/Control, Job Title, and Interaction of Job title and location nested within Ready/Control. To the six clinics in the study, a total of one hundred and forty-five surveys were distributed and eighty-one returned (Pramod, 2003).

The results of the study showed that five of seven factors were reliable and that there were no significant differences between the ready clinics and control clinics. Pramod goes on to discuss that the instrument does not achieve the desired objective of measuring attitudes toward the implementation of the EHR. The reasons given were the study was done very early during the implementation, the survey was too long, no perfect match between the test pilot clinics and control clinics, a lower power to detect an actual difference, substantial variance and that there was no other reliable instrument (Pramod, 2003). Improvements included addressing each factor.

Since the study failed to meet its objective, there are ways to improve on the study. Increasing the sample size may increase power of the study. There could have been a decrease in educational variance by giving out more

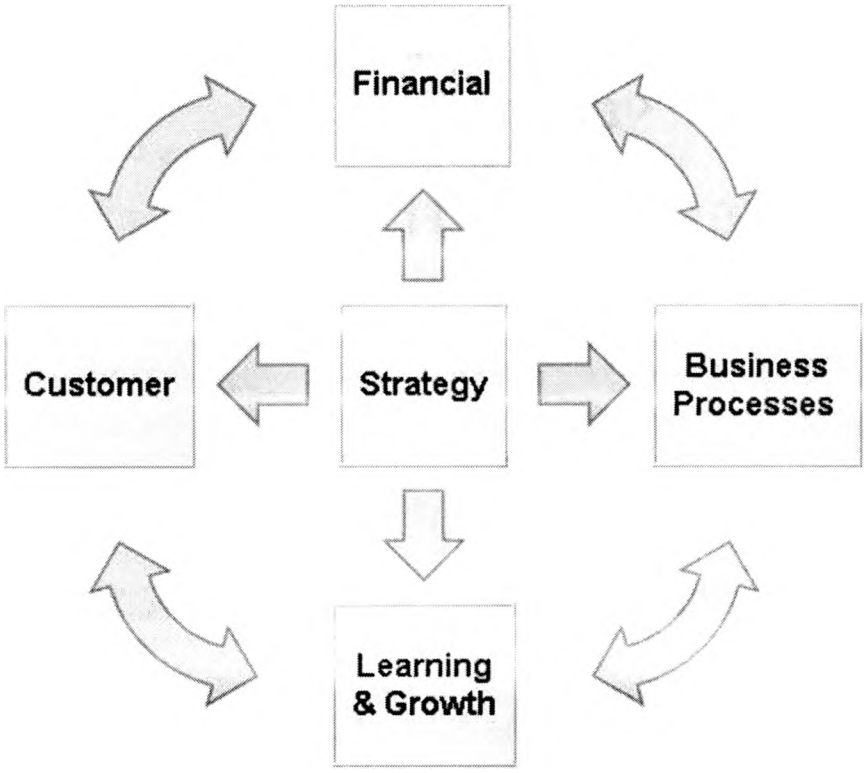
information on the EHR functions. The control clinics could be the least ready clinics. The instrument could have been more focused on the implementation of the EHR. A more proven and reliable instrument such as the Cork et al (1998) instrument could be used as a comparison along with an external judge to bring out more construct validity to the study

In conclusion, the Shultz and Slevin instrument proved to have at least some merit as a means of reliability evaluating and measuring the attitudes of employees towards the implementation of an electronic medical record Using this study as a model for future studies, modifications to the instrument could bring a much higher validity to future studies

The Balanced Score Card

The Balanced Scorecard (Balanced Scorecard Institute, 1998) is a performance measurement system that considers financial measures, but also customer, business process, and learning measures. The Balanced Scorecard framework is depicted in the following diagram:

Figure 1 - Diagram of Balanced Score Card



The balanced scorecard is a management system that enables organizations to clarify their vision and strategy and translate them into action. It provides feedback around both the internal business processes and external outcomes in order to continuously improve strategic performance and results.

The balanced scorecard suggests that an organization view itself from four perspectives, and to develop metrics, collect data and analyze them relative to each of these perspectives: financial perspective, customer perspective, business process perspective, and the learning and growth perspective. These four perspectives are a logical connection between learning and growth leading to better business practice. Better business

leads to increased value to the customers, which in turn finally leads to improved financial performance (Balanced Scorecard Institute, 1998).

The balanced scorecard methodology builds on previous management ideas such as Total Quality Management (TQM), including customer-defined quality, continuous improvement, employee empowerment, and primarily measurement-based management and feedback. The balanced scorecard incorporates feedback around internal business process outputs, as in TQM, but also adds a feedback loop around the outcomes of business strategies. This creates a "double-loop feedback" process in the balanced scorecard (Balanced Scorecard Institute, 1998).

Gordan and Geiger (1999) developed a performance management system, based on the balanced scorecard, to help healthcare IT managers to evaluate an electronic patient record (EPR) project, and to use that framework to evaluate a pilot EPR implementation. In the study, Gordan and Geiger used a consensus building group process to come into agreement on the initial indicators and their cause-effect relationships. Using a combination of surveys, focus groups, observations, and quantitative analyses, the measures for each balanced scorecard objective were developed. The essence of the balance for this scorecard was to implement an EPR system that satisfies the needs of users at reasonable cost and to reduce costs while optimizing patient satisfaction and quality of care.

CHAPTER 3

METHODOLOGY

First Draft of the Survey Instrument

To measure employee attitudes and stress factors in this study, a survey instrument will be created from an existing instrument, modified and distributed. This instrument measures employee attitudes towards the implementation of an EHR. The instrument in this study was derived from a 2003 survey to measure pre-implementation attitudes of users toward the implementation of an EHR (Jacob, 2004). Originally, the instrument was derived from the Schultz and Slevin instrument used in 1975 for the implementation of another type of innovation outside of health care. For this study, the Pramod instrument will be modified by adding, deleting, or modifying existing questions (See Chapter 4 – Analysis of First Draft for more discussion of the use of this instrument).

Second Draft of the Survey Instrument

Since the Pramod instrument was an ineffective instrument for measuring attitudes, a new instrument will be created from the literature. The instrument will address the potential problems of an EMR implementation.

This newly created survey instrument will be sent to small group of undergraduate students whom will serve as a pilot study to help with the refinement of the survey instrument's second draft. The pilot study will help determine if the questions of the survey instrument are worded clearly enough, check if the questions provide the required information, and whether the information provided can be analyzed as required. Several points will emerge during processing of the second draft data indicating changes that should be made before the full survey is finalized.

Second Draft of the Refined Survey Instrument

Following the development of survey questions from the second draft, keeping in mind the four dimensions of a Balanced Scorecard, the instrument will be administered to groups of undergraduate health profession students who will serve as a pilot study.

In order to "refine" the instrument, factor analysis will be used to modify and delete certain questions from the second draft of the instrument. Factor analysis, or principle components analysis, is a statistical technique used to reduce a set of questions to a smaller number of questions, each being clearly related to a pure psychological construct. Factor analysis is an effective method of providing evidence that items are related to one another and as such are "measuring" some aspect of the same underlying construct. Questions not loading on desired factors are candidates for deletion or re-wording. Questions remaining in the survey instrument will load heavily on clearly understood factors or psychological constructs.

Third Draft of the Survey Instrument

In order to validate the second draft of the instrument as a proper means of measuring employee attitudes towards the EHR, jury validation was used to finalize the instrument. This jury team is composed of the CEO of the hospital and hospital staff and physicians. The CEO of the hospital will serve as the primary juror to determine if the instrument is useful to the hospital management team during the EHR implementation. The CEO's perspective of the instrument is critical to fully validate the usefulness and validity of the instrument. The secondary jurors will test the validity of the instrument as well. Several physicians will also be added to review the concerns related to the hospital EHR implementations. The physicians will be chosen to represent a range of computer experience and a variety of medical specialties. Since the medical staff has a central and critical role in patient care and medical decisions, their input on what will make a successful EHR implementation in critical.

The purpose of this jury is to test the validity of the instrument. These jury validations are open discussions with a small number of people who have already seen the instrument. The jury will help determine if the instrument is measuring what it is intended to measure and whether the information provided can be analyzed as required. Several points will emerge during processing of the pilot study data indicating changes that were made before the full survey was refined and finalized.

CHAPTER 4

ANALYSIS / RESULTS

Analysis of the First Draft

Initially, the Pramod instrument was based on the Schultz and Slevin instrument. The Schultz and Slevin instrument was modified from the initial purpose to evaluating the pre-implementation attitudes towards an EHR The main change from the Schultz and Slevin instrument to the Pramod instrument was the replacement of the application "FORECAST" in the Shultz and Slevin instrument with "EHR". For example, the question in the original instrument, "The use of FORECAST will increase profits" was changed to "The use of the EHR will improve patient care." Pramod did not make any other changes to the Schultz and Slevin instrument.

Since the Pramod instrument was based on the Schultz and Slevin instrument, there were seven factors that were to be addressed. These factors were: performance, interpersonal, changes, goals, support / resistance, client/ implementer, and urgency. The Pramod instrument was passed out to a pilot study of graduate students and analyzed using factor analysis to determine these factors. The results from the Pramod study showed that though five of the seven factors were reliable and the instrument could not bring out significant differences between the ready clinics the

instrument was passed out to and control clinics to measure the instrument against. The Pramod study determined that the instrument did not achieve the desired objective of accurately bringing out attitudes toward the implementation of the EHR. After careful review of the question, it was decided that the instrument will not be used in this study and the creation of one based on the balanced score card concepts would provide a better measurement of implementation success. (See Appendix a – First Draft for the Pramod Survey Instrument)

Analysis of the Refined Second Draft

Following the development of survey questions, keeping in mind the four dimensions of a Balanced Scorecard, the instrument was administered to groups of undergraduate health profession students who served as the pilot study.

Factor analysis was conducted on the pilot study data to determine what, if any, underlying structures exist for measuring employee attitudes towards an EHR. Principal components analysis was conducted utilizing a varimax rotation. The analysis produced a four component solution, which was evaluated with the following criteria: eigenvalue, variance, scree plot, and residuals. Criteria indicated a four-component solution was appropriate. Thus, principle components analysis was conducted to retain 4 components and apply the varimax rotation. Inclusion of four components increased the model fit as it decreased the residuals exceeding the .05 criteria. Table 1 presents the loading to each component and questions. Component 1 loaded

a total of 8 questions. Component 2 loaded a total of 4 questions. Component 2 loaded a total of 3 questions and component 4 loaded a total of 2 questions.

Table 1 - Loadings for Each Question of the Second Draft Instrument

Component	Factor	Question's
1	Cost / Efficiency	Q5, Q9, Q13, Q14, Q16 Q17, Q18, Q19, Q20
2	Job Responsibilities	Q4, Q6, Q8, Q11, Q12, Q15
3	Successful Implementation	Q2, Q3, Q7
4	Unknown	Q1, Q10

All 4 components had positive loadings. Component number 1 was labeled Cost / Efficiency Component number 2 was labeled job responsibilities Component number 3 was labeled successful implementation. Component number 4 was labeled "unknown" because of the unknown relationship of the questions that loaded to this component. The data analysis shows there are 8 questions that relate to customer/efficiency issues, 4 questions that relate to job responsibility issues and 3 questions that relate to successful implementation issues. The 20 questions used for the survey are listed in the appendix. The respondent's mark one value among a, b, c, d or e for each question.

Table 2 presents the variance to each component in the factor analysis.

Table 2 - Total Variance Explained

Component	Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %
1	5 166	25 828	25 828
2	3 729	18 643	44 471
3	2 623	13 115	57 587
4	2 055	10 274	67 860

After rotation, the first component of "cost-efficiency" accounted for 25.8% of the total variance. The second component of "job-responsibilities" accounted for 18.6% of the total variance. The third component of "successful-implementation" accounted for 13.1% of the total variance and the fourth accounted for 10.3%. The total variance for all four components accounted for 67.9%.

Table 3 presents the rotated component matrix of the pilot study data. As seen by this factor loading matrix, a few questions loaded heavy on more than one component or did not load clearly on only one component.

Table 3 - Rotated Component Matrix

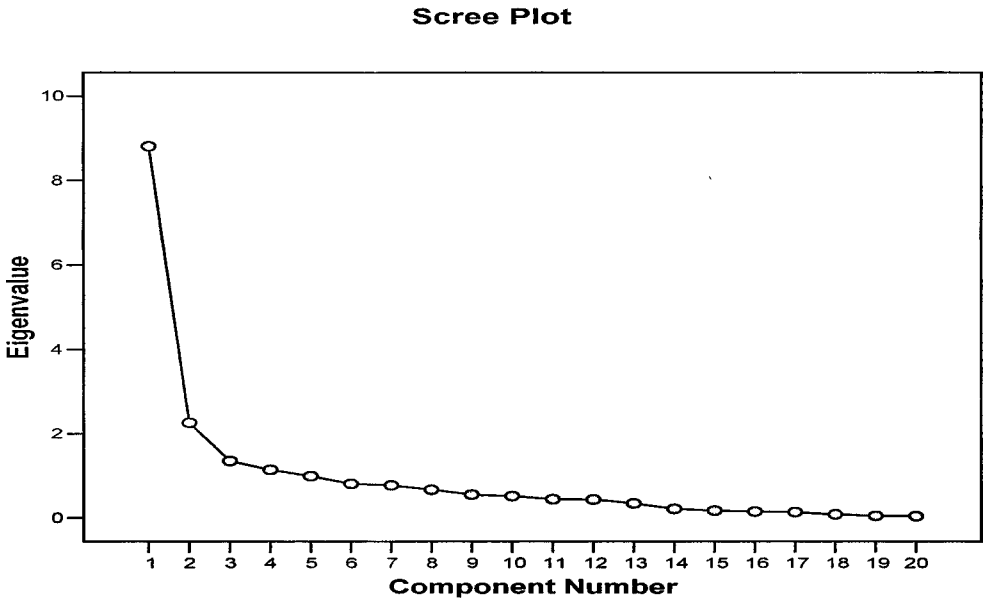
	Component			
	1	2	3	4
q1	135	187	059	**.901**
q2	.231	183	**.650**	173
q3	- 071	250	**.678**	084
q4	278	**.447**	410	352
q5	**.713**	012	196	- 040
q6	207	**.705**	244	097
q7	135	120	**.824**	- 078
q8	.165	**.720**	287	018
q9	**.821**	.135	120	344
q10	473	.135	037	**.615**
q11	.225	**.832**	.178	.159
q12	.137	**.670**	191	228
q13	**.681**	349	365	191
q14	**.714**	.470	.153	113
q15	462	.476	**.556**	- 115
q16	**.494**	464	- 279	376
q17	**.728**	084	.154	304
q18	**.613**	160	.196	406
q19	**.788**	401	.001	028
q20	**.700**	461	-.140	169

Extraction Method. Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization. Rotation converged in 6 iterations.

The scree plot in Figure 2 confirms a four-factor solution. According to Cattell's scree test, all factors can be omitted after the one starting the elbow in the downward curve of the eigenvalues.

Determining where the "elbow" begins is

Figure 1 -Scree Plot of Pilot Study Data



a matter of visual interpretation. One rule is to consider only those with eigenvalues over 1, and by looking at figure 2, components 1, 2, 3, and 4 are over 1 giving making this a four factor solution.

Table 4 shows the corresponding questions that relate to the financial perspective of the balanced scorecard. Some of these questions are quality or efficiency related at this stage, and may separate into another construct following a larger factor analysis to be conducted using a hospital employee sample at a later date.

Table 4 - Questions That Load To Component 1 Cost / Efficiency

Question Number	Question
5	The EHR is helping reduce the cost of patient care for the hospital
9	The EHR is better enabling the hospital to control costs.
13.	The EHR is helping improve the efficiency of patient care
14	Patient information is improved because of the EHR
16	My annual performance evaluation will improve because of my EHR skills
17.	The EHR is helping improve the financial competitiveness of the hospital
18	Patient information privacy and security are improved because of the EHR
19	My job related processes and procedures are easier because of the EHR
20	My job efficiency is better because of the EHR

Table 5 shows the corresponding questions that relate to the learning and growth perspective of the Balanced Scorecard. These questions are all related to training, ease of job responsibilities, or job satisfaction.

Table 5 - Questions that Load To Component 2 Job Responsibilities

Question Number	Question
4	My job performance is improving because of the EHR.
6	Clinician decision-making is improved because of the EHR
8	My job responsibilities are easier because of the EHR
11	My daily responsibilities are easier because of the EHR
12.	My job satisfaction is higher because of the EHR
15.	Communication within the hospital is improved because of the EHR

Table 6 shows the corresponding questions that relate to the internal business perspective of the Balanced Score Card. These questions measure how successful the implementation has gone.

Table 6 - Questions that Load to Component 3: Successful Implementation

Question Number	Question
2.	The new EHR implementation will be a quick process
3.	Hospital staff have embraced and accepted the EHR
7.	Physicians have embraced and accepted the EHR.

Table 7 shows the corresponding questions that relate to the unknown factor in the factor analysis of the pilot study data. With a larger sample of hospital employees, these questions may load under another factor.

Table 7 - Questions that Loaded as the Unknown Factor

Question Number	Question
1	The new EHR implementation will be a quick process
10	Hospital staff have embraced and accepted the EHR

Changes to the Second Draft

In order to prepare the instrument more thoroughly as a proper tool, the second draft underwent a few modifications. Upon initial examination of the instrument, the certain modification needed to be done with the instrument:

These modifications included the following:

1. Adding a whole new element to the survey instrument of measuring importance to each question. This measurement of importance to each question will aid in future studies.
2. 5 more questions were added to address the customer perspective of the Balanced Scorecard,
3. The verbs in all the questions were unbolded.
4. Demographic variables added for future studies to determine were differences exist.
5. The entire survey instrument is "boxed" with a border for easier reading.

Preparation of the Third Draft

The preparation of the third draft will be reviewed from two perspectives; the first will be from a CEO's perspective, and the second from hospital staff and physicians. Each perspective will aid in the final draft of the instrument.

CEO Perspective

In order to refine the instrument thoroughly, the CEO of the hospital examined the refined second draft of the instrument to determine its validity, usefulness to the management of the EHR implementation and recommended modifications to the instrument. The purpose of the CEO examination of the second draft was to capture his perspective of the instrument and recommend modifications. Upon initial examination of the instrument, the CEO objectives to be achieved with the instrument are:

1. First and foremost, the CEO wants to improve patient safety. This will aid in further developing the Balanced Scorecard customer perspective in the instrument. By asking specific questions in the instrument, the instrument will help insure patient safety remains at the forefront of management's attention during the EHR implementation.

2. The CEO wants to make sure the instrument, itself, does not lead hospital employees to form, or reinforce, a negative image

of the EHR implementation process before success has a chance.

3. The CEO want to make sure Physicians are happy with the EHR, and that the new system helps improve potential relationships and serves the implementation needs of the physicians.

From the CEO's perspective, the survey should capture all of the above objectives. In order to facilitate this objective, the second draft of the instrument was refined even more by modifying certain questions from a list of suggested questions provided by the CEO.

By looking at the CEO's objectives and suggested possible questions, seven questions were modified from the second draft. These changes to the second draft will reflect the CEO's perspectives on the use and validity of the instrument. (See Appendix F – CEO Suggested Questions for the entire list of questions)

Addressing the CEO's Objectives and Suggested Questions

In order to address the CEO's objectives and suggested questions to the refined second draft of the instrument, comparisons had to be made between the CEO's questions and the second draft questions. Each question from the CEO's suggested questions was compared to the possible matching question on the existing second draft of the instrument and an action was determined for each CEO question. These actions included adding, deleting,

or not addressing the question at all. Below are the CEO questions and the action for each one as compared with the second draft of the instrument:

1. "The EHR will improve patient safety and reduce medical errors."

   This question is already addressed in question 1 of the second draft, no action taken on the instrument.

2 "The EHR will improve documentation."

   This question is already addressed in question 27 on the second draft, no action taken on the instrument.

3. "The EHR will reduce lost charges."

   This question is already addressed in question 25 on the second draft, no action taken on the instrument.

4. "The EHR will facilitate more accurate/timely billing."

   This question is already addressed in question 25 on the second draft, no action taken on the instrument.

5. "The EHR will improve the medication administration process."

   This question is not addressed in question 8 on the second draft, needs to be addressed on the instrument.

6. "The EHR will reduce medication errors."

   This question and question 5 are comparable to question 8 on the second draft, so both of these questions will be handled as one question and some modifications will be needed on the instrument.

7. "As an employee I understand the potential benefits of the new EHR."

   This question is not addressed in question 29 on the second draft, so this question needs to be swapped with question 29 on the second draft.

8. "Physicians on the medical staff will support the new EHR."

   This question is partially addressed in question 10 on the second draft, so needs to be addressed on the instrument by modifying question 10 on the second draft to match this question.

9. "Physicians will find the new EHR easy to use."

   This question is already addressed in question 22 of the second draft, no action taken on the instrument.

10. "Access to x-ray, lab and other test results will be improved with the new EHR."

    This question is comparable to question 20 and 22 on the instrument and is not addressed specifically in any question on the second draft. It needs to be addressed on the instrument by removing question 20 on the second draft and replacing it with this question.

11. "Patient satisfaction will improve as a result of using the new EHR."

    This question is partially addressed in question 15 on the second draft, so it needs to be addressed on the instrument by

removing question 15 on the second draft and replacing it with this question.

12. "Old Medical Records will be more easily accessible after implementation of the new EHR "

    This question is partially addressed in question 16 on the second draft, so it needs to be addressed on the instrument by removing question 16 on the second draft and replacing it with this question.

13. "Access to clinical information will be more readily accessible because of the EHR."

    This question is not applicable to the instrument because this question is focusing on the future capabilities of the EHR. No comparison to the instrument was made to the instrument.

Specific Changes to the Second Draft from CEO Comments

The comparison of the CEO questions to the refined second draft yielded six further modifications to be made to the second draft as follows:

1. Number 8 of the second draft was removed and replaced with "Medication administration will improve because of the EHR."
2. Number 29 was removed from the survey and replaced with "As an employee I understand the potential benefits of the new EHR."

3. Number 10 was modified to read "Physicians on the medical staff have embraced and accepted the EHR."
4. Number 20 was removed from the second draft and replaced with "Access to x-ray, lab and other test results have improved with the new EHR."
5. Number 15 from the second draft was removed and replaced with "Patient satisfaction will improve as a result if using the new EHR."
6. Number 16 of the second draft was removed and replaced with "Patient history will be more easily accessible after implementation of the new EHR."

Hospital Staff and Physician Perspective

In order to refine the instrument more thoroughly, hospital staff and physicians examined the second draft with the changes from the CEO's perspective to determine its further validity and usefulness and recommended further modifications to the instrument. The hospital staff and physician perspectives helped in further modifications to the instrument and led to the final draft.

Hospital staff and physicians were interviewed to get their perspectives and concerns related to the proposed EHR. After examining the CEO modified second draft in light of the perspectives of the hospital staff and physicians, further changes were made in the survey questions. The following concerns were expressed by either hospital staff or physicians in interviews:

1. Multiple users for patients charts may include physician office staff
2. Reduce physician office staff time
3. Training in operation of the EHR
4. Time required for patient information retrieval
5. Security and confidentiality of patient information
6. Doctor/ patient relationships
7. Patient safety
8. Retrieving patient history from old records
9. Accessing patient information from remote locations
10. EHR value to patients
11. Retrieving results of lab tests

Addressing the Hospital Staff and Physician Concerns

In order to address the hospital staff and physician objectives in light of the CEO modified second draft of the survey instrument, comparisons were made between these perspectives and the existing questions. Each hospital staff and physician perspective was examined and compared to the existing questions on the CEO modified second draft of the survey instrument and an action was determined for each concern. These actions included adding, deleting, modifying survey questions; or not addressing the concern at all. Below are the perspectives and the action for each as compared with existing questions on the CEO modified second draft of the survey instrument·

1. "Multiple users for patients charts may include physician office staff"

   This question is not addressed in any question on the CEO modified second draft of the survey instrument. No action taken on the instrument since this survey is primarily for hospital employees

2. "Reduce physician office staff time"

   This concern is similar to number one above and will not be addressed in the survey instrument since the survey is primarily for hospital staff. But, since this and number one above are concerns of physicians, they will be tracked during the implementation and if they should continue to be a concern, they may be addressed in another way.

3. "Training in operation of the EHR"

   This concern is already addressed in questions 18 and 23 on the CEO modified second draft, so no action is taken.

4 "Time required for patient information retrieval"

   This concern is already addressed in question 21 on the CEO modified second draft, so no action is taken on the instrument.

5. "Security and confidentiality of patient information"

   This concern is already addressed in question 26 on the CEO modified second draft, so no action is taken on the instrument.

6. "Doctor/ patient relationships"

   This concern is not addressed in any question on the CEO modified second draft; so a question will be added, modified, or changed on the instrument.

7. "Patient Safety"

   This concern is already addressed in question one on the CEO modified second draft, so no action is taken on the instrument.

8. "Retrieving patient history from old records"

   This concern is already addressed in question 16 on the CEO modified second draft; so no action is taken on the instrument.

9. "Accessing patient information from remote locations"

   This concern is a common feature in the new EHR and is not thought to be a problem. It will be tracked informally and measured in another way should this become a problem. No changes to the existing survey instrument are made.

10. "EHR value to patients."

    This question is already addressed in question 15 on the CEO modified second draft, so no action is taken on the instrument.

11. "Retrieving results of lab tests"

    This question is already addressed in question 20 on the CEO modified second draft, so no action is taken on the instrument.

Changes to the CEO Modified Second Draft

The comparison of concerns for the hospital staff and physicians to existing questions on the CEO modified second draft yielded only one modification. That modification is as follows:

1. Questions number 17 of the CEO modified second draft was removed and replaced with "The EHR will allow for more efficient use of patient charts among physicians and nurses."

Final Draft of the Survey Instrument

With the inclusion of the concerns of the CEO, hospital staff, and physicians, a third draft of the survey instrument is. This survey instrument is now ready for further, more extensive testing and refinement using the project leader team from Central Texas Medical Center who are most involved in the design of the new EHR. Following the next round of testing, the instrument will be ready for final approval by the hospital leadership and could be used to measure the success of the EHR implementation process

CHAPTER 5

CONCLUSIONS

The objective of this thesis was to create an instrument to measure employee attitudes before the implementation of an EHR in a hospital and, through careful analysis of stakeholder concerns, insure that the instrument is an appropriate tool to measure employee attitudes. This study first focused on using an existing survey instrument such as the Pramod instrument to measure employee's attitudes before the implementation of an EHR. After careful consultations, this instrument proved to be ineffective for measuring attitudes surrounding the implementation of an EHR. Thus, a new instrument was needed.

This new survey instrument is the product of this study. Several drafts were analyzed for validity and usability in measuring implementation attitudes for an EHR. Early drafts of this new instrument underwent several refinement stages. Questions were designed using the concepts of a Balanced Scorecard. Factor analysis was used to further refine the questions and to help understand the underlying constructs measured by the survey instrument. Modifications to this early instrument were made and the instrument was further analyzed by the hospital CEO, hospital staff, and physicians. Further changes were made to address the concerns of these

stakeholds, thus resulting in a final third draft of a survey instrument to measure employee attitudes toward the implementation of an EHR.

Ways to Continue this Study

In order to continue this study, several steps aimed at improving the reliability, usability, and validity of this instrument should now be undertaken:

1. Factor analyze a larger sample of survey completed by hospital staff involved in the design of the new EHR. From this analysis will come further refinement of the survey questions, and a better understanding of the underlying constructs being measured. Examine the reliability of the instrument using this larger sample.
2. Subject the instrument to another round of qualitative analysis by the hospital leadership team involved with the EHR implementation. Involve the CEO in this final modification and refinement stage.
3. Once approved, begin using the survey instrument to measure the employee attitudes concerning the EHR implementation. Baseline data from throughout the hospital should be collected prior to "go live" for the EHR. As part of this administration of the instrument, analyze differences between areas of the hospital and different demographic groups (minority employees, older

employees, technical, administrative, physicians, etc.). Use the analysis of these different groups to better design training programs to meet their needs.

4. Continue to administer the survey instrument on a time-table approved by the hospital leadership team to measure the success of the implementation over time. Continue to report the success of the implementation using the concepts from the Balanced Scorecard.

This study has shown that the final draft of the instrument has merit as a valid and usable survey instrument to evaluate attitudes towards the implementation of an EHR. Using this study as a beginning, modifications to the instrument should be completed to bring about improved validity, reliability, and usability for future measurement studies with this instrument.

APPENDICES

Appendix a – First Draft

EMR Survey Questionnaire

Name:
Job Title:
Department:

An Electronic Medical Record (EMR) a.k.a. Computerized Patient Record System – is being considered for implementation at OHSU. This survey is to evaluate your opinion about the Electronic Medical Record (EMR). Each question in this questionnaire is concerned with how you feel about each statement as it applies to the situation after the EMR is operational.

Please read each statement carefully and circle one of the words from the following line that describes most clearly how you feel about the statement

For example: I find the EMR system better for retrieving patient information.
a. Strongly disagree b. Disagree c. Uncertain d. Agree e. Strongly agree

Please keep in mind what is important is your opinion

1. I will need to communicate more with others.
a. Strongly disagree b. Disagree c. Uncertain d. Agree e. Strongly agree

2. My job will be more satisfying.
a. Strongly disagree b. Disagree c. Uncertain d. Agree e. Strongly agree

3. The results of my efforts will be seen better by others.
a. Strongly disagree b. Disagree c. Uncertain d. Agree e. Strongly agree

4. Top management will provide the resources to implement the EMR.
a. Strongly disagree b. Disagree c. Uncertain d. Agree e. Strongly agree

5. The EMR system costs too much
a. Strongly disagree b. Disagree c. Uncertain d. Agree e. Strongly agree

6. I will be supported by my boss if I decide not to use the EMR system.
a. Strongly disagree b. Disagree c. Uncertain d. Agree e. Strongly agree

7. It will be easier for me to perform my job well.
a. Strongly disagree b. Disagree c. Uncertain d. Agree e. Strongly agree

8. Decisions based on the EMR system will be better.
a. Strongly disagree b. Disagree c. Uncertain d. Agree e. Strongly agree

9. The results of the EMR system are needed now.
a. Strongly disagree b. Disagree c. Uncertain d. Agree e. Strongly agree

10. People will accept the required change.
a. Strongly disagree b. Disagree c. Uncertain d Agree e. Strongly agree

11. The accuracy of information I receive will be improved by the EMR.
a. Strongly disagree b. Disagree c. Uncertain d. Agree e. Strongly agree

12. The individuals I work with will change.
a. Strongly disagree b. Disagree c. Uncertain d. Agree e. Strongly agree

13. The implementers of the EMR don't understand our problems
a. Strongly disagree b. Disagree c. Uncertain d. Agree e. Strongly agree

14. I will have more control over my job.
a. Strongly disagree b. Disagree c. Uncertain d. Agree e. Strongly agree

15. The EMR system is important to me.
a. Strongly disagree b. Disagree c. Uncertain d. Agree e. Strongly agree

16. I need the EMR system.
a. Strongly disagree b. Disagree c. Uncertain d. Agree e. Strongly agree

17. It is important that the EMR be used soon.
a. Strongly disagree b. Disagree c. Uncertain d. Agree e. Strongly agree

18. Individuals will set higher targets for performance.
a. Strongly disagree b. Disagree c. Uncertain d. Agree e. Strongly agree

19. Top management sees the EMR as being important.
a. Strongly disagree b. Disagree c. Uncertain d. Agree e. Strongly agree

20. I will be able to improve my performance.
a. Strongly disagree b. Disagree c. Uncertain d. Agree e. Strongly agree

21. This project is important to my boss.
a. Strongly disagree b. Disagree c. Uncertain d. Agree e. Strongly agree

22. The management structure will change.
a. Strongly disagree b. Disagree c. Uncertain d. Agree e. Strongly agree

23. The use of the EMR will improve patient care.
a. Strongly disagree b. Disagree c. Uncertain d. Agree e. Strongly agree

24. This project is technically sound.
a. Strongly disagree b. Disagree c. Uncertain d. Agree e. Strongly agree

25 Others will be more aware of what I am doing.
a. Strongly disagree b. Disagree c Uncertain d Agree e. Strongly agree

26. The information I receive from the EMR will make my job easier.
a. Strongly disagree b Disagree c Uncertain d Agree e. Strongly agree

27. I will need more help from others.
a. Strongly disagree b. Disagree c. Uncertain d. Agree e. Strongly agree

28. The EMR system will not require any changes in the clinic structure.
a. Strongly disagree b. Disagree c. Uncertain d. Agree e. Strongly agree

29. I will spend less time looking for information.
a. Strongly disagree b. Disagree c. Uncertain d. Agree e. Strongly agree

30. The goals of OHSU will become clearer.
a. Strongly disagree b. Disagree c. Uncertain d. Agree e. Strongly agree

31. Implementing the EMR will be difficult
a. Strongly disagree b. Disagree c. Uncertain d. Agree e. Strongly agree

32. The EMR system should be put into use immediately.
a. Strongly disagree b. Disagree c. Uncertain d. Agree e. Strongly agree

33. I will have to get to know several new people.
a. Strongly disagree b. Disagree c. Uncertain d. Agree e. Strongly agree

34. Top management does not realize how complex this change is.
a. Strongly disagree b. Disagree c. Uncertain d. Agree e. Strongly agree

35. People will be given sufficient training to utilize the EMR.
a. Strongly disagree b. Disagree c. Uncertain d. Agree e. Strongly agree

36. This project is important to top management.
a. Strongly disagree b. Disagree c. Uncertain d. Agree e. Strongly agree

37. My counterparts in other departments will identify more with OHSU's goals.
a. Strongly disagree b. Disagree c Uncertain d. Agree e. Strongly agree

38. There will be adequate staff available to successfully implement the EMR
a. Strongly disagree b. Disagree c. Uncertain d. Agree e. Strongly agree

39. I will need to consult others more often before making a decision.
a. Strongly disagree b. Disagree c. Uncertain d. Agree e Strongly agree

40. The patterns of communication will be simpler.
a. Strongly disagree b. Disagree c Uncertain d. Agree e. Strongly agree

41 I will need to talk more with other people
a. Strongly disagree b. Disagree c. Uncertain d. Agree e Strongly agree

42 It is urgent that the EMR system be implemented.
a. Strongly disagree b. Disagree c. Uncertain d. Agree e. Strongly agree

43. I will need the help of others more often.
a. Strongly disagree b. Disagree c. Uncertain d. Agree e. Strongly agree

44. I will be able to see the results of my efforts better.
a. Strongly disagree b. Disagree c. Uncertain d. Agree e. Strongly agree

45. I enjoy working with those who are implementing the EMR.
a. Strongly disagree b. Disagree c. Uncertain d. Agree e. Strongly agree

46. When I talk to those implementing the EMR, they respect my opinion.
a. Strongly disagree b. Disagree c. Uncertain d. Agree e. Strongly agree

47. My counterparts in other departments are generally resistant to changes of this type.
a. Strongly disagree b. Disagree c. Uncertain d. Agree e. Strongly agree

48. The sooner the EMR system is in use the better.
a. Strongly disagree b. Disagree c Uncertain d. Agree e. Strongly agree

49. The accuracy of my job performance will improve as a result of using the EMR.
a. Strongly disagree b. Disagree c Uncertain d. Agree e. Strongly agree

50. My performance will be monitored more closely.
a. Strongly disagree b. Disagree c Uncertain d. Agree e. Strongly agree

51. Benefits of the EMR system will out weigh the costs.
a. Strongly disagree b. Disagree c. Uncertain d. Agree e. Strongly agree

52. The organization' goals and my goals will be more similar than they are now.
a. Strongly disagree b. Disagree c. Uncertain d. Agree e. Strongly agree

53. The clinic will perform better.
a. Strongly disagree b. Disagree c. Uncertain d. Agree e. Strongly agree

54. Personal conflicts will not increase as a result of the EMR
a. Strongly disagree b. Disagree c. Uncertain d. Agree e. Strongly agree

55. The implementers of the EMR will provide adequate training to users.
a Strongly disagree b. Disagree c. Uncertain d. Agree e. Strongly agree

56. The aims of my counterparts in other departments will be more easily achieved.
a. Strongly disagree b. Disagree c. Uncertain d. Agree e. Strongly agree

57. My personal goals will be better reconciled with the organization's (OHSU) goals.a. Strongly disagree b. Disagree c. Uncertain d. Agree e. Strongly agree

Appendix b – Second Draft: First Iteration

EMR Survey Questionnaire

This survey is to evaluate your opinion about an Electronic Medical Record (EMR). Each question in this questionnaire is concerned with how you feel about each statement as it applies to the situation when using the EMR in a job setting.

Please read each statement carefully and circle one of the words from the following line that describes most clearly how you feel about the statement

Please answer the following questions using these responses:

a) Strongly disagree
b) Disagree
c) Uncertain
d) Agree
e) Strongly agree

Please keep in mind what is important is your opinion

1. My job **is** more satisfying because of the EMR system.
2. Top management **is** providing the resources to implement the EMR effectively.
3. It **is** easier for me to perform my job well.
4. Administrative decisions **will be** better because of the EMR system.
5. Clinical decisions **will be** better because of the EMR system.
6. Staffs in the hospital **are** accepting the EMR system.
7. Physicians **are** accepting the EMR system.
8. The accuracy of information **I** receive will be improved by the EMR.
9. My job **is** more satisfying because of the EMR.

10. It **will be** easier for me to perform my job well.
11. I **will need** more training and education to use the EMR.
12. My daily routine **will change** because of the EMR.
13. Top management **sees** the EMR as being important.
14. The cost of the EMR **is not** important since it improves patient care.
15. The information I receive from the EMR **will** make my job easier

Appendix c – Second Draft: Second Iteration

EMR Survey Questionnaire

This survey is to evaluate your opinion about an Electronic Medical Record (EMR) Each question in this questionnaire is concerned with how you feel about each statement as it applies to the situation when using the EMR in a job setting.

Please read each statement carefully and circle one of the words from the following line that describes most clearly how you feel about the statement

Please answer the following questions of how you feel using these responses:

f) Strongly disagree
g) Disagree
h) Uncertain
i) Agree
j) Strongly agree

Please answer the following questions of how important it is using these responses:

1) Very unimportant
2) Unimportant
3) Neutral
4) Important
5) Very Important

How do you feel about it?	Question	How important is it?
a b c d e	The cost of the EMR **is not** important since it improves patient care.	1 2 3 4 5
a b c d e	Implementing the EMR **will be** costly.	1 2 3 4 5
a b c d e	The EHR **will raise** financial burdens to the administration.	1 2 3 4 5
a b c d e	When the EHR is implemented, the price of care shall go up as well.	1 2 3 4 5

a b c d e	The EHR **will** affect financial budgets in the clinic	1 2 3 4 5
a b c d e	The EMR system **should** be put into use immediately	1 2 3 4 5
a b c d e	Clinicians **will be** able to make better decisions because of the EHR	1 2 3 4 5
a b c d e	Administrative decisions **will be** better because of the EMR system	1 2 3 4 5
a b c d e	The clinic **will have** more control of their patient information.	1 2 3 4 5
a b c d e	Customers **will not** have any more HIPAA problems at the clinic.	1 2 3 4 5
a b c d e	Staffs in the hospital **are** accepting the EMR system	1 2 3 4 5
a b c d e	Physicians **are** accepting the EMR system.	1 2 3 4 5
a b c d e	My daily routine **will change** because of the EMR.	1 2 3 4 5
a b c d e	The patterns of communication **will be** simpler between doctors and clinicians because of the EMR.	1 2 3 4 5
a b c d e	I **require** college education to use the EMR.	1 2 3 4 5
a b c d e	It **is** easier for me to perform my job well.	1 2 3 4 5
a b c d e	It will be easier for me to perform at a higher level because of the EHR.	1 2 3 4 5
a b c d e	My job **is** more satisfying because of the EMR.	1 2 3 4 5
a b c d e	A promotion is more likely for me because of I can use the EHR.	1 2 3 4 5
a b c d e	I **will need** more training and education to use the EMR	1 2 3 4 5
Thank You For Participating In This Survey!		

Appendix d – Second Draft: Third Iteration

This survey is to evaluate your opinion about the CTMC implementation of the Cerner Electronic Health Record (EHR). Each question in this questionnaire is concerned with whether you agree or disagree with each statement as it applies to the situation when using the EHR in a job setting, plus how important that aspect of the EHR is to you.

Department_____ Gender: M / F Age_____

Please read each statement carefully and circle the answer from the following line that describes most clearly how you feel about each statement.

Please answer the following questions of how you agree or disagree using these responses:

SD) Strongly disagree
D) Disagree
U) Uncertain
A) Agree
SA) Strongly agree

Please answer the following questions as to how important it is using these responses:

6) Very unimportant
7) Unimportant
8) Neutral
9) Important
10) Very Important

How do you feel about it?	Question	How important is it to me?
SD D U A SA	1. Implementation of the new EHR is well worth the cost to improve care	1 2 3 4 5
SD D U A SA	2. The new EHR implementation will be a quick and efficient process.	1 2 3 4 5
SD D U A SA	3 Hospital staff will embrace and accept the EHR.	1 2 3 4 5
SD D U A SA	4 My job performance is improving because of the EHR	1 2 3 4 5

SD D U A SA	5. The EHR will help reduce the cost of patient care for the hospital.	1 2 3 4 5
SD D U A SA	6. Clinician decision making will improve because of the EHR.	1 2 3 4 5
SD D U A SA	7. Physicians have embraced and accepted the EHR	1 2 3 4 5
SD D U A SA	8. My job responsibilities are easier because of the EHR.	1 2 3 4 5
SD D U A SA	9 The EHR is better enabling the hospital to control costs.	1 2 3 4 5
SD D U A SA	10. Administrative decision making is improved because of the EHR	1 2 3 4 5
SD D U A SA	11 My daily responsibilities are easier because of the EHR	1 2 3 4 5
SD D U A SA	12. My job satisfaction is higher because of the EHR.	1 2 3 4 5
SD D U A SA	13. The EHR is helping improve the efficiency of patient care.	1 2 3 4 5
SD D U A SA	14. Patient information is improved because of the EHR.	1 2 3 4 5
SD D U A SA	15. Communication within the hospital is improved because of the EHR.	1 2 3 4 5
SD D U A SA	16. My annual performance evaluation will improve because of my EHR skills.	1 2 3 4 5
SD D U A SA	17. The EHR is helping improve the financial competitiveness of the hospital.	1 2 3 4 5
SD D U A SA	18. Patient information privacy and security are improved because of the EHR.	1 2 3 4 5
SD D U A SA	19. My job related processes and procedures are easier because of the usability of the HER	1 2 3 4 5
SD D U A SA	20. My job efficiency is better because of the EHR.	1 2 3 4 5
Thank You For Participating In This Survey!		

Appendix e – Second Draft: Fourth Iteration

This survey is to evaluate your opinion about the CTMC implementation of the Cerner Electronic Health Record (EHR). Each question in this questionnaire is concerned with whether you agree or disagree with each statement as it applies to the situation when using the EHR in a job setting, plus how important that aspect of the EHR is to you.

Department_____ **Gender: M / F**
Age_____

Please read each statement carefully and circle the answer from the following line that describes most clearly how you feel and importance about each statement.

Please answer the following questions using these responses:

SD = Strongly disagree
D = Disagree
U = Uncertain
A = Agree
SA = Strongly agree

1 = Very unimportant
2 = Unimportant
3 = Uncertain
4 = Important
5 = Very important

How do you feel about it?	Question	How important is it to me?
SD D U A SA	1. Implementation of the new EHR is well worth the cost to improve care.	1 2 3 4 5
SD D U A SA	2. The new EHR implementation will be a quick and efficient process.	1 2 3 4 5
SD D U A SA	3. Hospital staff will embrace and accept the EHR.	1 2 3 4 5
SD D U A SA	4. My daily routine is easier on me because of the EHR.	1 2 3 4 5
SD D U A SA	5. The EHR will help reduce the cost of patient care for the hospital.	1 2 3 4 5
SD D U A SA	6. Employee stress levels have been reduced because of adequate EHR training.	1 2 3 4 5
SD D U A SA	7. Clinician decision making will improve because of the EHR.	1 2 3 4 5
SD D U A SA	8. Physicians have embraced and accepted the EHR	1 2 3 4 5

SD D U A SA	9. My job responsibilities are easier because of the EHR	1 2 3 4 5
SD D U A SA	10 Training in use and operation of the EHR has been a good investment.	1 2 3 4 5
SD D U A SA	11. The EHR is better enabling the hospital to control costs	1 2 3 4 5
SD D U A SA	12. Administrative decision making is improved because of the EHR	1 2 3 4 5
SD D U A SA	13. My patient workflow is easier to handle because of the EHR.	1 2 3 4 5
SD D U A SA	14. My job satisfaction is higher because of the EHR	1 2 3 4 5
SD D U A SA	15 Training in the EHR has reduced confusion in use of the EHR.	1 2 3 4 5
SD D U A SA	16. The EHR is helping improve the efficiency of patient care.	1 2 3 4 5
SD D U A SA	17. Patient information is improved because of the EHR.	1 2 3 4 5
SD D U A SA	18. Communication within the hospital is improved because of the EHR.	1 2 3 4 5
SD D U A SA	19. Training in use of the EHR has been cost-effective and worthwhile	1 2 3 4 5
SD D U A SA	20. My annual performance evaluation will improve because of my EHR skills	1 2 3 4 5
SD D U A SA	21. The EHR is helping improve the financial competitiveness of the hospital.	1 2 3 4 5
SD D U A SA	22. Patient information privacy and security are improved because of the EHR	1 2 3 4 5
SD D U A SA	23. My job related processes and procedures are easier because of the usability of the EHR.	1 2 3 4 5
SD D U A SA	24. My job efficiency is better because of the EHR	1 2 3 4 5

SD D U A SA	25 Training in the EHR has met my current needs for information about the EHR	1 2 3 4 5

Appendix f – Third and Final Draft

This survey is to evaluate your opinion about the CTMC implementation of the Cerner Electronic Health Record (EHR) Each question in this questionnaire is concerned with whether you agree or disagree with each statement as it applies to the situation when using the EHR in a job setting, plus how important that aspect of the EHR is to you

Department_____ **Gender: Male / Female** **Age**_____

Position_____ **Tile**_____ **Ethnicity**_____

Please read each statement carefully and circle the answer from the following line that describes most clearly how you feel and importance about each statement

Please answer the following questions using these responses:

SD = Strongly disagree
D = Disagree
U = Uncertain
A = Agree
SA = Strongly agree

1 = Very unimportant
2 = Unimportant
3 = Uncertain
4 = Important
5 = Very important

How do you feel about it?	Question	How important is it to me?
SD D U A SA	1. Patient safety has improved because of the EHR.	1 2 3 4 5
SD D U A SA	2. Implementation of the new EHR is well worth the cost to improve care	1 2 3 4 5
SD D U A SA	3. The new EHR implementation will be a quick and efficient process.	1 2 3 4 5
SD D U A SA	4 Hospital staff will embrace and accept the EHR.	1 2 3 4 5
SD D U A SA	5. My daily routine is easier on me because of the EHR	1 2 3 4 5
SD D U A SA	6 The EHR will help reduce the cost of patient care for the hospital	1 2 3 4 5
SD D U A SA	7 Employee stress levels have been reduced because of adequate EHR training	1 2 3 4 5
SD D U A SA	8 Medication administration will improve because of the EHR.	1 2 3 4 5
SD D U A SA	9. Clinician decision making will improve because of the EHR.	1 2 3 4 5
SD D U A SA	10. Physicians in the medical staff have embraced and accepted the EHR	1 2 3 4 5
SD D U A SA	11. My job responsibilities are easier because of the EHR.	1 2 3 4 5
SD D U A SA	12. Training in use and operation of the EHR has been a good investment.	1 2 3 4 5

SD D U A SA	13. The EHR is better enabling the hospital to control costs	1 2 3 4 5
SD D U A SA	14 Administrative decision making is improved because of the EHR	1 2 3 4 5
SD D U A SA	15 Patient satisfaction will improve as a result of using the EHR	1 2 3 4 5
SD D U A SA	16 Patient history will be more easily accessible after implementation of the EHR	1 2 3 4 5
SD D U A SA	17 The EHR will allow for more efficient use of patients chart among doctor and nurses	1 2 3 4 5
SD D U A SA	18 Training with the EHR has reduced confusion in use of the EHR	1 2 3 4 5
SD D U A SA	19 The EHR is helping improve the efficiency of patient care	1 2 3 4 5
SD D U A SA	20. Access to x-ray, lab and other test results has improved with the new HER	1 2 3 4 5
SD D U A SA	21 Communication within the hospital is improved because of the EHR	1 2 3 4 5
SD D U A SA	22 Availability of information for physicians has improved because of the EHR	1 2 3 4 5
SD D U A SA	23. Training in use of the EHR has been cost-effective and worthwhile	1 2 3 4 5
SD D U A SA	24 My annual performance evaluation will improve because of my EHR skills.	1 2 3 4 5
SD D U A SA	25. The EHR is helping improve the financial competitiveness of the hospital.	1 2 3 4 5
SD D U A SA	26. Patient information privacy and security are improved because of the EHR.	1 2 3 4 5
SD D U A SA	27. Charting of patient information has improved because of the EHR.	1 2 3 4 5
SD D U A SA	28 My job related processes and procedures are easier because of the usability of the EHR.	1 2 3 4 5
SD D U A SA	29 As an employee, I understand the potential benefits of the EHR	1 2 3 4 5
SD D U A SA	30 Training in the EHR has met my current needs for information about the EHR	1 2 3 4 5

Appendix g – CEO Suggested Questions

Electronic Health Records (EHR) Survey Suggested Questions

1. The EHR will improve patient safety and reduce medical errors?
2. The EHR will improve documentation?
3. The EHR will reduce lost charges and ?
4. The EHR will facilitate more accurate/timely billing?
5. The EHR will improve the medication administration process?
6. The EHR will reduce medication errors?
7. As an employee I understand the potential benefits of the new EHR?
8. Physicians on the medical staff will support the new EHR?
9. Physicians will find the new EHR easy to use?
10. Access to x-ray, lab and other test results will be improved with the new EHR?
11. Patient satisfaction will improve as a result of using the new EHR?
12. Old Medical Records will be more easily accessible after implementation of the new EHR?
13. Access to clinical information will be more readily accessible because of the EHR?

Appendix h – Physician Interview Questions

Name:	
Time:	Where:
Room:	Phone Number:
1. Do you see the new hospital information system helping or hurting how you interact with patients and hospital staff?	
2. Will the new system help you in any way in your private practice?	
3. Given the new federal regulations are expected soon where health information systems will be expected to exchange patient information. Do you see any benefits in exchanging patient data with your office system?	
4. Can you think of any recent hospital patients where having the new information system may have improved the quality of care they received?	
5. Do you believe you will need to know much about the new system?	
6. Has there been any discussion among the hospital medical staff about the new system?	
7. Do you have any other concerns related to the new hospital information system?	
8. How you will interact with it?	
9. What it will mean to your patients?	

Appendix I – Physician Interview Notes

Interview notes with an Internal Medicine Physician

This physician believes that his staff will have greater efficiency with an EHR. A patient's chart has more than one user, meaning that multiple users such as nurses or physicians can view the chart simultaneously The physician goes on to say that the EHR will benefit his private practice by eventually allowing access to the hospital's records from outside the hospital. Removing patient records from the hospital is not commonly allowed. Currently, the physician only has access to the patient's hospital record through a secure web access. The physician's office staff spends a lot of time filling out paperwork and sending/receiving faxes. The EHR will help reduce this staff time and allow instantaneous access to information. There have been occasions where the EHR could have assisted the physician with hospital visits of patients by allowing bedside access to the chart. The doctor mentioned there are no special concerns he has about training in the EHR since he already has good computer skills. He understands that he will need to learn the "nuts and bolts" of what may be a complex system. There has been little discussion among or with physicians, to-date, about the new system. Seminars are scheduled soon for physicians, and he plans on attending them. Concerns the doctor is worried about are the glitches ("bugs") in the system. He worries about the possibility of lost patient data. There may be use of both the old and new systems for a while until the "bugs are worked out." The physician plans to interact with the system as much as

possible. The EHR will mean a lot to patients by allowing physicians access to patient information faster from anywhere in the hospital.

Interview notes with a General Surgeon

The physician believes that if he were more computer literate, it still would not have a big effect upon his interaction with patients. He sees the new system as less of a transition since he is not currently dependent on computer based information and is focused more on care of the individual patient. He believes that not engaging in though personal communication with the patient can lead to a problem with patient safety. The new EHR will make the gathering/receiving of patient information quicker. He sees HIPPA regulations as having made patient information harder to access. His greatest concern related to the new EHR is safeguarding accuracy of patient information. A recent incident where the EHR could have been useful is where a cancer patient needed their information transferred to a cancer clinic across the street. It took two days and 3 people to transfer the information. A further concern for the physician is that he feels pressured to be much more knowledgeable in using computers. There has been discussion among the medical staff about electronic charting. He sees a time when the EHR might eliminate paper-based records. Another concern about the system is patient confidentiality and security. Will be the system be secure? This physician sees himself embracing the system in time and will eventually come to accept it. The doctor worries that the EHR will cause him to lose the doctor/patient relationship he prefers.

Interview notes with a Family Practice Physician

The doctor feels that the new system will not hurt any patient or staff interaction. The new system will help his staff exchange information better. He sees only minimal personal benefits of the system for his practice because he does not have an HER in his office. His practice is only paper based. His only real concern, related to patient safety, is the mix up of information. He worries that the accuracy of patient information will not be any better compared to the current paper based systems. He reasoned that humans can manually put in the wrong information in either computer or paper-based systems. Another concern of the doctor was "no control of data." The data in computer systems are accessible anywhere in the world. "With computer-based systems, there is really no privacy of patient data" according to the doctor. The doctor sees himself interacting with the system after training. He sees the new system helping retrieve patient data quicker, and being a benefit to patient care.

Interview notes with an ED Unit Clerk

The ER clerk sees the EHR helping the way in how ED staff interacts with patients. He pointed out that there are times that the system can help when patients have potential drug problems. The EHR can give a "snapshot" into a patient's medical past. He sees the new system as a great benefit in patient care if used properly. Some doctors will be able to obtain patient records through secure dialing from home. With any computer, there are security risks for physicians or private practices when connecting from outside

the hospital. There have been several instances where an EHR would have helped with nursing home patients in the ED. An EHR would have told the ER staff if the patient is a DNR (Do Not Resuscitate) patient. The doctors need to know about this since this can turn into a legal issue. The family can have legal document such as a DNR for the patient stored in the EHR. A training related concern of the clerk is the skills of the instructors to teach others in the hospital on how to use it.

Every computer system has a lot of features, and sometimes we have questions that need answering. If the instructor lacks the knowledge to answer it, then the instructor has failed in his job. No one is currently trained on how to use the system. If he is to be an effective trainer, he believes he needs to know all of the features of the new system. There is discussion among the ED staff about the EHR and why it's "go-live" has been pushed back. Rumors of problems persist on why it was pushed back. Also, a lot of employees feel the workload will increase because of the training and the learning curve required to effectively use the EHR. Another concern is the physicians' use of paper templates to write information on patients. If physicians are currently using these paper templates, they need to be incorporated in to the system. Since IT system developers are not knowledgeable in medical procedures, if they don't design the system to meet the needs of clinicians, and then there can be major problems in patient care. He is also concerned there will not be enough forms or screen templates. Development of these screen forms has been very slow. An integral aspect

of the implementation is development of the forms and the attention it is getting is a concern. The clerk will be an early adopter and interact with the EHR soon since he will be one of the trainers. He believes the EHR will mean a lot to the patients if know of its value. Families can have the patient's information on a screen viewable by the family. These screens can help answer questions on the patient's status, where they are, and the diagnosis

Interview notes with a Family Physician

The physician sees the EHR as helping the interaction with patients The new system will help the private practice by accessing data more efficiently. The EHR will provide a searchable interface for medical records. Given the new federal regulations, HIPAA, the EHR will aid in the exchanging of data by incorporating labs and x-rays into the system. A recent event where the EHR improved the quality of care to a paper was when the doctor hand to read another doctors diagnosis on a fax. This fax had the diagnosis, but was hard to read. This is a hand writing issue. No doctor writes the same as another. This issue can be solved with an EHR. A concern the physician has is that he's worried about the implementation. If the IT department looses focus on concentrate on the "big picture" of the implementation, and forgets the smaller picture, they loose the idea behind medicine. An example is the login process, if a doctor is not aware on how to do this, then there is a problem. The physician plans to interact with the system by progress notes and home access The system will mean a lot to patients by having more eligible notes and better reporting of patient data

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VITA

Agustin Moreno was born in Newark, New Jersey, on November 1, 1976, the son of Jorge Moreno Benitez and Rocio del Carmen Rosales de Moreno. After completing his work at Leander High School, Leander, Texas in 1994, he attended Austin Community College, Austin, Texas in 1995. During the two years of 1995 - 1997 at Austin Community College, he prepared himself to attend Texas State University-San Marcos. He received the degree of Bachelor of Science from Texas State University-San Marcos in December 2003. In August 2003, he entered the Graduate College of Texas State University-San Marcos and was employed as a graduate teaching assistant with Texas State University-San Marcos.

Permanent Address: 800 Alhambra Drive
Georgetown, Texas 78628

This thesis was typed by Agustin Moreno.