2009

Use of the Electronic Health Record in Private Medical Practices

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USE OF THE ELECTRONIC HEALTH RECORD IN PRIVATE MEDICAL PRACTICES

A Dissertation

Submitted to the Department of Instructional Leadership Excellence

at Duquesne University School of Education

Duquesne University

In partial fulfillment of the requirements for

the degree of Doctor of Education

By

Archish Maharaja, CFP, CPA/PFS, MBA

January 2009

DUQUESNE UNIVERSITY
SCHOOL OF EDUCATION
Department of Instruction and Leadership

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January 16, 2009

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ABSTRACT

USE OF THE ELECTRONIC HEALTH RECORD

IN PRIVATE MEDICAL PRACTICES

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Dissertation Supervised by Dr. Robert Agostino

The purpose of this study is to examine the use of the electronic health record (EHR) by physicians in Allegheny and Westmoreland counties in Southwestern Pennsylvania. Five research questions were designed to inquire about the physician practice characteristics and its relationship to the EHR deployment, the importance of educational intervention in the EHR adoption, and the physician's belief if the EHR contributes to improvements in the quality of patient care and practice productivity and profitability. A survey of The Use of Electronic Health Records by Medical Practices was used to collect 169 physician responses from the two counties. This survey was divided into six sections: practice characteristics, health information technology, computers and health care, financial considerations, the office practice environment and personal characteristics for a total of 27 questions. These were designed to inquire about the

current status of the practice, availability of the electronic health record or its components, current use of information technology, practice and physician perspective about the EHR and information technology and personal demographical questions. This survey was adopted in a modified format from the original article, Correlates of Electronic Health Record Adoption in Office Practices: A Statewide Survey, written by Dr. Steven R. Simon, MD et al, and conducted in the Commonwealth of Massachusetts. The responses were statistically analyzed using the Statistical Package for Social Sciences (SPSS v. 16) Software. Results of the survey questions show that there is a correlation with having an EHR system and its effect on a practice, leading to improvements in the quality of patient care, and an increase in practice productivity and profitability. In spite of findings such as this, the adoption of EHR in Allegheny and Westmoreland counties is relatively low because of a lack of financial investment in the technology driven by the physician perception that EHR does not add to their personal income. These results show that an opportunity exists to educate physicians on the EHR to point out its contribution to improving the quality of patient care, as well as positively affecting their financial well being. It also indicated the necessity of developing industry-wide common EHR technology adoption initiatives and protocols in order to increase the implementation of EHR in physician offices

DEDICATION

This study is dedicated to my wife Gita Maharaja, who motivated and helped me to start and finish the program, our daughters Nisha and Kerina Maharaja who have sacrificed their time and have understood their parent's quest for higher education. And to my parents Late Mr. Suresh Maharaja and Rajni Maharaja who stood by their children and motivated me to rich high. My Late father's advice, "In life two things does not go to waste education and money" shall never be forgotten. Truth be told, I have always pursued only the education and hope to continue on the same path. I shall never forget all of your words and contributions to my life. May god bless all of you.

ACKNOWLEDGEMENT

Approximately four years ago when I started this degree program it was with the intention of doing it just for the fun of it. I was reluctant to start another degree program and most importantly did not know if I wanted to study for one more examination. But I must admit this has been a great experience in learning and researching something that is one of my main interests, namely using technology to improve one's life. I hope that the completion of this degree program will allow me to continue my mission.

First and foremost, I must thank Nisha and Kerina Maharaja, our daughters who have been the most patient individuals and have understood the reason for their parent's absence at their school functions and Sunday afternoons. One individual who deserves all the credit for encouraging and motivating me to start and finish this program is my wife, Gita Maharaja. Yes, we had our difference of opinions on how to do the dissertation or research but in the end we both knew each other's strength and weaknesses, which helped me in finishing this program. So thank you for being there and I know she will finish this program also.

Atul and Marvis Maharaja, my uncle and aunt, and my cousin Reena, deserve a great amount of credit and appreciation for their unselfish dedication and the opportunity they provided me to come to this country. Three other individuals who have stood by my parents and sister in India during my absence, Bhupendra and Panna Dave my maternal uncle and aunt and their son, Nayank, who have also contributed greatly to my success. They have taken on the responsibility and delivered their services to my family without a word of thanks from me. Everything you have done cannot be repaid but my hope is that

I am able to reciprocate that to someone someday. Above all, the most important individual in my life, my mother Rajni Maharaja, deserves credit and blessing for her piety and services to my late father, Mr. Suresh Maharaja. To my sister Namita Jani thanks for being there when our parents needed help.

The beginning and completion of this doctoral degree credit could not have been possible without the leadership, guidance, and motivation by Dr. Robert Agostino. He had the courage to go against the norm in admitting business students into the School of Education at the Duquesne University. Your contribution to my success is greatly appreciated. Dr. William Barone helped in bringing laser-like focus to my dissertation and motivated me towards its completion; and Dr. Gibbs Kanyongo's guidance in statistical method design and analysis was invaluable to my research.

I would like also to acknowledge the significant contribution of the article by Dr. Steven R. Simon, MD, MPH, The Correlates of Electronic Health Record Adoption in Office Practices: A Statewide Survey, whose groundbreaking research was a major help to my own research. The survey used in this research was also adopted from the same article and I thank Dr. Simon for allowing me to use the original survey. I also thank Dr. Rajiv Varma for his assistance in the data gathering process. Perhaps most critically I could not have received the data needed for statistical analysis without the cooperation and assistance of Mr. John (Jack) Krah, Executive Director of the Allegheny County Medical Society and his team members. All of your contributions are much appreciated.

Finally huge thanks to my business cohort members, Donna Nedelk for your kind words, Don DiGirolamo for your wisdom, Jared Simmer for your practical advice and wit and Eric Swift for your help and friendship at the library. I would also like to thank all of

my Instructional Leadership at Duquesne (ILEAD-4) cohort members for your camaraderie.

I would like to end this part of acknowledgement with my favorite quote: “Success is not an event, nor it is a success of an individual--it is a combined effort of friends and family.”

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Chapter One: Introduction

Overview of the Electronic Health Record (EHR) in the Health Care Industry

In today's electronic information age, it is expected and presumed that access to information will empower physicians in their ability to provide quality care to their patients and thereby improve their quality of life while at the same time helping to limit their healthcare expenses. In 2005 the United States spent $2 trillion (over 16% of our gross domestic product, which amounts to $6,697 per person) on healthcare - the highest in the world (Catlin, Cowan, & Washington, 2007). Other countries' healthcare spending accounts for much less of their GDP: Switzerland, 10.9%; Germany, 10.7%; Canada, 9.7%; and France, 9.5%. Only 15% of our physicians use electronic healthcare records (EHR) to manage the patient's health information. In comparison, European countries have made a significant advancement in the use of the EHR: Sweden, 90%; the Netherlands, 88%; Denmark, 62%; the United Kingdom, 58%; Finland, 56%; and Austria 55%. The European Union's average of 29% was just about double that of the United States (National Coalition on Health Care, 2006).

The healthcare industry within the United States has lagged behind in the adoption, integration, and universal utilization of the electronic medical record. From the physician's point of view, several factors contribute to this dilemma.

First is the fear of losing personal interaction with the patient due to adoption of technology. As Warner V. Slack, M.D. (1997, p. ix), states, "a humanizing influence on the practice of medicine helps patients and their families maintain better health, manage medical problems when they occur, seek and use health care facilities in an enlightened manner, and participate as partners with clinicians in medical decisions that can both

improve the quality and reduce the cost of medical care." Until recently, the patient-physician relationship was a one-way street on which a physician prescribed a solution for the patient to follow. However, now the EHR offers an enormous amount of information and instantaneous access to that information, to physician and patient alike. This could lead to both the physician and the patients questioning the need to have face-to-face contact since diagnostic tools and treatment methods have been taken over more and more by machines.

In addition, the amount, mode, quantity, and sources of information can in themselves become a cause for concern. Since the EHR is a tool, and not the solution to all healthcare evils, several questions must be asked: How are the tools used to gather information, and who collects it? In what format will it be? Who will have access, and how will access be restricted? In short, the tool must be designed so it can be used to achieve optimum results and not be a burden for the providers of the healthcare solutions.

One final but critical obstacle for the physicians is the investment in and financing of the EHR. A quagmire exists in the healthcare industry since the beneficiary of information and solutions is the patient and the prevalent user is the physician, yet the financial stakeholder is ultimately the insurance company. This fragmentation creates in its simplest form a problem of coordination and integration of information and technology. Each of the stakeholders often has a competing interest and outcome for which they are aiming.

Status of the Electronic Health Record (EHR) in Pennsylvania

The eHealth Initiative and the Foundation for eHealth Initiative were formed in the state of Pennsylvania to encourage adoption of information technology, and

especially the EHR, to bring about improvements in quality, safety, and efficiency of healthcare for Pennsylvania residents (Pennsylvania eHealth Initiative, 2007). The initiative report points out the following important issues which need to be addressed:

- Patient privacy and confidentiality
- Care transformation/process excellence
- Interoperability of health information technology (HIT) applications
- Common statewide health information exchange (HIE) infrastructures
- Clinical decision support.

The same report identifies the following key foundational roles for the Pennsylvania eHealth Initiative:

- Identify opportunities for Pennsylvanians to use health IT and HIE to improve care.
- Educate the public providers and policymakers regarding the benefits and challenges of health IT and HIE.
- Assist in the coordination of health IT efforts among Pennsylvania healthcare stakeholders.
- Identify opportunities to coordinate with the benefits from federal initiatives.
- Develop statewide consensus on established and emerging standards.
- Work with providers, payers, and policymakers to define business cases (including return on investment) for HIT and HIE.

The prescription for Pennsylvania by Pennsylvania Governor Edward G. Rendell (2007, p. 28) stated, "Electronic health records are known to reduce errors by making

patient information more clear, complete, and available to healthcare providers in a more timely manner, so quicker and more accurate decisions can be made." In addition, the governor issued an executive order to form a Health Technology Commission by December 31, 2007, to establish standards and specifications for personal health records and electronic medical records that ensure necessary interoperability; define components and terminology; and recommend financial and financing incentives for health care providers to purchase these systems. Additionally, the administration proposed legislation to mandate adoption of e-prescription by each healthcare provider as a condition of their medical licensing. The legislation further states that the administration will advocate that medical malpractice insurance discounts are granted to health care providers who adopt and use an interoperable electronic medical record system (Rendell, 2007).

Rationale of the Study

The traditional method of paper medical record-keeping is becoming gradually obsolete in today's world. Technology is able to provide infinite amount of information instantaneously. Brandy & Blair (1995) points out "the most direct contribution that information technology can make to improving the quality of healthcare is to provide the clinician with better information about the patient problem at hand, and alternative tests and treatments for that problem, preferably at the point of care" (p. 125.). One of the recommendations to achieve this goal is for the physicians to adopt electronic patient records. (Brandy, 1995). The University of Illinois Medical Center took on a special effort known as the Gemini project to be able to leverage information technology to transform people, processes and performance. As part of this project the planners stated one of the objectives as, "providing caregivers' access to a longitudinal electronic patient

health record and improving access to clinical information across the enterprise and increasing the efficiency and effectiveness of caregivers" (Ranganathan, and Manheim-Watson, 2004, p. 17). The EHR is described as a tool used to store, retrieve and share information about a patient's medical history and care. This description is supported by Shortliffe (1999) who states

> In order to be useful, the record also must provide facile mechanisms for displaying needed data, for analyzing them, and for sharing them among different kinds of individuals (including secondary users of the record who are not involved in direct patient care). Thus computer based-medical record is best viewed not as an object or product, but rather as a set of processes that an organization must put into place, supported by technology. (p. 417)

The introduction of technology does not provide an answer to all of the problems related to medical records. Each clinician and for that matter all involved must be educated on how the tool can be utilized effectively and efficiently. The lack of information technology education has resulted in a dearth of response in adapting technology in health care management. Shortliffe (1999) states, "There is a difference between computer literacy (familiarity with computers and their routine uses in our society) and knowledge of the role that computing and communications technology can and should play in our health-care system" (p.14). The health care industry is doing a meager effort of training future clinicians in computing technology and consequently leaving them unprepared for the potential effective and efficient use of technology in health care record-keeping. Scholars point out that technology is the key to alleviating physicians' dependence on memory. Bright and Hall (1995) supports this argument by

stating “the effective use of this technology holds the promise of freeing future physicians from an over dependency on memory and facilitating the development of new knowledge and skills” (p. 1064). As addressed by Bright and Shortliffe, the importance of technology cannot be ignored in the health care industry. Consequently, stakeholders in that field , namely physicians, administrators, nurses, clinicians and other involved players, can benefit from research that are being carried out on the potential effectiveness and efficiency of technology in health care management.

The need for this study is justified by the following reasons:

- A mandate by the State of Pennsylvania legislation for the EHR adoption.
- Research has indicated that no such studies have been done in the State of Pennsylvania.
- Studies, supporting the use of healthcare information and Electronic Health Records/Medical Records, will provide stakeholders with a comprehensive patient health record system.
- Knowledge about the role of technology as a tool for improving productivity and profitability needs to be spread among physicians.
- Lack of knowledge about the EHR creates a need to educate physicians of the usefulness of technology and to recommend educational strategies to support the learning process of adopting technology.

Purpose of the Study

The purpose of this study is to investigate the use and understanding of the EHR among a group of physicians in Allegheny County and Westmoreland Counties. Specifically the study will survey and report quantitative data on physicians’ current

practice characteristics and any factors which may contribute to the EHR usage. Second it will investigate if the adoption rate or the physician perception to adopt the EHR can be influenced by providing structured educational programs. The study will assess the strategies necessary to educate physicians in the process of the EHR adoption. Given that the EHR adoption requires a different kind of leadership and education, along with financial investments and incentives to increase the EHR adoption, implementation, and use, the assessment will focus on those criteria. Finally, the study will investigate how physicians perceive the effect of the EHR in the improvement of the quality of patients' care, and the productivity and profitability of the medical practice.

Research Questions

A detailed study of physicians in private practice within the western Pennsylvania area will be conducted to research the following questions:

- Are there different characteristics among physicians which contribute to the EHR deployments at a medical practice?
- Are educational interventions related to the adoption of HER by physicians?
- Do physicians believe the EHR can contribute to improvements in the quality of care?
- Do physicians believe the EHR can improve the practice productivity?
- Do physicians believe the EHR can improve the practice profitability?

Significance of the Study

This project was undertaken as an attempt to contribute to research in the field of health care management. As mentioned previously in the literature, the role of technology in the health care industry is being given much attention due to the fact that speedy, effective and efficient service is crucial in that industry. Hence, the study attempted to provide stakeholders, namely, physicians, nurses, health care administrators, clinicians and others involved in the field with information that would assist them to evaluate the use of technology in health care record-keeping in their own institution. It is also hoped that this study has contributed to a pool of resources that have assisted physicians and other involved in health care management with training strategies that would better equipped them with the educational knowledge to utilize the EHR. Finally, the study sought to serve as an educational tool that would provide physicians with information that would guide them on how the EHR would benefit their practice in terms of improvement in patients' quality care, productivity and profitability.

Educational Impact of the EHR

All new technologies are incorporated into the work environment to improve services and provide accurate, complete, and rapid access to information so that educated decisions can be made. All new ideas require education and training: healthcare information technology or the EHR is no exception. A focus group in Oxendine's 2002 "Study of technology adoption in California: Medical groups, Individual Practioners' Association's, and community clinics" rated training to be one of the most important factors for the successful adoption of technology. The group respondents suggested developing educational programs about the technology and the success of existing

technology. Educational programs must be designed which can transform the technology into information, and information into knowledge. The transformation of concept to adoption may be slow but education can increase success. Bailyn (1960, p. 14) states, "It becomes apparent when one thinks of education not only as formal pedagogy but as the entire process by which a culture transmits itself across the generations."

One of the key factors in the successful adoption of healthcare information technology is educational support for physicians. Robinson (2007, p. 14) states:

> Training for clinicians must be clinically relevant. The training for each discipline and for clinicians in different specialty areas must reflect their particular area of practice. Training should be planned with different learning curves in mind in relation to comfort and prior technical abilities. Successful training of physicians and other clinicians is a primary factor in their adoption of HIT and their continuous support of it.

Educating physicians requires thoughtful planning of programs, which focus on the individual, and include a continuous stream of information embedded in their daily clinical schedules. Robinson (p. 14) offers, "For physicians, successful training should be one-on-one and offered on rotational basis. Ultimately, training for all clinicians must fit into their schedule. Facility and environmental factors should also be taken into account when educating clinicians." A physician's reluctance to accept technology must be addressed by customized education incorporated with step-by-step, on-the-job training, with recognition of incremental success.

Limitations of Study

This survey's main limitation is the size of respondent sample and practice characteristics. Due to the existence in western Pennsylvania of two large hospital network systems (University of Pittsburgh Medical Center (UPMC) and the West Penn Allegheny Health System), a significant number of physicians practice in individual offices but are part of a larger system which has adequate availability of financial and technological resources. Respondents from such offices may skew survey results. Furthermore, respondents receiving the survey via standard mail may or may not respond in a timely enough fashion to be included in the statistical analysis. The respondent list is derived from the county medical society and regional hospital's medical staff directory so there is a possibility that contact information may or may not be updated.

Delimitations of Study

This study will use current membership lists from the Allegheny county medical society and regional hospital's medical staff directories as the official contact list in order to garner meaningful data from the survey. Electronic mail and direct postal mail delivery services will be used to gain an improved response rate. Survey endorsement assistance will be sought from each of the county medical societies in order to encourage physician participation.

Use and adoption of the EHR by a physician could create a reasonable expectation and demand by patients to be able to view the same at any time, at any location. This aspect of the EHR is beyond the scope of this study; factors such as patient

education and interpretation of the data may not be valid due to lack of technical knowledge or comparison with unreliable resources.

Another significant factor is the lack of global standards for the structure of the EHR. The technical standards and protocols will have to be researched by future studies. These limitations do not negate current study but offer an opportunity for future studies in these areas.

Definition of Terms

Clinical Data Repository (CDR): A computerized system for the collection of patient health information.

Clinical Decision Support (CDS): Computer-based software used to assist health care providers in the diagnostic decision making process.

Computerized Patient Record: Individualized patient health information recorded

Computerized Practitioner Order Entry (CPOE): A computer-based system used by health care providers to enter patient's treatment orders.

Electronic Health Record (EHR): Computerized comprehensive patient record encompassing administrative, clinical, and management information, which can be used in the clinical decision-making process.

Electronic Medical Record (EMR): A computerized patient record containing medical information, to be used in the clinical decision-making process. EMR may be able to interact with the organization's administrative and management systems and is generally owned by the health care provider or the facility.

Electronic Patient Record: Electronically recorded and stored patient health information.

Electronic Prescribing: An electronic exchange of medication information regarding the patient, to and from the health care provider and pharmacist.

Gross Domestic Product (GDP): The total market value of all goods and services produced within a country in a given period of time.

Health Care Provider: For the purpose of this study, the term is limited to a practicing physician, regardless of specialty.

Health Information Technology (HIT): Any use of a computer or software in processing, retrieving, sharing, or storing a patient's health-related administrative, clinical, or management information.

Health Information Exchange (HIE): The ability and characteristic of access, exchange, and retrieval of the information around and within different organizations or geographical locations.

Interoperability: Ability of an electronic system to interact with any other computer system without major modification or human intervention.

National Health Information Network (NHIN): A network made up of an individual's health-related administrative, clinical, diagnostic, and management information processing, enabled by laws, policies, programs, practices, standards, and technologies.

Practice Management Systems (PMR): A computerized system to manage a health care provider's administrative, financial, and managerial aspects of his business.

Regional Health Information Organization (RHIO): An organization formed to promote, improve, and integrate quality of patient care, information, and safety, by encouraging exchange and integration of information among the various stakeholders within a

geographic area. RHIOs also work in collaboration and cooperation with national healthcare organizations, to carry out the national healthcare agenda.

Chapter Two: Historical Perspective and Literature Review

Introduction

The Electronic Heath Record (EHR) is viewed as an essential technology, which can improve delivery and quality of healthcare, provide significant cost savings, and make patient information available around the clock and world. In his January 20, 2004, State of the Union address, the President of the United States George W. Bush, said, "By computerizing health records, we can avoid dangerous medical mistakes, reduce costs, and improve care" (New Generation of American Innovation, 2004, p. 7) The president's leadership role in understanding the importance of the EHRs, and putting emphasis on use of this technology for most Americans within 10 years, provides governmental initiative for private industry, health care providers, and organizations.

The Medical Records Institute's *Ninth Annual Survey of Electronic Medical Record Trends and Usage for 2007* (2007) reports ten major barriers to implementing the EMR; lack of adequate funding (40.4%) is the primary reason; other reasons (in order of importance) include difficulties changing to EMRs (30.9%), difficulties creating a migration plan (29.3%), inability to find affordable EMR software (29.1%), return on investment (ROI) justification (23.7%), EMRs which meet current application or technical requirements (21.1%), fragmented EMR among IT platforms and vendors (19.0%), lack of support by staff and partners (18.8%), EMR evaluation difficulties (18.5%), and other reasons (17.2%).

The completeness, availability, and access to a patient's health and medical record are the primary tools in correctly diagnosing and treating the patient. Florence Nightingale (1863, p. 176) pointed out in her *Hospital Notes*, "In attempting to arrive at

the truth, I have applied everywhere for information, but in scarcely an instance have I been able to obtain hospital records fit for any purposes of comparison." Patient charts historically are paper records containing a patient's medical history, relevant to each visit at a particular physician's office or health care facility, such as a hospital or laboratory. To comprehend the transition of a patient's paper record to an electronic record, a brief background of the evolution of computers and their role in today's version of electronic health records is imperative.

History of Computers

Information may be seen as a commodity, which is why its importance and potential may not be realized. Marsden S. Blois (1986, p. 776) writes about information and computers:

> [I]t also seemed useful to draw attention to the important distinction between information (the commodity with which informatics deals) and the computer as a tool for use in processing this commodity. The computer continues to be an exciting object, it is increasingly present, and it rarely fails to attract attention. Unfortunately, the commodity, which is processed by the computer, tends to be overlooked.

The processor is the main component of the computer, technologically speaking. The invention of the processor dates back to the mid-1600s, and Pascal. Pascal's device was automated in the 1830s by Charles Babbage, a Cambridge mathematician who improved the processor but never completed what could have been the first digital computer. The first semi-digital computer was developed in 1940 by George R. Stibitz at Bell Laboratories. This computer used On and Off switch positions to represent 0 and 1,

using the binary mathematical system. Collen (1995, p. 5) writes, "The world's first fully functional, program-controlled, general-purpose, electro-mechanical digital computer was completed in 1941 by Konrad Zuse, in Germany. His machine used relay switches and was based on the binary system. Due to World War II, Zuse's work received little recognition in the United States."

In 1943, Howard H. Aiken built the first Mark I electromechanical computer while he was working at Harvard University with IBM engineers; this was the real beginning of electronic computers. The main difference between the Mark I and the previous processor was the Mark I's electronically performed operations. Since the 1920s, the International Business Machine (IBM) Corporation was one of the driving forces in computer research and development.

Collen (1995, p. 5) writes further, "Credit for the invention of the first generation of all-electronic digital computers has been given generally to the mathematicians Alan M. Turing and M.H.A. Newman and their colleagues at the Bletchley Research Establishment in England." Computer research and development picked up speed, and new second-generation computers were introduced in 1958. These second-generation computers were comparatively smaller in size and worked on less electrical power. Around 1959, the first transistorized computer, with a 32,768-word memory and a magnetic tape device as a second storage unit, was sold by IBM. Collen (1995, p. 7) writes, "By the end of the 1950s, IBM had three-fourths of the computer market in the United States. IBM continued through the end of the 1980s to be 'the world's most profitable industrial company.'"

By the 1960s, a third generation of smaller computers began to appear in the laboratories. The commercial marketing of the smaller version did not start until the mid-1960s, by the Digital Equipment Company (DEC). Other commercial producers such as Hewlett-Packard also started to market their versions of smaller computers. The first Programmed Data Processor (PDP) designed by C. Gordon Bell was the driver for the mini-computer.

At the same time, mini-computers were beginning to be used in the healthcare field, propelling development of different operating systems such as AT&T Bell Laboratories' UNIX, IBM's Operating System/2 and Microsoft's Disc Operating System (MS-DOS). Other database systems and applications programs were developed, along with different data transfer devices and techniques, and Local Area Networks (LAN). The processing power and access to data and information due to computer-propelled expectations to improve the quality of care spurred research and development within the healthcare industry. A whole new field called "medical informatics" was evolving. History of computers in the healthcare industry.

The healthcare industry traditionally has been an industry in which service-provider-to-patient communication was conducted in a protective, encrypted language, in which a provider wrote notes in Latin shorthand and used terminology so that a patient could not understand the diagnosis, problem, or process. Warner Slack (1997, p. 6) writes, "When the doctor handed the patient a prescription, it was written in Latin to prevent communication." Patients believed the physician's instructions and diagnosis could not be challenged or scrutinized. Healthcare professionals did not want to be challenged or receive criticism for their work. Warner Slack (1997, p. 6) points out, "The

concern that the public will not understand and will be misled is certainly legitimate, but it is sometimes expressed a covert means of protecting the guild, rather than the public. There is valuable equity in the concentration of information."

Benjamin Spock's self-help articles and books were the first indication of change, spurring healthcare industry players to write more accessible, understandable articles and books on various healthcare issues. Various industries' integration of computers from the 1950s onward finally began in the healthcare industry. Most computer use was in the fields of biology and engineering, or bioengineering. For the first time, computers and information were referenced more globally within the healthcare industry. The new term was *healthcare informatics*. Collen (1995, p. 39) states, "Eugene Garfield (1986), of the Institute of Scientific Information, credited A. I. Mikhailov, of the Scientific Information Department of Moscow State University, with first using the Russian terms *Informatik* and *Informatikii*." The term *informatics* is defined in different ways but essentially means the learning or use of information processing and computers together. The Random House Dictionary defines informatics as the "study of information processing; computer science" (Random House Webster's, 2005).

Articles developed around the theme of informatics as it related to public health. As in any industry, government and universities were taking baby steps towards inclusion of medical informatics. Universities were taking more of a holistic approach in developing medical informatics curricula; they included medical data processing, computing, information processing, and information systems (which in turn encompassed hardware, software, and telecommunications, to process the information). Simultaneously, medical informatics' progress advanced in developed nations around the

world. In Tokyo, in 1977, at the Second World Conference on Medical Informatics, Collen (1995, p. 41) defined medical informatics as "the application of computer technology to all fields of medicine - medical care, medical teaching and medical research." He further revised the definition to include, "the application of computers, communications, and information technology and systems to all fields of medicine - to medical care, medical education and medical research." The defining process, of medical informatics as a new discipline to manage healthcare information, was gaining momentum. The use of the computer in the medical field was seen as exciting, yet it was perceived only as a research tool. Marsden S. Blois (1986, p. 777) compares computer use to that of a microscope and states:

> I would suggest that the computer in its relation to medicine is analogous to that of microscope in the last century. The optical microscope was the tool that in the 19th century opened up entirely new domains of medicine. Its application to the classification and retrieval of data and to the management of information will result in a deeper insight into the structure of medical information and knowledge itself. In this role, it will provide us with a general means for enhancing the effectiveness of human inference (logical as well as statistical) and judgment, and find increasing use in both the clinic and the research laboratory.

The Association of American Medical Colleges (AAMC) recognized the trend and started an internal evaluation and integration process to incorporate this technology into the field of medicine. Jack D. Myers (1986, p. 3) clarified medical informatics as "a developing body of knowledge and set of techniques concerning the organization and management of information in support of medical research, education and patient care."

Donald Lindberg of the National Library of Medicine (1987, p. 187) developed and defined the term:

> Medical informatics attempts to provide the theoretical and scientific basis for the application of computer and automated information systems to biomedicine and the healthcare affairs…. Medical informatics studies biomedical information, data and knowledge-their storage, retrieval and optimal use for problem solving and decision-making. It touches on all basic and applied fields in biomedical science and is closely tied to modern information technology, notably in the areas of computing and communications.

Blois and Shortliffe, well-known researchers within the field of healthcare informatics, defined the term (quoted in Collen, 1995, p. 42) as follows:

> …the rapidly developing scientific field that deals with the storage, retrieval, and optimal use of biomedical information, data, and knowledge for problem solving and decision making. It accordingly touches on all basic and applied fields in biomedical science and is closely tied to modern information technologies, notably in the areas of computing and communication.

The medical community and university-based researchers started to debate and question if the new field of medical informatics included only physicians and care providers, possibly limiting the application and utility of medical informatics. In 1984, Marion Ball provided further clarification to the concept (quoted in Collen, 1995, p. 43): "[A] definition of medical informatics might be those informational technologies which concern themselves with the patient-care decision-making process performed by healthcare practitioners."

The debate really concentrated on the use of word “medical” within informatics terminology. Collen (1995, p. 43) presents the following two figures to further explain the term medical informatics and its components.

Figure 1 Medical informatics represented in three dimensions

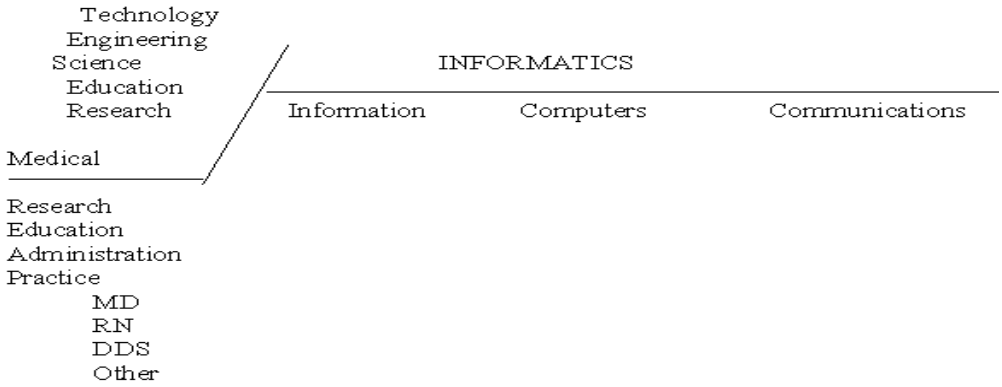
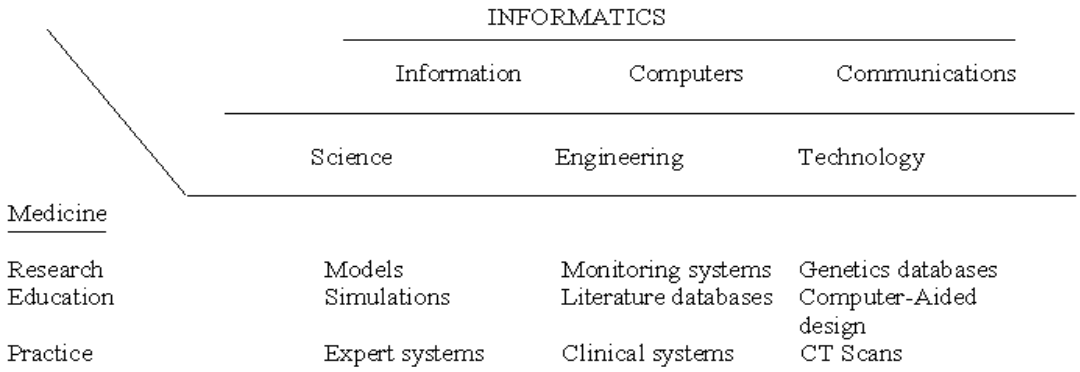


Figure 2 Selected subsets of medical informatics, further encompassing major dimensions and subsets of the field



Collective organizational efforts.

Medical informatics was further developed by various organizations and professional conferences. Collective efforts by various governmental, educational, and

commercial organizations accelerated medical informatics-related developments. These organizations developed strategies and devoted personnel and financial resources to further explore the potential of medical informatics. The AMA organized "The Computer and the Medical Record" in 1966 to further explore effects of computers in the medical field, and to spur dialog. The AMA also set up various subcommittees to further explore informatics.

Individuals with interest in medical informatics saw an opportunity and a challenge, to integrate this new technology into the field of medicine, and they took initiative to form or participate in the organizations devoted to medical informatics. To foster development of medical informatics, in 1960, the International Federation for Information Processing (IFIP) was created. The United States chapter was called the American Federation for Information Processing Society (AFIPS) and was instrumental in giving a boost and some structure to the field of medical informatics. Several subcommittees were created within AFIPS, of which one, the Fourth Technical Committee (TC-4), held its first MEDINFO Congress in 1974. This event was so successful that TC-4 ended up renaming itself the International Medical Informatics Association (IMIA). Successively, the American Medical Informatics Association (AMIA) was formed. In 1989, Marion Ball was the first American woman representing the United States in the association, and in 1992, she was elected the first woman president of IMIA (Collen, 1995).

The medical informatics revolution had begun. The term *medical informatics* was well accepted within the medical field. Collen (1995, p. 50) writes, "The First World Conference on Medical Informatics (MEDINFO 74) was held in Stockholm in August

1974 and was organized by IFIP's TC-4." Successive MEDINFO conferences were held in 1977, 1980, and 1983, and the United States hosted its first conference in 1986.

Local medical societies also recognized the importance of computer technology and initiated medical informatics conferences and meetings. The Champaign County Medical Society (along with other organizations) sponsored the First Illinois Conference on Medical Informatics in 1974.

The Society for Computer Medicine was the first professional organization dedicated to medical informatics. During the same period, commercial organizations, the government, and universities took serious interest in the development and deployment of medical informatics.

Traditionally, medical research in the United States received its financial support from philanthropic individuals and organizations. While medical computing research was facilitated mainly by the federal government, commercial organizations such as Lockheed, Technicon, and IBM were also in the process of developing hardware and software for the field of medical informatics. Hospitals like Massachusetts General Hospital developed software to be used within its own facility. The oldest medical computing center was built in 1958 at the University of Cincinnati's College of Medicine, which had acquired the Burroughs E 102 computer. Further research was fueled by grants from the National Institutes of Health (NIH). The NIH promoted university-based medical informatics research projects. Lee Lusted (quoted by Collen, 1995, p. 58) wrote, "[I]f a birthday were to be chosen for biomedical computing, the date of September 20, 1960, seems appropriate because on that day the National Institutes of Health Advisory Committee on Computers in Research was launched."

Tulane University established the first biomedical computer system in 1959; its department was chaired by James Sweeney, identified as the first "professor of computer medicine" in the United States. Sweeney said "This means that I treat sick computers" (Collen, 1995, p. 60).

History of the Electronic Health Record

Computers provide a tool with which one can access, communicate, manipulate, store, and transmit vast amounts of information and data almost instantaneously, a superior advantage over information recorded on paper. Containing detailed information about the patient's demographic, health insurance information, patient's physical and health-related vital statistics, past illnesses, laboratory and radiological test results, disease diagnoses, and the action plan, the EHR provides historical and prospective perspective about the patients' health. Therefore, the accuracy, availability, completeness, and usefulness of the EHR became a most important factor in treating a patient, be it in the hospital or a physician's office. The patient's health record traditionally was developed and kept at each individual hospital, physician's office, or health organization, which a patient may have visited, requiring attention to his/her health. This created a duplication of information and a lack of coordination with respect to laboratory and radiological tests, not to mention waste of financial and human resources. Lawrence Weed (1971, p. 4) writes:

> What is done in medical education to prepare the physician for a lifelong scrutiny of the records on his patients? The answer is, very little, for in many medical schools (as in many specialty training programs), elaborate provisions are made for transmitting the facts of basic science and clinical medicine, but little is done

to transmit to the student the scientific methodology that will eventually permit him to deal with complex biological systems successfully.

The invention of technology and the drawbacks of a paper-based patient health record was the impetus for the development of an electronic health record. Lawrence Weed was a pioneer in the field of medical informatics and is considered the father of the Problem-Oriented Medical Record (POMR) and Subjective, Objective, Analytical, and Planning (SOAP) progress notes for the patient health record. He worked on the Problem Oriented Medical Information System (PROMIS) project from 1969 to 1982, at the Medical Center Hospital of Vermont (PKC Corporation, 2007).

Since Lawrence Weed's work on the PROMIS system, there have been several other individuals and organizations pushing throughout the 1980s towards the EHR, such as the Health Evaluation through Logical Processing (HELP) program at a Utah hospital, Massachusetts General Hospital's Computer-Stored Ambulatory Record (COSTAR), and Duke University School of Medicine's The Medical Record (TMR) (Berner, Detmer, & Simborg, 2005). Until the 1990s, most information systems were developed for clinical decision making and research projects. Berner et al. (2005, p. 4) writes, "A major focus of informatics research during the 1980s was on the use of expert system methodologies developed in the 1970s to develop clinical decision support systems to assist with clinical diagnosis."

Due to a rapid increase in medical cost reimbursements and the existing healthcare reimbursement practices during the 1990s, the Diagnosis-Related Groups (DRG) reimbursement system legislation for hospitals was introduced in Congress, and

managed care insurance programs by the health insurance companies were implemented. Berner (2005, p. 4) writes:

> DRGs held the potential for providing an incentive to link clinical and billing systems, since, for the first time, reimbursement depended not only on what was done to a patient, but also on the diagnosis (es). At the time improvements in health care information and communication technology (HICT), along with the renewed motivation to cut health care costs, were viewed as an impetus to increase clinical computing. After all, HICT had been developing for decades. Would the wave finally break and EMRs in daily clinical practice become widely adopted?

The technological revolution in the 1980s, along with the political leadership of governmental, non-governmental, not-for-profit, and commercial organizations, provided fertile grounds for the growth and eventual adoption of the EHR.

One of the first major developments in the 1980s was the start of Health Level Seven (HL7). HL7 is an international organization, founded in 1987, and dedicated to creating standards for exchange, management, and integration of health care information (Health Level Seven, 2007). The National Institute of Health's report *the computer-based patient record: An essential technology for health care* (1991) was a major step for the entire health care sector. It provided guidance and information with respect to the uses and users of technology, and policy and implementation of the computer-based patient record (Detmer & Ball, 1991). It also emphasized the importance of patient health information rather than the medicine in the patient record. Berner (2005, p. 5) writes,

> The future record should provide a number of necessary functions, and the center of the action should be the patient and not the "Medicine". The goal was to improve relevant communications and then keep a relevant record of communications. The key was not the technology but how the technology could be utilized to reinvent health care.

In 2001, HL7 established the EHR special interest group, to develop the EHR system standards, giving the EHR an elevated status within the HL7 and promoting its importance to healthcare organizations.

The Institute of Medicine (IOM), established in 1970 by the National Academy of Science, is the leading organization in the United States to examine and provide guidance with respect to public health matters. IOM's first report, *To Err is Human: Building a Safer Health System*, focused on providing guidance on quality improvements in patient safety, and the leadership needed by the consumer, educational, governmental, and industry leaders. Most of the report focused on developing sound strategies to combat various types of errors committed within the healthcare industry. Among its various patient healthcare safety recommendations, one of them provides for the establishment of a patient safety-related organization called Agency for Healthcare Research and Quality (Richardson, Kohn, & Corrigan, 2000).

In its second report, *Crossing the Quality Chasm: A New System for the 21st Century*, the IOM focused on care delivery improvements and innovations (Richardson, 2001). Most importantly, this report provided much needed input for the advancement of information technology within the healthcare field in the 21st century. In the report's

recommendations (Richardson, 2001, p. 166), number 9 is the most important for the technology and leadership, stating:

> Congress, the executive branch, leaders of health care organizations, public and private purchasers, and health informatics associations and vendors should make a renewed national commitment to building an information structure to support health care delivery, consumer health, quality measurement and improvement, public accountability, clinical and health services research, and clinical education. The commitment should lead to the elimination of most handwritten clinical data by the end of the decade.

The President of the United States of America, Mr. George W. Bush, appointed the President's Information Technology Advisory Committee (PITAC) to provide him with expert advice on improving healthcare technology (Javitt, Neupert, & Staelin, 2004). PITAC published a report in 2004 called *Revolutionizing Health Care through Information Technology*, which provided significant guidelines for the adoption of the EHR. Based on this report, the President set a goal of adopting the EHRs for most American citizens within ten years (Javitt et al., 2004). He also provided funding of $100 million for health information technology. The importance of electronic health records was fueled by political and governmental leadership and funding. The Health and Human Services secretary, Tommy G. Thompson (2004, p. 1) said, "… the most remarkable feature of this twenty-first century medicine is that we hold it together with nineteenth-century paperwork."

Literary relationship of recent studies to the EHR

THE EHR adoption, deployment, and use for the patient and physician is the first step in improving healthcare and reducing healthcare costs in the United States of America. The top five driving factors (of eight total) for EMR adoption in physician practices as cited by the Medical Records Institute's *Ninth Annual Survey of Electronic Medical Records Trends and Usage for 2007* are improved patient documentation (81.2%), efficiency and convenience (73.1%), remote access to patient information (72.1%), savings and increased revenue (64.2%), and point-of-care access to, capture of, and transmission of patient information (63.2%) (Medical Records Institute, 2007). Patient information improvement can be brought about by the use of technology. Ash and Bates (2005, p. 9) state in their position paper,

> If systems are to be used by individual clinicians, a number of important personal issues must be considered. It must be understood that physicians are not resistant to technology; they have embraced many new medical technologies with no hesitation. They are embracing use of personal digital assistants (PDAs) for clinical purposes with amazing speed. In contrast, however, they are reluctant to adopt new ways of doing things that interfere with their workflow and that they perceive take time away from their patient care work… Overall, when clinicians have access to larger amounts of information with which to make decisions, and when the system fits their workflow, they tend to use it.

The important issue is to find out what it will take the physician to adopt the EHR. Ash and Bates (2005, p. 10) further state, "We need to determine what the motivating factors are that will get some people to make this transition from paper to

electronic records." The same position paper asserts that communication, training, medical and nursing education, and alignment of goals can be helpful in spurring the change from paper record to electronic record. Physician perception and experience can only be changed by experiencing new practice methods. Jeffrey C. Bauer (2006, p. 6) writes,

> Decades of experience suggest the process of improving medical services must be managed if it is to happen at all. Left to their own devices, delivery systems and clinicians will perpetuate the traditional way of doing things, even when strong evidence suggests a different approach would produce lower costs or better quality….
>
> In economic terms, P4P (Pay-for-performance) is a subsidy for the extra costs of performance improvement. "Getting Healthcare right" requires substantial investments in IT infrastructure for delivery systems and uncompensated time for practitioners who need to learn how to use the new tools and process.

The most recent 2007 study *Correlates of Electronic Health Record Adoption in Office Practices: A Statewide Survey* by Simon et al. (p. 115) states, "In addition, our study revealed that a majority of physicians pointed to technical factors, including lack of computer skills, lack of limitations of systems, as important barriers." This study provides a list of factors determining lack of the EHR adoption in physician practices; common factors include financial commitment, efficiency and need for information, and communication and training.

The second issue hampering the wide adoption and use of the EHR addresses possible educational and training solutions. Lack of investment and investment incentives

are one of the main barriers to the EHR adoption in the healthcare industry. The healthcare industry relies and makes decisions based on information; in spite of this reliance, it invests only 2% of its gross revenues in information technology (compared with 10% for other information-intensive industries) (Raymond & Dold, 2002). Information can only be valuable if it is used to diagnose the problem. In Kaiser Permanente's report, *Clinical Information Systems: Achieving the Vision,* Raymond and Dold (2002, p. 3) write,

> The limitations of the 20th century health care system are such that the old medical care paradigm is less viable and the emergence of a new way of practicing medicine is almost inevitable. A variety of signs suggests that the traditional paradigm is not well suited for the 21st century: the paper-based system supporting clinical care is increasingly non-viable; human memory-based medicine is increasingly unreliable; clinical data capture has become a business imperative; and consumer expectations for improved care and service are rising.

Knowing these barriers and impediments, physicians and the healthcare industry need to provide and stimulate an industry-wide communication, education, and training program (Ash & Bates, 2005). The study emphasizes the role of communication and training in bringing about a change in behavior, to make the transition from a paper system to a paperless system. The authors (p. 11) state,

> From an organizational perspective, the use of social learning and diffusion theory concepts for encouraging opinion leaders/informal clinical leaders to diffuse information greatly assists the communication efforts. There are tactics that can be used to "convince the curmudgeon' as well, such as one-on-one

communication and training and since there are many varieties of curmudgeons, there needs to be a variety of strategies.

The study recommends flexibility and different ways of providing training and support assistance, mentioning, "Training can take many forms. There is some debate about whether group training or even one-on-one training is ideal in all circumstances. Some places have succeeded by offering support more than training so that information can be given at the exact time it is needed" (Ash & Bates, 2005, p. 11). Not only the provider, but the patient also, needs to be informed and trained in terms of the resources available and their usefulness in health monitoring. The same study points out, "The role of the patient is paramount, both as an informed consumer of health care and as a driver of the effort to have complete information available to the provider. The public is aware of the health care safety issues, but the role technology can play in addressing those issues is not as visible" (Ash & Bates, 2005, p. 11). The importance of communication and training is perceived as part of a major barrier to EMR implementation in medical practices but the process to improve this by communication and training was not addressed in the Medical Records Institute's *Ninth Annual Survey of Electronic Medical Records Trends and Usage for 2007* (Medical Records Institute, 2007). Development of communication avenues, along with the training programs specifically developed for practitioners and patients could accelerate the adoption and implementation of the electronic health record.

The other three questions investigate how a health care provider can take advantage of the EHR, to improve quality of care, productivity, and profitability. The essential benefits of implementing a technological tool to improve the patient's health,

reducing costs, and making the practitioner's practice profitable. The use of the EHR can significantly improve a patient's life-years, with little cost. Hillestad, Bigelow, Bower, and Federico (2005) state that through the use of an EMR, 13,000 life-years can be gained, at a cost of only $.1 to $.4 billion. A study by Wang, Middleton, and Prosser (2003, p. 401) states, "The primary areas of benefit are from reductions in drug expenditures, improved utilization of radiology tests, improvement in charge capture, and decreased billing errors." Quality improvement is harder to measure: What were the initiatives and what results does a product or process deliver, such as improvement in medical errors, improvement in longevity, and access to information, whereas productivity and profitability can be measured financially (Wang et al., 2003).

A 2003 cost-benefit analysis study of primary-care use of electronic medical records estimated per-provider cost of the EMR to be $1,600 per year. The same study states (Wang et al., p. 400), "In the 5-year cost-benefit model, the net benefit of implementing a full electronic medical record system was $86,400 per provider." The largest savings were derived from reduction in drug expenditure (33%); decreased radiology utilization (17%), decreased billing errors (15%), and improvement in charge capture (15%). A study of fourteen solo or small-group primary care practices stated a $44,000 the EHR cost per full-time equivalent provider, and $8,500 annual ongoing costs. The annual savings per full-time equivalent provider averaged approximately $33,000, primarily from increased coding levels and efficiency-related savings or revenue gains. The same study also stated that it took 2.5 years to pay off the initial investment in the EHR (Miller, West, Brown, Sim, & Ganchoff, 2005). Participants in the study also

reported that initially providers saw fewer patients and worked longer hours because of the need to enter initial patient visit data.

In "Ending the Document Game," Haza and Long (2005) describes seven essential steps of interoperability of health information and the electronic medical record, as follows: 1) complete and instant online access to patient health record, 2) neither party has to ever again reenter the information, 3) regardless of which healthcare facility the patient visits, all information will be available, 4) the patient will have the ability to grant access to any provider in the world, 5) the financial part of the EHR can be available to other parties, 6) quality of care information can be available to other organizations, and, finally, 7) patient health confidentiality is always preserved and protected. According to Haza and Long, the EHR built with these essential elements and interoperability can provide three major benefits. The first is the moral benefit of improving quality of care and reducing preventable deaths due to medical errors; the second is the intellectual benefit of technology transferred to take care of a patient's health; and the final benefit is the elimination of delays and inefficiency of paper charts.

A 2005 survey of 34,490 medical groups comprising three or more physicians reported a 15% adoption rate (Gans, Kralewski, Hammons, & Dowd). The same study stated the perceived benefits as improved access to records and improved workflow. Other benefits were indicators of savings in the financial costs and improved revenue. Initiatives or actions which can improve the EHR implementation were listed as development of standardized questions for vendors, a standardized request for proposal methods, information about each the EHR's integration and interoperability with other

information systems, a educational program on how to select and implement the EHR, and information about the EHR vendor certifications.

According to the 2009 Health Information and Management Systems Society's (HIMSS) Analytics Ambulatory Healthcare Information Technology Survey, about one third of participants (30 percent) responded that their organization has an Electronic Medical Record system (HIMMS, 2008). Another research done by the American Academy of Family Physicians reported that 37 of the 459 respondents fully implemented EHR and that 13 percent would adopt EHR in the near future (Porter, 2008). The health care cost reduction is also an important part of the EHR and health care information technology. In a recent January 2009 report from the Deloitte Center for Health Solutions, Keckley and Underwood (2009) stated that health care reform involving EHR would result in about $530 billion spending reduction and quality improvement over the next 10 years according. This information was based on the Health Care Reform Pyramid which includes four building blocks, namely, consumerism, coordination of care, comparative effectiveness/evidence based medicine and health care information technology. The most recent development is the proposal by the President Obama who would like to computerize all health records within five years as well as integrate health care information technology at all levels in the health care sector (Goldman, 2009). Different studies from the Rand Institute and Commonwealth Fund referred to by Goldman reveal that this particular implementation cost will be $100 billion over the next 10 years. At the same time the government estimates that this program can create about 212,000 health expert technology jobs (Goldman, 2009). Electronic health records as a tool has the power to change the health care in the United

States of America but first physicians must understand this tool and its benefits before putting it in practice.

Summary

The innovation and evolution of the computer encouraged everyone to change the way one lives daily and carries out personal life through interaction with others, regardless of the purpose of this interaction. As Mr. Bill Gates once said, "Never before in history has innovation offered promise of so much to so many in so short time" (Haza and Long, 2005, p. 50). The challenge is to make a tool to improve the process and deliver the best result possible. In the United States of America, computers have made outstanding advances in other industries but the healthcare industry, with its use of a paper system to track patients, has resisted the adoption of computers and change brought about by the technology. The paper system is dangerous and offers poor quality of care to patients. According to a study regarding missing clinical information during primary care visits, providers were missing clinical information in 13.6% of all cases. Such missing information was 52.3% of the time likely to be within the United States but outside of the provider's clinic, and it could adversely affect the patient 44% of the time, by resulting in delayed or additional care (Smith, Guerra Arraya, & Bublitz, 2005). This does not account for financial costs incurred by the entire health care industry, and the patient. Patients are ready to use the EHR technology to improve and monitor their health. According to a 2006 survey conducted by Lake Research Partners for the Markle Foundation, 65% of 1003 individuals surveyed around the United States are interested in electronically accessing their personal health information. The survey also found that 88% of the survey participants would like online health records. Ninety-one percent of

the individuals surveyed stated that it would be important to have access to health records so they know that health care providers understand their personal situation, 84% wanted to check their records for mistakes, and 88% would like access to their the EHR in order to reduce duplication of services, tests, and procedures. However, 80% of the participants also expressed a great concern over identity theft and fraud because of electronic health information (Connecting for Health/Markle Foundation, 2006).

This study researched imperatives for the EHR adoption and implementation, further the need for structured information and training programs in order to educate physicians regarding the EHR, and finally, to determine if the use of the EHR improves delivery of quality care to patient and increases productivity and profitability

Chapter Three: Methodology

Introduction

This chapter provides a detailed description of the methodology for this study including a complete description of the instrument, the sample, sampling procedures, data collection, and data analysis.

The study examines the use of the electronic health record (EHR) in the physician's office in western Pennsylvania using a survey adopted from Steven Simon's 2005 study *Correlates of Electronic Health Record Adoption in Office Practices: A Statewide Survey* (Simon et al., 2007).

Following five questions were researched through the survey:

- Are there different characteristics among physicians, which contribute to the EHR deployments at a medical practice?
- Are educational interventions related to the adoption of EHR by physicians?
- Do physicians believe the EHR can contribute to improvements in the quality of care?
- Do physicians believe the EHR can improve the practice productivity?
- Do physicians believe the EHR can improve the practice profitability?

Survey Instrument

The 2005 survey (see Appendix C) was mailed to 1,921 randomly selected physicians, from the total population of 20,227 physicians in the state of Massachusetts in 2005 (Simon et al., 2007). Prior written approval was obtained from the primary

researcher of the study (Simon, 2007). In order to validate the instrument, the original authors of the survey instrument conducted a pilot study with a convenient but broad-based sample of physicians. The survey was already administered in the State of Massachusetts and analysis was carried out proving its reliability

The survey used for this study was modified from the originally designed survey based on extensive review of the literature and other studies. Some of the survey questions were omitted or minor modification was instituted to reflect the research questions of this study and its use in the State of Pennsylvania. It focuses on ambulatory physician practices or the physicians providing care to outpatients and office-based healthcare providers, rather than inpatient healthcare providers. The instrument is a nine-page survey, divided into six sections, with a total of 27 questions. Each question is designed to elicit several descriptive answers based on the type of question. The answer choices in Question 16 were changed to reflect the intent of the research within the western Pennsylvania counties, and the relationship of state medical societies and organizations, which support the EHR use within a physician practice. Seven subsections of the survey instruments and questions per subsections are listed and briefly described as follows:

Section 1. Practice characteristics: Questions regarding outpatient practice. Total: 8 questions

Section II. Health information technology: Questions with respect to computers and health information technology in the main office.

Total: 8 questions

Section III. Computers and health Care. Questions regarding physician's perception of computer's effect on health care.

Total: 1 question with 8 sub-questions

Section V. Financial considerations: Questions regarding the financial impact of the EHR.

Total: 4 questions

Section VI. The office practice environment. Questions describing practice with respect to the EHR.

Total: 1 question, with 7 sub-questions

Section VII. Personal characteristics: Questions regarding individual's background. Total: 5 questions.

Survey questions with multiple answers have been given appropriate numerical value from 1-5. Some of the questions required respondents to provide brief value-based descriptive answers. Assigning numerical value to all questions provides capability to the researcher to carry out statistical analysis.

Sample

The target population comprised of the physicians practicing within two western Pennsylvania counties. The physician' demographic information was gathered from the county medical society and the regional hospitals medical staff directories. Due to the nature of the population, it is possible that more than one physician in a group practice may receive and complete the survey. Each physician will be able to take the survey in his or her place of employment, or home, without any supervision. Allegheny medical society was contacted with respect the study and its objective to gain approval of their

respective administrators and they have provided written approval for the use of their membership list. The survey to Allegheny County's 1831 members was electronically sent out by the society to preserve confidentiality of the membership. For the Westmoreland County a list of physicians was tabulated through the regional hospital's medical staff directory and 250 physicians were randomly selected for the survey mailings.

Specific participants for the survey were randomly chosen by the county society or from the practicing physician list in the Westmoreland County and they were invited to participate in the survey via the electronic survey in the Allegheny County or via postal mail. Each participant will also be instructed to complete the survey at the time and place of their choosing.

Data Collection Method

The data was collected by sending out the survey instruments to participating physicians via electronic or paper mail. (Both electronic and paper mail delivery methods were used to better assure delivery and response.) Each of the respondents was asked to confirm that they had not previously completed the survey by either method. Upon receipt of the completed surveys, each one was cataloged to await final analysis.

Survey respondents were selected from the list of physicians from the Allegheny and Westmoreland counties. The electronic list was compiled with the provider's last name, address, electronic mail addresses, and phone numbers. Based on this information, the survey was mailed via either the electronically or paper mail with a cover letter describing the study, the purpose and conditions of their participation, and survey completion instructions.

Statistical Analysis

The survey responses were analyzed using Statistical Package for Social Sciences (SPSS) version 16 statistical and data management software. Each survey was assigned a unique identification number to reflect its uniqueness to the population. Data analysis was performed based on the research questions posed in this study. Descriptive statistical analysis tools of correlation and measures of the central tendency were used to describe the data characteristics and make statistical analysis of research questions to the survey answers.

Limitations

The study is designed to provide statistical support for the research inquiries. There still remain the following limitations:

1. The research study was conducted only within the two western Pennsylvania counties. Had it been conducted throughout the state, results might differ. Additionally, the list of physicians was obtained from the membership directory of county medical society and regional hospitals medical staff directory. It is possible that there are physicians who may not belong to this society or the hospital, and thus their name was not included as a potential survey participant.
2. It is possible that more than one physician within the same physician practice or group completed the study and yet projected different results due to position within the organization, experience, or perspective.
3. Because the Western Pennsylvania counties traditionally represent an older population, the practices therein may not provide adequate exposure to specialty practices, which serve younger populations.

4. This study's validity was established by its previous use. The responses may still be different because of the self-reporting nature of the study. It is also possible that a physician had office personnel complete the survey on his behalf, thus not relaying true physician feedback.

5. This study was limited to the physician' perceptions, not taking into consideration the views of ancillary care providers such as physician assistants, physical therapists, nurse practitioners, and/or nurses.

Institutional Review Board Procedures

This research was submitted to the Institutional Review Board (IRB) for its approval. Per IRB procedures, requirements, and rules, this study was categorized as an exempt study. The first step in the process was to submit the initial research proposal to the dissertation committee for approval. Upon approval, the proposal was forwarded to the School of Education IRB representative for his approval. The final step was to complete the IRB form for the proposal submission, describing the study, research questions, purpose, significance of the study, survey instrument, research design, data collection method, and data analysis procedures; the packet also includes the National Institute of Health certificate of training completion for the researcher and the committee members. This proposal was reviewed for compliance, presentation, and contribution of the study. Upon satisfactory review, approval was granted to the researcher to conduct the research.

Summary

This chapter describes the survey instrument and methodology used to interpret the results in support of the five inquiries. The results may provide additional information

regarding the barriers to the EHR adoption and implementation by the physicians in the two counties. It also will provide an analysis of physician' perceptions about communication and training needed for successful the EHR implementation and use. Finally and most importantly, the results will be used to analyze the EHR's utility in improving quality of care for the patient, and profitability and productivity of the provider.

Chapter Four: Research Analysis

This Chapter provides a detailed description of the analysis of the data and the findings of the study, and is organized according to the following sub-headings: (a) Introduction, (b) Sample and Data Collection, (c) Analysis procedures, (d) Analysis and (e) Conclusion.

(a) Introduction:

Today, the healthcare industry is overwhelmed due to the necessity to keep costs low while at the same time being mandated to maintain quality of care and to provide comprehensive coverage. Adoption of information technology in the clinical, administrative and management sectors of healthcare may be the key to achieving this balance. In particular, the use of the Electronic Health Record (EHR) should be explored as one solution to managing the growing crisis. According to one expert, "no clinical computing topic is being given more attention than that of electronic medical records. Healthcare organizations, finding that they do not have adequate systems for answering questions crucial to strategic planning and for remaining competitive with other (physician) groups, are looking to information technologies for help" (Shortliffe, 1999). It is also important to research how a new vision of the EHR can be achieved. Further, "realizing the vision described… will depend on at least three factors: an enhanced Internet; better education and training for health-care providers; and changes in the management and organization of the health-care institutions" (Shortliffe, 1999). The purpose of this study is to investigate the efficacy of the EHR as one of the main tools of information technology in the medical arena by surveying physicians in private practices in Allegheny and Westmoreland counties in Southwestern Pennsylvania.

This study used a total sample of 269 physicians from these counties who responded to either the paper or the electronic survey. The survey consisted of 27 questions divided into six sections, and attempted to answer the following questions:

- Are there different characteristics among physicians that contribute to the deployment of the EHR in a medical practice?
- Are educational interventions related to the adoption of EHR by physicians?
- Do physicians believe the EHR can contribute to improvements in the quality of medical care?
- Do physicians believe the EHR can enhance their practice productivity?
- Do physicians believe the EHR can make their practice more profitable?

(b) Sample and data collection

For the Westmoreland County physicians, hospital staff directories were collected and used to mail hardcopy surveys. The Westmoreland database contained 250 names of physicians who practiced in the county. In the database it was possible that some physicians showed their practice address in Westmoreland but their main practice was actually located in another county, so that their mailing address was the one listed. The survey was mailed to 250 physicians, with 52 physicians returning it, for a response rate of 20.8 percent. Of those responding only 17 physicians indicated that their main practice site was in Westmoreland County. Other physicians had their main practice

located in Allegheny County or other surrounding counties but were seeing patients in Westmoreland as part of a satellite office.

The physician database for Allegheny County was electronically accessed in cooperation with the Allegheny County Medical Society (ACMS). ACMS executive board and management had stipulated that they would not provide any demographic information to the researcher but would electronically mail out the survey to their members. ACMS sent out the survey electronically twice to 1831 physicians. This resulted in response rate of approximately 12 percent, netting 217 surveys. At the suggestion of the ACMS management, gifts were also offered and the survey was mailed out twice in anticipation of achieving a higher rate of return. Between Allegheny and Westmoreland Counties a total of 2081 surveys were sent via U.S. mail or electronic mail. The total return rate was 13 percent, or 269 surveys, for the entire study. The 13 percent rate of return provides a moderate number of surveys for the analysis of this research, but due to the relatively low response rate, the findings of this study cannot make general conclusions for the population surveyed. Despite this, the information culled from the responses received can still provide significant insight into the research questions. Table 1 shows the summarized survey sample and population return rate.

Table 1

Sample and Return Rate

County	Number of Survey Mailed/Emailed	Survey Returned	Percentage Returned
Allegheny	1831	217	12%
Westmoreland	250	52	21%
Total	2081	269	13% (Overall)

A similar study was conducted in the state of Massachusetts by a group of researchers led by Steven R. Simon, MD. The survey administration was outsourced to Atlantic Research and Consulting of Boston, Massachusetts, and each of the survey participants was offered a $20 cash honorarium. This administration resulted in 71 percent return rate. The project was supported by a grant from the Agency for Healthcare Research and Quality (Simon, 2007). It is possible that the present survey may have achieved a higher rate of response had each participant been offered a cash honorarium, or if the research had the financial support of an independent agency.

(C) Analysis procedures

Data analysis was carried out with the use of the Statistical Package for Social Science (SPSS) version 16 statistical analysis software. The initial step was comprised of frequency analysis for the verification of number of valid answers versus the missing answers to establish validity of the data. In conjunction with the frequency analysis, standard measures of the central tendency mean, median and mode were also generated

for each of the questions. Detailed correlation analysis was carried out for the five research questions.

Demographic analysis and description of the sample

Demographic questions were designed to provide background on physician practices within the two counties. The first survey question concerned the number of offices physicians use in a week and showed that 268 physicians answered the question with a simple mean of 2 offices and a mode of 1 office. The same physicians also spent 50 percent to 75 percent of time in outpatient practice.

Physician practice ownership and practice characteristics showed that of the 210 participants, who answered the question, the highest percentage of physicians, 36.4 percent, practiced in a single specialty group or partnership and 28.7 percent of the 210 physicians were full owners of the physician practice. Geographically, of the 199 physicians who answered the practice location question, 181, or 66.5 percent of the physicians were located in Allegheny County, and 17 physicians were practicing in Westmoreland County.

The patient demographic information showed that 75.58 percent are white patients, with African American patients accounting for 15.74 percent and Hispanic patients 2.17 percent. This analysis was important to identify overall characteristics of the practice and its impact on the adoption and use of EHR.

After looking at the demographic information, the next phase was running the main analysis to answer the research questions that guided this study. In the section below, results will be presented according to research questions.

(D) Analysis

Research Question One

Are there different characteristics among physicians that contribute to EHR deployment at a medical practice?

The use of basic patient information retrieval and availability of information technology was evaluated through survey question 8, which asked about the access to patient information in each practice based on the list of patients by diagnosis or health risk, by laboratory results and by medications they currently take. Results to this question were obtained by running frequencies and the results showed a total of 194 responded to this question and of them 27.8 percent said it was easy or somewhat easy to access the patient list by diagnosis but 14.9 percent said either it was very difficult, or that such a list could not be generated. A list of patients by laboratory result showed that only 11.8 percent participants thought it was easy to generate this list but 44.9 percent of the physicians indicated they could not generate such a list. On the question of a list of patients by medication, 37.4 percent of the physicians indicated that they cannot generate this list. The following table depicts the detailed results of this question:

Table 2

Obtaining lists of patients through medical record system (paper and/or electronic)

List of Patients by	Very Easy	Somewhat Easy	Somewhat Difficult	Very Difficult	Cannot Generate
(A) Diagnosis or health risk	27.8%	27.8%	14.4%	14.9%	14.9%
(B) Laboratory results	11.8%	11.2%	16.0%	16.0%	44.9%
(C) Medication they currently take	19.0%	12.8%	10.8%	20.0%	37.4%

(Due to rounding, each row may not add up to exactly 100%)

By far the most prevalent example of information technology found in physician offices was that used for patient scheduling. About 84.4 percent of the physician offices were using the technology for patient scheduling, and among these 21.1percent had been using them for about 10 years or more, which is the highest number of years. By contrast when these same practices were asked about using technology to generate prescriptions, 63.4 percent of these practices reported using handwritten ones only. These findings suggest that this is a critical area in which education and training in the use of information technology needs to be encouraged. This is illustrated by the report, Preventing Medication Errors, by the Institute of Medicine, which found that each year there are about 450,000 preventable adverse drug events in hospitals, 800,000 at long-

term care facilities and 530,000 among Medicare outpatients (Institute of Medicine, 2006). One of the most important corrective actions cited in this report is the use of information technology in prescribing medication. The report states, "A second important step in reducing the number of medication errors will be to make greater use of information technologies in prescribing and dispensing medications. Doctors, nurse practitioners, and physician assistants cannot possibly keep up with all the relevant information available on all the medications they might prescribe—but with today's information technologies they don't have to" (Institute of Medicine, 2006). It is also recommended in the report that by 2010 all prescribers and pharmacies should be using information technology for prescribing medication (Institute of Medicine, 2006).

One of the important questions of this study is the adoption of the Electronic Health Record by physician practices. Survey question 11 asked if physician practices are utilizing any component of the EHR. Among the 269 physician practices that attempted the survey only 175 physicians answered the question. The response showed that only 37.1 percent of the physicians had implemented the EHR. The EPIC system, a major medical management software application, was the EHR used the most by these practices. The use of EPIC is high because it has been implemented by the University of Pittsburgh Medical Center (UPMC), the largest healthcare system in Western Pennsylvania. It may also be an indication of the mandate enforced by UPMC to implement and integrate the EHR within the entity wide system. Despite this, there were 33 different EHR systems reported in use by the practices surveyed. This use of several different EHR programs certainly indicates a lack of confidence among the physician

community in any one product, but may also point to the need for standardization in the area of medical technology.

Next, physicians who have not adopted EHR were asked if they had plans to adopt it. In fact, only eight physicians answered the question, which may indicate a lack of planning or uncertainty on the part of the physicians with respect to the implementation of EHR. Finally, the physicians were asked how long they have been using the EHR system. The answers varied a great deal but many of the practices adopted some aspect of the EHR starting around 2002. The next wave of adoption began in 2004 and it has continued to increase incrementally each successive year.

The review of the survey results indicates that physicians who belonged to a large group such as UPMC Health System or West-Penn Allegheny Health System were adopting the EHR much more so than solo practitioners. Further, even in those physician offices that were using some aspect of the EHR, many were still using handwritten prescriptions or manual laboratory ordering, likely indicating a resistance to the available technology. There were also indications of a lack of specificity in the physician community as to when they plan to adopt the EHR, and even the ones who were using it for one aspect of office records showed insecurity in other applications. The use of EPIC may be due to the software's utility for hospital-based patients and the fact that UPMC's core service is for hospital patients. The factors that contribute to the adoption and implementation of the EHR will be answered by the following research questions.

Research Question Two

Are education interventions related to the adoption of EHR by physicians?

This question was intended to measure whether increasing the physician's knowledge and understanding of the technology would lead to its adoption. To measure the relationship, a correlation analysis was performed using the Pearson Correlation in SPSS. Pearson Correlation analyzes relationship between two continuous variables; and in this case between the adoption or lack of adoption of EHR and physician's knowledge and understanding of the factors that may affect the adoption. The Pearson Correlation Coefficient is a numerical representation that provides a value between -1 a perfect negative relationship and +1 a perfect positive correlation. A value of 0 indicates no linear relationship.

The survey question tested different variables namely, computer skills, technical support, time to acquire the knowledge about the system, start-up and ongoing financial costs, training and productivity loss, physician skepticism, privacy or security concerns, uniform standards and technical limitations of the system which indicate physician knowledge and understanding about the EHR and opportunities for educational intervention. The following table shows the correlation analysis:

Table 3

Correlation between Electronic Health Record use and the barriers of adoption and use of the computer technology in the physician practice:

	Pearson Correlation	Significance (1-tailed)
Do you have EHR?	1	-
Computer skills of office staff and MD	.040	.301
Computer technical support	.120	.059

Lack of time to acquire knowledge-		
About the system	.070	.180
Start-up financial cost	.227**	.001
Ongoing financial costs	.342**	.000
Training and productivity loss	.287**	.000
Physician skepticism	-.026	.366
Privacy or security concerns	.166*	.015
Lack of uniform standards	.107	.079
Technical limitations of systems	.090	.121

** $p < 0.01$, * $p < 0.05$, (1-tailed)

The above analysis points to some significant opportunities for education and training. The Pearson Correlation Coefficient of .227 (significant at the $p < 0.01$ level) for the start-up financial cost is significant, indicating that affordability is the third highest factor in deciding if a physician adopts EHR. To address this, financial analysis investment and break-even analysis, profit margin, and return-on-investment scenarios and formulas can be developed to educate physicians on the utility of EHR in terms of making their practices profitable. Further analysis might well reveal the efficacy of physician education to develop cost-reduction and revenue enhancement strategies through the use of EHR.

The second most important Pearson coefficient correlation of .287 (significant at the $p < 0.01$ level) was based on physician perception that training for EHR takes away time from staff productivity and a practice's profitability. To address these concerns training programs that can be offered during non-office hours or off-peak hours, as well

as online training and learn-as-you go programs may further give incentive to practices to begin adoption of the EHR.

Finally, the single most important factor among all the relationships of whether the physician will adopt the EHR is depicted by a coefficient of .342 (significant at the $p < 0.01$ level) for the ongoing cost of using and maintaining the EHR. The maintenance cost analysis and software downtime ratios can provide the objective proof. Financial analysis of EHR implementation should provide a detailed analysis of initial investment, maintenance cost of the software, financial and time investment needed for the adoption versus the financial rewards and the quality of care improvements.

Three other factors, privacy and security concerns related to EHR, availability of computer support and the lack of standards within the industry also were not well understood by the physicians. The privacy and security concerns, with a coefficient of .166 (significant at the $p < 0.05$ level), indicated the physicians may not completely understand how to protect the patient data from online hackers and potential legal liabilities due to lack of security. The data also showed a correlation with a coefficient of .120 (1-tailed) between adopting EHR and availability of resources for computer support. This may address a physician's concern with respect to availability of patient charts and the ability to see patients without the computer or if the computer is down. Lack of uniform standards for the purpose of patient data exchange and retrieval proves to be a concern of the physicians with a coefficient of .107 (1-tailed). If more uniform standards are in place, then the EHR data can be transmitted universally, the quality of care can improve and patient care decisions can be made holistically.

Other variables, including technical limitations, with a coefficient of .090; lack of time to acquire knowledge about the system, with a coefficient of .070 (1-tailed); computer skill of the office and physician, with a coefficient of .040 (1-tailed) showed comparatively smaller correlations. Physician skepticism, with a coefficient of -.026 (1-tailed), showed no correlations versus the others. Lack of knowledge about these variables and their importance in terms of use of EHR also played an important role.

A review of ten variables and their correlations in adoption of EHR points up a lack of information and knowledge, as well as the real need to educate physicians on the technological exigencies that they will need to survive in the current climate. The data and their relationship to the adoption of EHR indicate that there may be an opportunity to increase the adoption and use of EHR with education and training. The physician's concern in three important areas--ongoing financial costs, financial losses due to training and productivity time investments and start-up financial costs--reveals a financial motivation that can be addressed by providing return on investment, cost and benefit and potential revenue increase analysis. Such education and training programs may need to be designed as individualized sessions. It also may be important to present a side-by-side analysis and projections with and without the use of EHR. Physician must also be educated in terms of various educational and training opportunities, such as in-class, online and on- the-job training programs which can be developed to address their concerns about the productivity losses incurred due to education and training for EHR. They must also be made aware of various options available for computer support and for safeguarding data. As this is not in their area of expertise, physicians must be given

information and training must be provided on how to safeguard and maintain the software within their own practice without incurring too much additional cost.

Furthermore, physician concerns regarding the technical limitations of a given system, lack of time to acquire knowledge about the system, computer skills of the office staff and physician, as well as physician skepticism can be addressed by providing detailed information comprising a slate of alternatives to address these concerns. Each of these concerns may be addressed by enlisting the help of a previous user or experts who can present a mini hands-on seminar for the physicians. Due to lack of time for the physicians, all education and training seminars may have to be arranged at their practice location or at a geographically convenient location near their practice.

Research Question Three

Do physicians believe EHR can contribute to improvements in the quality of care?

Quality of care relates to improving the patient's health with the help of the physician and self-help by the patients. Patients can improve their own health by watching their diet, exercising and following physician recommendations. Physicians can contribute to a patient's health by providing timely diagnosis, medication, surgery and other treatment and health maintenance recommendations to the patients. One of the ways these goals can be accomplished is with the help of patient health information and instant access to up-to-date research on disease and care available, and information technology as a tool makes will facilitate this. The Electronic Health Record, then, is one of the most comprehensive databases that can be accessed, manipulated and used to store critical data on every patient from birth to death. Adoption and use of such a tool can only improve the health of the patients and reduce healthcare, administrative and

management expenses in a physician practice. One of the research questions is to find out if the physicians believe that EHR can help in improving quality of care for patients. This survey question 17 evaluates the physician's perception in terms of computers and use of the EHR. The following is the correlation analysis of physicians having or not having the EHR and its relationship to qualitative improvements that EHR can bring about:

Table 4

Correlation between the use of Electronic Health Record and physician's perception with respect to computers ability to bring about quality care improvements;

	Pearson Correlation	Significance (1-tailed)
Do you have Electronic Health Record?	1	
Effects of computers on…		
Controlling costs of health care	.162*	.016
Quality of health care	.233**	.001
Interaction with the health care team	.168*	.013
Patient-physician communication	.164*	.015
Patient privacy	.233**	.001
Clinicians' access to up-to-date knowledge	.120	.057
Efficiency of providing care	.195**	.005
Medication errors	.107	.080

** $p < 0.01$, * $p < 0.05$, (1-tailed)

The above analysis establishes a correlation between the computer and the physician's perception of the improvements brought about by use of computers. Two of

the survey questions test quality of care and patient privacy and have the same coefficient of .233 (significant at the $p < 0.01$ level), showing a high correlation, as does the significance of .001 for both. The efficiency of providing care, having a correlation coefficient of .195 (significant at the $p < 0.01$ level), sets a close relationship between the use of the computers, EHR and improvements brought about in the quality of patient care. Such correlations indicate a recognition and understanding on behalf of the physician that computers can improve quality of care. Other inquiries also test the use of computers in interaction with the healthcare team, with a coefficient of .168 (significant at the $p < 0.05$ level) , patient-physician communication, with a coefficient of .164 (significant at the $p < 0.05$ level), and a relationship of use of computers in healthcare, showing a correlation coefficient of .162 (significant at the $p < 0.05$ level). These relationships further establish a clear correlation between use of the computers and its importance in improving quality of care.

The correlation of a clinician's access to current knowledge, with a coefficient of .120 (1-tailed), and the computer's role in reducing medical errors, receiving a coefficient of .107 (1-tailed), also showed a moderate relationship. Improved quality of care, which these relationships point to, can significantly increase patient mortality, improve quality of life and decrease financial expense. It also contributes in improving productivity for employers and the government can benefit due to reduced expense for maintaining public health.

Research Question Four

Do physicians believe EHR can improve the practice productivity?

For any commercial venture, productivity is very important with respect to increased output and profitability. Physician productivity derives from seeing more patients and providing the most up-to-date diagnosis in a timely manner. The use of EHR can provide a source through which they can review prior health history, current laboratory results, and the latest research, not to mention communicate with other health care providers and monitor patient health through remote technology thereby improving the productivity and quality of care at the same time. Physician productivity can result from the cooperation and interworking relationships of the office staff, its technological know-how, as well as the physician's own knowledge of the technology and interest in implementing the same in addition to the physician's own recognition of practice management and production strengths and weaknesses. This research question examines these and other factors to determine if the use of EHR can improve productivity. The following table provides a statistical substantiation to the various survey questions:

Table 5

Correlation between the use Electronic Health Record and physician's perception of their office environment:

	Pearson Correlation	Significance (1-tailed)
Do you have Electronic Health Record?	1	
The office staff is innovative	.106	.086
The physician(s) is (are) innovative	.140*	.035
The physician is the first to find new diagnostic tests and treatment.	.100	.099

Actively doing things to improve quality	.192**	.007
After improvement we evaluate effectiveness	.129*	.049
We have quality problems in our practice	-.056	.236
Our procedures and systems are good at-preventing errors.	.140*	.036

** $p < 0.01$, * $p < 0.05$, (1-tailed)

The above table shows that of the seven different factors analyzed, the strongest correlation of .192 (significant at the $p < 0.01$ level), indicating that a relationship may be established between the physician utilizing EHR and physicians actively pursuing ways to improve quality and in turn improving productivity. The survey also indicates the importance of a physician's self-confidence; that is, believing that they are at the forefront of innovations and establishing procedures and systems that prevent errors. A correlation of .140 (significant at the $p < 0.05$ level), between having the EHR and physicians believing that they are innovative may also indicate that EHR, combined with the skills that the physician brings to the table, may greatly enhance office productivity. Similarly a correlation of .140 (significant at the $p < 0.05$ level), with respect to physicians believing that their office procedures and systems are good at preventing the errors, indicates that the use of EHR may be advantageous in this area. The third highest correlation of .129 (significant at the $p < 0.05$ level), between using EHR and physicians following up on gauging the effectiveness of the improvements that they have implemented, may indicate their recognition of the importance of quality and productivity within their practice.

The survey also indicates a low correlation coefficient of .106 (1- tailed) in terms of the office staff's innovativeness. Such low coefficient may indicate a lack of physician confidence in the office staff as it may be a factor in whether physicians are willing to adopt EHR. Another low correlation coefficient of .100 (1- tailed) for physician acceptance may be a sign that they are not always the first ones to find new diagnostic tests or treatment. This perhaps may indicate the physician's perception that it does not affect productivity as much. Not considering the idea that being first to find a new treatment or test may also be attributable to their lack of research experience.

One of the most significant indications the survey provided was for the physician's recognition and low correlation coefficient of -.056 (1- tailed), indicating a negative relationship between having EHR and physicians recognizing that they have quality problems in their practice. This low indicator, along with a negative covariance of .033, also indicates no relationship between having the EHR and improving productivity. It is important to note that in the entire survey this was the one of the few that had a negative correlation coefficient and covariance. The negative correlation coefficient may also indicate that very few surveyed physicians believe or accept that there may be a quality problem within their practice that may translate into productivity.

The overall analysis of this research indicates that four survey questions showed a significant correlation coefficient from a high of .192 (1- tailed) to low coefficient of .129 (1- tailed) varied between the significance of 0.05 and 0.01 level based on 1 tailed test, thus indicating that EHR may contribute to higher productivity among this group of surveyed physicians.

Research Question Five

Do physicians believe EHR can improve the practice profitability?

Every organization strives to be an economically viable and profitable organization and physician organizations are no different. This research question attempts to find out if the implementation and use of EHR contributes to practice profitability. Several survey questions were designed to research the physician's perception in terms of the effect of EHR on the organization's profitability and personal income. The survey questions were designed to inquire if physicians believe that the use of EHR and the electronic information systems contribute to corporate and/or personal income, the amount of electronic information they use, patient satisfaction and clinical quality. Other survey questions queried availability of financial resources and percentage of income received due to use of EHR.

Table 6

The following table provides correlation of having EHR and its contribution to different factors:

Correlation between Electronic Health Record and the various factors contributing to the practice or personal income:

	Pearson Correlation	Significance (1-tailed)
Do you have Electronic Health Record?	1	
(a) Does it contribute to the practices income?		
Types of electronic information system you have?	.221**	.003
The amount you use electronic information?	.189*	.010

Patient survey results?	.066	.211
Clinical quality?	.128	.061
(b) Does it contribute to the personal income?		
Types of electronic information system you have?	.210**	.007
The amount you use electronic information?	.278**	.000
Patient survey results?	.045	.299
Clinical quality?	-.003	.485

** $p < 0.01$, * $p < 0.05$, (1-tailed)

The table above shows the correlation analysis between having the EHR and its impact on the practice and personal income and other factors. A relationship between having EHR and its impact on corporate income has a coefficient of .221 (significant at the $p < 0.01$ level), showing a significant relationship. This relationship establishes the relation between having a good information system and EHR and the practice earning its rewards. Similarly a coefficient of .210 (significant at the $p < 0.01$ level), for the impact of EHR on personal income also reveals a significant relationship, showing that having good information systems can translate into higher income for the corporation and individuals alike. It is noteworthy that such economic benefit must be passed on to the individual, otherwise the individual's motivation and performance may decline.

Another factor tested was the impact of EHR on the amount of information that physicians may use. The correlation coefficient of .189 (significant at the $p < 0.05$ level), is showing a lower significance, but the coefficient of .278 (significant at the $p < 0.01$ level), for personal income is higher than that for practice income. This value shows a greater relationship to EHR and how much information is used by the individual

physician versus the use of technology by the practice. Use of technology by physicians may well be impacted by their educational training as well as their willingness to use new technology in general. The next inquiry was the impact of EHR on income by assessing the patient survey results. A higher level of services provided due to use of the technology may translate into higher patient satisfaction and in turn higher income. The correlation coefficient of .066 (1–tailed) for the practice income and .045 (1 – tailed) for the personal income shows no particular impact in relation to EHR. Neither one of the statistical measures shows that the use of EHR can translate into better patient satisfaction. The last relationship tested was the use of EHR on clinical quality. This correlation had one of the most varied results. For practice income the correlation coefficient was .128 (1–tailed), showing a weak relationship and for personal income the coefficient was -003 (1-tailed), showing almost no relationship. This survey question showed that only two factors, income and use of information technology, had any impact on the corporate and personal income.

The next survey question tested the actual impact of EHR on physician income. This relationship between having and using EHR and receipt of additional income in 2007 had a coefficient of -.049 (1-tailed) and a covariance of -.034 (1-tailed), displaying a weak relationship. It shows that physicians do not believe that they will realize a higher income due to use of EHR.

The other two survey questions tested the availability of the financial resources for the practice that may shed light on whether the practice can afford the investment or not. Survey question 20 tested what financial resources were available from a range of "extensive resources" to "no resources available." The mean of 2.72 showed that for all

the survey participants moderate to limited resources were available. This may indicate that physicians may need, or are looking for, financial assistance from the outside the practice. The next survey question inquired into the amount of money the physicians would be willing to invest per physician in the practice. The choices were from less than $10,000 per physician to greater than $25,000 per physician, and answers ranged from "not at all difficult" to "impossible." From the varied choices, a lowest mean of 1.88 between not at all difficult to impossible was found for the less than $10,000 per physician choice. This indicates that physicians were not willing to invest more than $10,000 per physician to install a new computer system, even if they are convinced it would improve the quality of the care they could provide. Results for the other choice of an investment of $10,000-$25,000 per physician showed a mean of 2.72, indicating the physician thought it was somewhat difficult to very difficult to make this investment. The last option, investment of greater than $25,000 per physician had a mean of 3.30, indicating physicians found it very difficult to impossible to make this investment.

Detailed statistical analysis of this research question indicates that physicians perceive that EHR is a tool that may increase their practice and personal income. Other factors do not show a significant relationship between having EHR and its impact on patient satisfaction and quality of care. The survey also showed that even though there is established a correlation between having EHR and its impact on practice and personal income, physician practices do not have extensive financial resources available nor can they make the necessary investment of more than $10,000 per physicians to install the information technology system.

(e) Conclusion

Five research questions were analyzed based on the survey of the use of electronic health records by medical practices. This comprehensive survey was designed to provide a statistical substantiation and trend among the surveyed practice physicians with respect to adoption of the EHR, as well as evaluate and test correlation relationships for the research questions. The first research question attempted to find out if there are different characteristics among physicians that contribute to EHR deployments at a medical practice. The survey results show numerous shortcomings and opportunities for EHR adoption and use. Physicians were unable to generate a simple patient list by various categories even though they had an electronic patient appointment scheduling software. The results also showed that 63.4 percent of the physicians were providing handwritten medication prescriptions. From the survey results it becomes clear that the industry, the consumer, and possibly even the government, needs to get involved and demand that information technology be used in dispensing health care advice. As in economics, if there is a demand, the producers will have to come up with the supply or the product will have a high probability of failing.

The second research question results showed a great deal of need for physician education on the subject of physician office staff skills, availability of computer technical support, and time needed to acquire system knowledge, as well as ongoing and training costs and commitments, privacy and security concerns, and lack of uniform standards and technical limitations of the system. Education can bring about the change needed, and training and development modules can be developed and organized by subject area and importance to the physician and practice staff in order for this change to be effected. To address time constraints, education and training modules can be delivered

electronically at the physician's desktop or via audio/video technology. The access and ease of the educational and training session can increase its utility and in turn facilitate the use of the EHR and information technology in the healthcare industry.

The Electronic Health Record's role in enhancing quality of care was examined by the third research question. Improving quality of care for patients can not only positively affect patient's health, but it can also increase patient mortality and reduce individual and government healthcare expense. If used properly, technology can be a vital tool in delivering timely and comprehensive health care advice and treatment and providing detailed patient health diagnosis, treatment and health monitoring regardless of geographical and time constraints. The greater the technology collaboration and cooperation within the healthcare community, the better are the chances for success in the industry. The survey results provide significant correlation between utilizing EHR and its effects on cost control, quality of health care, interaction with the healthcare team, in addition to addressing patient privacy concerns and efficiency of delivery of care. This relationship can only be increased by providing proper education, training and creating a mandate within the industry for use of technology.

Technology is as integral to the healthcare business as it is to any other sector of society, and its implementation in a physician practice can greatly improve an organization's productivity. The survey questions revealed a strong correlation between utilizing all aspects of EHR and a physician's innovativeness and proactive willingness to improve quality and institute procedures and systems to help prevent errors and at the same time cut costs. All of these initiatives and working interrelationships have been shown to have positive effects on physician and practice productivity, which will be

greatly enhanced by diligent efforts to educate physicians and their staffs on all aspects of the EHR.

The final survey area examined ways that EHR can improve a practice's profitability. Every organization's longevity depends on financial success. The survey questions inquired into the contribution of EHR to practice and personal income and the responses revealed a strong correlation between use of technology and an increase in corporate and personal income. At the same time, the other survey questions concerning the availability of financial resources for the implementation of EHR showed that physicians were willing to invest less than $10,000 per physician and only moderate resources were available for investment. This point to a serious obstacle that must be overcome if physicians believe they do not have the necessary resources to invest in this technology. In the end, this attitude demonstrates the great opportunity for leaders in the healthcare community to educate physicians on the vital need to invest in a technology that will not only enhance the delivery of quality patient care but could also prove to be a reliable source of greater financial reward.

Chapter Five: Research Summary

Introduction

This chapter presents a summary of the findings, conclusions, and recommendations for future studies. It begins by restating the purpose of the study, and then presents a summary of the findings organized by the research questions, then followed by conclusions and recommendations for future studies.

Purpose of the study

This comprehensive study of the Use of the Electronic Health Record (EHR) in Medical Practices was carried out in order to research various physician practice characteristics and to examine their role in the deployment of EHR, including the effect of education in promoting physicians to use EHR and increasing physician awareness of the contributions of EHR to the quality of care, productivity, and profitability. Adoption of healthcare information technology has been advocated to help overcome some of the fundamental disadvantages of the current paper record system. A 2002 report authored by Raymond and Dold of Kaiser Permanente Institute for Health Policy states the following:

> The limitations of the 20th century healthcare system are such that the old medical paradigm is less viable and the emergence of a new way of practicing medicine is almost inevitable. A variety of signs suggest that the traditional medical paradigm is not well suited for the 21st century: the paper-based system supporting clinical care is increasingly non-viable; human memory-based medicine is increasingly unreliable; clinical data capture has become a business

imperative; and consumer expectations for improved care and service are rising. (Raymomd, 2002)

The study survey results show the physicians have a good understanding of the importance and advantages of having EHR and information technology. However, there are several contributing factors why the adoption rate of this technology is low in the United States as compared to Europe, and the survey results reflect this. Lack of financial resources available to physicians is perhaps the most important reason. According to the Commission on Systematic Interoperability's report, Ending the Document Games, "The adoption of healthcare information technology has been hindered by the economics of healthcare" (Haza, 2005). To illustrate this point, it has been reported that the total amount of funds set aside for information technology within healthcare organizations is two percent of its capital budget versus ten percent in other industries (Millenson, 1997). Additional factors that have impeded adoption of the technology are concerns about data security and patient privacy, difficulties with integration of the legacy systems, issues with vendor selection and fragmented delivery systems, as well as lack of industry standards, time and cost factors and inability of benefit realization (Raymond, 2002).

Adoption of EHR and other healthcare information technology has been shown to be beneficial for the healthcare provider, insurance companies, government and the consumer. One critical advantage for the healthcare provider is that EHR can serve as an additional tool to rely on other than memory. This argument is supported by Bright and Hall who state "The effective use of this technology holds the promise of freeing future physicians from an over dependency on memory and facilitating the

development of new knowledge and skills" (Bright and Hall, 1995). Insurance companies can benefit from reduced healthcare expenses, better efficiency in processing claims and improved patient healthcare. Government will benefit from the technology because of improved quality of care for its citizens, less dependence on government resources and improved tools in disease research as well as providing comprehensive data for first responders in case of healthcare emergency. On the whole, the consumer may ultimately derive the most benefit from information technology, resulting in improvement of communications between healthcare providers, reduction of healthcare expense and, most importantly, and in the long run contributing to the enhancement of the quality of an extended life. According to a 2006 survey conducted by the Lake Research Partners and American Viewpoint for the Markle Foundation, 65 percent of the public is interested in accessing their own personal health information electronically. Furthermore the same survey found that nearly 88 percent of the surveyed Americans thought that online records would reduce unnecessary repeated tests and procedures. The same survey also makes an important observation based on the responses that the public feels that access to electronic personal health records would have a number of personal benefits that could improve quality of care, such as improving doctor-patient communication, avoiding medical errors and reducing repeated tests and procedures (Connecting for Health/Markle Foundation, 2005). Adaption of EHR and the healthcare information technology are important tools that have the potential to make a fundamental change in the quality of care for the patient, reduce expenses for the patients and government and increase productivity and profitability of the healthcare organizations. Edward

Shortliffe writes in the Evolution of Electronic Medical Records, "Realizing the vision above will depend on at least three factors: an enhanced internet; better education and training for healthcare providers; and changes in the management and organization of health-care institutions" (Shortliffe, 1999).

Summary of research questions and statistical analysis

Five research questions for this study were designed to establish the relationship of the EHR and information technology within the medical practices and its use by physicians. A summary of the findings for these research questions is presented below organized according to the research questions. First research question was analyzed using descriptive statistics tools mean and median. Other questions from two through five were analyzed using inferential statistical tool Pearson correlation. For the fifth research question additional statistical analysis based on measures of central tendency was also carried out.

Question One: Are there different characteristics among physicians that contribute to EHR deployments at a medical practice?

Generally, the findings from this study showed that the individual practice characteristics were important factor in their contribution to the EHR deployment at a medical practice. The study showed that physician offices that had the electronic patient scheduling had limited function of scheduling and were unable to provide patient list report by use of medication or completed laboratory results. It also showed that physician offices which were using EHR had numerous brands of EHR's and no consistency among them.

This inquiry was the basis for several survey questions. The main objective of these questions was to identify current practice characteristics in terms of geographic location, amount of time spent by the physicians seeing patients, practice organizational characteristics, ethnic background of the patients, ease of generating patient lists, and the existence and use of information technology in prescribing medication and maintaining electronic health records. These inquiries were an integral part of identifying whether practice characteristics contribute to the use of EHR.

Survey responses were collected from Allegheny and Westmoreland counties in Southwestern Pennsylvania. The result analysis shows that while 84.4 percent of the physicians surveyed were using patient scheduling software to schedule their patients, 97.2 percent of them were unable to generate patient lists according to laboratory results or current medications, and, further, 63.4 percent of physicians were hand writing medication prescriptions. This shows that there is a clear opportunity to educate physicians with respect to the benefits of electronic prescribing technology, which has been proven to reduce medication errors and improve practice productivity. Additionally, the results show that among physicians who have adopted EHR, there are 33 different types. EHR in use, indicating perhaps that there is no one EHR system that has gained physician confidence. There may also be a concern about the industry not having common technical protocols and hence creating limited opportunity when it comes to transfer of data and universal usefulness of the patient health information. A result also indicated that if a group practice finances and provides a mandate for the EHR, its use may increase.

Question Two: Are educational interventions related to the adoption of EHR by physicians?

This research question sets up a fundamental inquiry to see if education and training can contribute to the increased use of EHR. The Pearson correlation analysis was conducted on the survey responses and it shows that physicians do need a formal and practical education and training program showing benefits and workings of the EHR. In this section survey questions were designed to test the physician's current use of EHR and its feature and its application in improving quality of care, productivity and profitability. The survey questions first examined the physicians' perception in terms of the computer skill of the physician and the office staff, the availability of computer technical support, availability of time to acquire knowledge about the computer, as well as start up and ongoing financial costs, training and productivity time loss, privacy and security concerns, lack of uniform standards and technical limitations of the system. The purpose of this inquiry was to discover whether physicians believe any or all of these are a barrier to the adoption of EHR.

The survey results showed significant opportunities for education and training in the areas of ongoing cost, start-up financial cost, training and productivity loss and privacy and security concerns due to the implementation of the EHR. Specifically, there is an opportunity to develop a return-on-investment (ROI) mathematical model, which can show how much a physician can recover by investing in the adoption of technology. Ongoing financial costs, possessing a high coefficient of .342 (significant at the $p < 0.01$ level), show a high correlation in a physician being resistant to EHR. An ROI model can show how much of the initial investment is needed and can

project recurring costs in maintaining the EHR in relation to the financial benefits of its use. Overall, other factors, such as lack of uniform standards and the need for technical support, were also showing moderate correlation and indicated further opportunities for education and training.

Question Three: Do physicians believe the EHR can contribute to improvements in the quality of medical care?

The results of Pearson correlation analysis for this research question shows that physicians do understand that EHR can contribute to improvements in the quality of care that a patient receives. While it is assumed that the use of technology can improve productivity due to availability of information, the question remains whether the use of EHR can do the same for improving a patient's quality of care. The survey questions designed to elicit this information asked participants to reflect on the effects of computers on controlling healthcare costs, improving the quality of health care, facilitating patient-physician communication, as well as increasing patient privacy, clinicians' access to up-to-date knowledge and the efficiency of providing care as well as reducing medication errors.

These responses to this survey question indicate the depth of whether a physician understands of how computers could contribute to improving the quality of patient care. It showed that the quality of health care and patient privacy, having a coefficient of .233 (significant at the $p < 0.01$ level), shows a high degree of correlation between having a computer and the improvement in the quality of care. Other factors, such as efficiency of providing care, interaction with the health care team and patient-physician communication also brought a strong correlation, indicating that physicians

believe that these factors also contribute to quality of care improvements. Thus, the survey results indicate that physicians do understand and accept that computers do contribute to quality of care improvements.

Question Four: Do physicians believe the EHR can enhance their practice productivity?

The findings of this research question indicate that physicians do understand that adoption of EHR can contribute to productivity improvements and that they are involved in improving practice productivity. Productivity for physicians is gauged by an increase in the number of patients seen, financial profitability, as well as improvements in quality of care. Survey questions tested the physician's view on the office staff's innovativeness, such as if they were one of the first to find new diagnostic tests or treatments, if they were actively doing things to improve quality of care and evaluating their effectiveness, if there were quality problems in the practice and if the practice had procedures and systems in place to prevent errors.

Automation takes place mainly to improve productivity and reduce cost. Similarly, the use of EHR in physician offices would also be expected to improve the practice's productivity. The correlation coefficient of .192 (significant at the $p < 0.01$ level), indicates that physicians were actively doing things to improve quality. There were other significant relationships such as the practice physicians were innovative and believed that their practice procedures were good at preventing errors. The response to the question if the physicians believed that they had quality problems in their practice had a negative coefficient of .056 (1- tailed) indicating very weak relationship. This also may indicate that physicians believed that they were actively

involved in improving and controlling productivity. Overall, the survey responses indicate that physicians do believe that EHR can contribute in improving practice productivity.

Question Five: Do physicians believe the EHR can make their practice more profitable**?**

The results of this research question show that physicians do believe that adoption of EHR does contribute to increase in the practice income based on the correlation analysis. Although based on the analysis of measures of central tendency they firmly believe that they do not have the financial resources needed to make the investment in adopting EHR. This question seeks to find out if the type of electronic information system, amount of electronic information used, patient survey results or clinical quality measures, such as pay-for-performance improves medical practices and physician's income or profitability. Other survey questions asked, based on the practice use of EHR or electronic prescribing, how much of their income has increased, the physician's perceptions on availability of the financial resources and, per physician, how much they are willing to invest in purchasing new computer system or EHR.

The survey questions designed to inquire into the contribution of EHR to the practice income or a physician's personal income indicates a significant correlation. It indicated that there was a significant correlation of .221 (significant at the $p < 0.01$ level), for the EHR contributing to practice income and a correlation of .210 (significant at the $p < 0.01$ level), for contributing to the physician's personal income. Furthermore, physicians also believe that the amount of information used at the

practice level has a significant correlation of .189 (significant at the $p < 0.01$ level). Other survey questions inquired on how many financial resources were available for the EHR investment. It showed a mean of 2.72, indicating that they only had moderate to limited financial resources. The next question indicated that physicians believed that they can easily afford an investment of $10,000 or less per physicians in EHR, but as the investment amount increases, the affordability per physician also showed a mean of 3.30, indicating very difficult to impossible to invest in the financial resources.

Implications of Results

Overall, the research questions provide insightful results that indicate a significant need for physician education in how the EHR can be affordable and provide a return on investment, can improve productivity as well as practice and personal profitability and income. The review of this research points to several improvements that can facilitate the adoption of the EHR. The following are some of the recommendations:

(1) Federal, state and local governments, professional societies as well as non-government organizations should take initiative in educating physicians about the financial investment requirements and returns from the use of EHR.

(2) Educational training programs for physicians should be developed that can demonstrate real-life EHR adoption scenarios and results. These programs should be designed to be delivered at the physician workplace and home. Ease of learning and physician time constraints should be kept in mind when developing educational programs.

(3) Ongoing expert speaker and online training seminars should be organized to foster confidence level after EHR adoption.

(4) The best examples of EHR adoption and use from the industry should be shared and made available to physicians so they can develop confidence in the new tool, and such sites could become a resource for the healthcare industry.

(5) Medical practices that have already implemented health information technology can develop an EHR adoption prototype plan that can be used as an EHR referral prototype, which should include benchmark and timeline indicators.

(6) The healthcare industry should develop a list of organizations that may be able to provide financial resources to medical practices for EHR adoption and maintenance. There also needs to be a list of recommendations on the "How to's" of EHR maintenance.

(7) Government, professional and commercial organizations should develop web-based EHR resource sites that would provide EHR solution lists, access to EHR experts and weblogs where physicians can communicate (Appendix E).

(8) The benefits of the Electronic Health Record also need to be communicated to the consumer. Consumer education with respect to EHR can create a demand that may encourage physicians and insurance companies to adopt the technology.

(9) Professional physician societies should dispense specialty based EHR adoption and usage advice on how to make this tool functional for offices.

(10) Physicians, consumers and professional societies need to demand government leadership, action, and financial assistance to foster the adoption of EHR and healthcare information technology.

(11) The government needs to modernize existing laws to promote the advantages of implementation of the EHR and healthcare information technology.

(12) The healthcare industry should promote public and private interests in reducing healthcare expenses using the Electronic Health Record and should also develop and implement national health information exchange protocols, data standards, as well as a data warehouse.

(13) Build a common health information interconnection framework for all physicians and healthcare providers.

(15) Promote patient health information data security through electronic technology.

(16) Cultivate a global health exchange organization to promote universal electronic health information exchange and improvement in quality of care.

The above recommendations by no means comprise an all-inclusive plan for the increased adoption of the EHR and other healthcare information technology, but the development of these initiatives can have a tremendous impact on how widespread the use of the technology becomes. However, no progress will be made to this goal unless and until physicians have a more realistic view of the financial benefits of the EHR, while at the same time consumers demand improved access to their own

healthcare data and in turn demand quality of care improvements and lower health costs.

Recommendations for future study

This study was designed to analyze the Use of Electronic Health Record by Medical Practices. The sample of physicians was drawn from the Allegheny and Westmoreland counties in Southwestern Pennsylvania. They were surveyed to inquire if the use of EHR is driven by practice characteristics, if educational programs may increase the use, and whether it will improve quality of care, productivity and the profitability. This survey was a comprehensive inquiry, yet due to the vastness of the subject matter, there are many areas that need to be researched in the future. The following are some of these research opportunities for the future:

(1) There needs to be an inquiry into developing, designing and implementing educational programs to educate physicians about the EHR and its utility. The success rate of these educational programs and the concomitant evaluation of the outcomes can provide the data on the potential success of EHR in medical practices. An example of a proposal for a seminar on health care information technology and electronic health records is attached in the appendices (see appendix D).

(2) One of the major disincentives to the adoption of EHR is the leadership, or lack thereof, provided by the political establishment, as well as insurance companies and other industry and consumer leaders. A study of leadership provided for the adoption of EHR can potentially increase its use. This study may provide the

proof of what type of leaders and incentives are needed to encourage physicians in adoption of the EHR.

(3) A more extensive study can be done using the original survey, which had additional inquiries into EHR. It also may be conducted a broader area of the fourteen Western Pennsylvania counties to gain a larger prospective. Offering each participant a nominal financial consideration for their efforts in completing the survey also may incentivize the participants. A study of a larger geographical area may show different results than this study.

(4) A study will also need to be done by asking only those physicians who currently have the EHR. This inquiry can show the physician's motivation for installing and using EHR and what factors contributed to this. It can also show what is the utility of EHR and if the practice has benefited.

(5) Further study or relationship of physician practices using the EHR and its impact on insurance company profitability may be of interest. Such a study may also shed light on the insurance companies ability to realize cost savings due to the physician use of EHR, and if they would pass on any savings on to the consumer.

(6) One of the most important studies that need to be done is to see what is the impact of the EHR on a patient's long-term health. This inquiry can be useful in showing that the use of EHR contributes to improvement in the quality of care.

(7) Interworking relationships and the ability of each of the EHR systems in accessing, transferring and storing patient data among various technology networks also needs to be studied. Such relationships and common industry protocol have a potential for increasing the use of the EHR.

(8) One of the major goals of the EHR is ultimately to benefit the patient's long-term health. A study of the utility of EHR to patients in managing and monitoring their health outside the physician practice can be of great use in improving their quality of life. Also, studying whether patients can transmit and access their own data through a public database of online can be a potential source of improved health.

(9) Security and confidentiality of the patient data is one of the most important aspects of patient privacy because the use of EHR can potentially jeopardize or compromise patient privacy. Thus, more extensive studies need to be conducted on the impact of EHR and its data on patient's privacy.

(10) A study of the different features of the EHR and its utility in increasing productivity, profitability and providing comprehensive care to patients needs to be conducted. It can gauge the true functionality of the software and its maximum usefulness to the physicians, patient, and staff.

Conclusion

In final analysis, this study has shown that physicians within the Allegheny and Westmoreland Counties would benefit from structured educational and training programs on the adaptation of EHR. The results indicate that physicians believe that EHR would improve the quality of care as well as their individual and practice's productivity and profitability. The projected economic trends support the fact that the growth of EHR is inevitable because of the importance being given to quality of care and reduction of expenses in the health care industry by the administration of the current President of the United States of America, Mr. Barack Obama.

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Appendix A: Consent to participate in a research study

TITLE: Use of the Electronic Health Record (THE EHR) in Medical Practices

INVESTIGATOR: Archish Maharaja, 447 Pinkerton Road, Wexford, PA 15090-8681 Phone: 412-364-2034, Electronic Mail Address: archmaharaja@yahoo.com

ADVISOR: Dr. V. Robert Agostino, School of Education (412-396-1852). Electronic Mail Address: rob123ag@hotmail.com

SOURCE OF SUPPORT: This study is being performed as partial fulfillment of the requirements for the doctoral degree in instructional leadership at Duquesne University.

PURPOSE: You are being asked to participate in a research project that seeks to investigate the use of the electronic health record in medical practices. Participants will be asked to complete a survey that will take approximately 15 minutes to complete. You will be provided with a choice of completing a paper or electronic survey.

This is the only request that will be made of you.

RISKS AND BENEFITS: There are no risks greater than those encountered in everyday life. The information obtained through your participation in this study will add to the body of knowledge that currently exists pertaining to the use of the THE EHR in the provider's offices. It will also indicate what can be done in terms of educating physicians to increase the use of the THE EHR

COMPENSATION: There will be no compensation for your participation in this study. However, participation in the project will require no monetary cost to you.

CONFIDENTIALITY: Your name will never appear on any survey or research instruments. No identity will be made in the data analysis. The researcher will hold identifiers of those people who participated but will not hold identifiers associated with specific survey responses. Your responses will only appear in statistical data summaries. The survey data is only available to the investigator who maintains the Survey Monkey account. Once the investigator's Survey Monkey account is cancelled your data will be accessible for 90 days as a summary view only before it is archived.

The servers are kept at SunGard (http://www.sungard.com). Physically the servers are kept in a locked cage which requires a pass card and biometric recognition for entry. There is digital surveillance equipment and the system is staffed 24 hours a day. The completed paper survey will be entered in the data analysis software for the statistical analysis and will be destroyed upon completion of the analysis.

RIGHT TO WITHDRAW: You are under no obligation to participate in this study. You are free to withdraw your consent to participate at any time.

SUMMARY OF RESULTS: A summary of the results of this research will be supplied to you, at no cost, upon request. To request a copy of the results please write or telephone the investigator. Contact information is included on page one of this form.

SECURITY: Survey Monkey will be used as the data collection service. SurveyMonkey.com is aware of your privacy concerns and strives to collect only as much data as is required to make your Survey Monkey experience as efficient and satisfying as possible, in the most unobtrusive manner as possible. Data is collected and stored, but only made available to the account holder. All information collected is kept confidential and secure, and is not shared with any third-parties. Survey Monkey has met the Safe Harbor requirements on 11/29/2004 02:29:37 PM SurveyMonkey.com has been placed on the Safe Harbor list of companies accordingly. This list 151 can be found at: **http://web.ita.doc.gov/safeharbor/SHList.nsf/WebPages/Oregon**

For the completed paper survey data will be manually entered in the data analysis software. The paper copies will be kept in the principal researcher's house in a locked file cabinet and shall be destroyed upon completion of the entire study.

VOLUNTARY CONSENT: I have read the above statements and understand what is being requested of me. I also understand that my participation is voluntary and that I am free to withdraw my consent at any time, for any reason.
On these terms, I certify that I am willing to participate in this research project.
I understand that should I have any further questions about my participation in this study, I may call Archish Maharaja (412-364-2034), the Principal Investigator, Dr. V. Robert Agostino (412-396-1852), the Advisor, and Dr. Paul Richer, Chair of the Duquesne University Institutional Review Board (412-396-6326).

If you agree to participate in this study please click on the link below to take you to the survey. Or complete the attached survey and please mail it in the stamped and self-addressed envelope.

http://www.surveymonkey.com

Thank you for taking time to complete the survey.

Archish Maharaja, February 20, 2008

Appendix B: Letter of Request to Allegheny County Medical Society (ACMS)

December 29, 2007,

Jack Krah
Executive Director
Allegheny County Medical Society (ACMS)
713 Ridge Road
Pittsburgh, PA 15212

Dear Jack:

It gives me a great pleasure to write this letter of introduction for Mr. Archish (Arch) Maharaja. Arch currently is pursuing his educational doctoral degree in healthcare and is researching use of Electronic Medical Records in physician offices. By profession he is a Certified Public Accountant and has been providing healthcare practice consulting and management services to practitioners around the Pittsburgh area for the last 12 years.

Arch has asked me to write this letter to see if you will be kind enough to meet with him so he can provide you further detail on his research topic use of Electronic Medical Records in physician offices. In particular Arch would like to see if ACMS would share the membership directory with electronic mail addresses so he can conduct electronic survey. Furthermore he also requests to see if ACMS would be kind enough to write a letter of endorsement, promoting physicians to take the survey. There is no financial commitment for ACMS or the physicians. The same survey was used for an THE EHR study in the State of Massachusetts by a Harvard Medical School professor. His research proposal will be submitted for the institutional review board to preserve the privacy and confidentiality of everyone involved in his research.

I have known Arch for the last 12 years in professional capacity and have always provided me with invaluable healthcare business advice. So I am very encouraged to see that he is pursuing his research in the healthcare and hope to learn some valuable information and tools which can be applied in day to day practice of healthcare.

Thank you very much for your time and consideration and certainly hope that you or someone from your organization will be able to assist him in his research. I have asked Arch to contact you in next several days to set up a personal meeting with you at your office.

Sincerely,

Rajiv R. Varma, M.D.

CC: Archish (Arch) Maharaja

Appendix C: Survey of the Use of the Electronic Health Record in Medical Practices

Instructions:

This survey asks about your medical practice and factors related to the use of the Electronic Health Record within your practice. It will take about 15 minutes to complete.

All responses are private and confidential. Results will be analyzed only in the aggregate and individual responses will not be reported.

Section I. Practice Characteristics.

In this section, we ask you questions about your outpatient practice.

1. In a typical week, in how many different offices do you see patients?

- ☐1 One
- ☐2 Two
- ☐3 Three
- ☐4 None, I do not see any out patients (**Skip** to Question 30 on Page 7)

For the remainder of the survey, please keep in mind the office practice site where you spend the most time, your **main** practice

---

2. What percent of your **outpatient** clinical time is spent at your (Main) practice?

- ☐1 Less than 25% of outpatient time
- ☐2 25%-49% of outpatient time
- ☐3 50%-75% of outpatient time
- ☐4 More than 75% of outpatient time

3. How would you best characterize your practice? (Please check only **one**)

- ☐1 Solo primary care practice
- ☐2 Solo specialty care practice
- ☐3 Primary care group or partnership
- ☐4 Single specialty group or partnership

☐5 Multi-specialty group or partnership

4. Are you a

☐1 Full Owner

☐2 Part-Owner

☐3 Not an owner of the practice

5. Practice Location

☐1 Allegheny County

☐2 West Moreland County

6. Please **estimate** the number of outpatient visits **you** have in a **typical week** in your practice.

_ _ _ outpatient visits

7. Please **estimate** approximately what percentages of the **patients you see** in a **typical week** are of each race/ethnicity:

a) Asian _ _ %

b) American Indian or Alaska Native _ _ %

c) Black or African American, non-Hispanic _ _ %

d) Native Hawaiian or Other Pacific Islander _ _ %

e) White, non-Hispanic _ _ %

f) Hispanic or Latino _ _%

g) Other _ _ %

8. With your current medical record system (paper and/or electronic), how easy would it be for you or your staff to generate the following information about your patients?

	Very Easy	Somewhat Easy	Somewhat Difficult	Very Difficult	Cannot Generate
a) List of patient by diagnosis Or health risk (e.g. diabetes)	☐1	☐2	☐3	☐4	☐5

b) List of patients by laboratory results (e.g. patients with abnormal hematocrit levels) ☐1 ☐2 ☐3 ☐4 ☐5

c) List of patients by medication they currently take (e.g. patients on warfarin) ☐1 ☐2 ☐3 ☐4 ☐5

Section II: Health Information Technology

The next set of questions will ask you about the computers and health information technology in your main practice. Please select the answer that best describes your practice.

9. Does your practice use a **computerized scheduling system**?

☐1 Yes ⟶ (If "Yes" please **answer a**.)

a. For how many years has your practice used a Computerized scheduling system? ___ Years

☐2 No

10. Upon completing a typical office visit, how do you generate medication prescriptions?

☐1 Computerized, with decision support (e.g. drug interaction alerts)

☐2 Computerized, no decision support.

☐3 Handwritten

☐4 Other (Describe:_____)

11. Does your main practice have components of any electronic health record (THE EHR), that is, an integrated clinical information system that tracks patient health data, and may include such functions as visit notes, prescriptions, lab orders, etc?

☐1 Yes

☐2 No ⟶ (If "No" please **answer a.** then **SKIP to question 19**)

a. When do you plan to implement the EHR?

☐1 Within the next 12 months

☐2 Within the next 1-2 years

☐3 Within the next 3-5 years

☐4 No specific plans

12. What is the name of your EHR system (e. g. EPIC, Logician): _____

13. Please indicate when your practice **first** began using and THE EHR:

_ _ / _ _ _ _ (month/year)

14. Please indicate all **features of the EHR** that you **have available** in your practice. For those features that you have, indicate the extent to which **you use** them:

	Available			**Use**		
Features of your the EHR	Yes	No	Don't Know	I do not use	I use some of the time	I use most or or all of the time
a) Laboratory test results	☐1	☐2	☐3	☐1	☐2	☐3
b) Laboratory order entry	☐1	☐2	☐3	☐1	☐2	☐3
c) Radiology test results	☐1	☐2	☐3	☐1	☐2	☐3
d) Radiology order entry	☐1	☐2	☐3	☐1	☐2	☐3
e) Electronic visit notes	☐1	☐2	☐3	☐1	☐2	☐3
f) Reminders for care activities (e.g. overdue health maintenance)	☐1	☐2	☐3	☐1	☐2	☐3
g) Electronic medication list of what each patient takes	☐1	☐2	☐3	☐1	☐2	☐3
h) Electronic problem list	☐1	☐2	☐3	☐1	☐2	☐3
i) Can transmit prescriptions to pharmacy electronically or via electronic faxing	☐1	☐2	☐3	☐1	☐2	☐3
j) Electronic referrals or clinical meeaging (secure	☐1	☐2	☐3	☐1	☐2	☐3

e-mailing between providers)

15. How much of a barrier is each of the following to beginning or expanding the use of computer technology in your practice?

	Not a barrier	Minor barrier	Major barrier
a) Computer skills of you and/or Colleagues/staff	☐1	☐2	☐3
b) Computer technical support	☐1	☐2	☐3
c) Lack of time to acquire knowledge about systems	☐1	☐2	☐3
d) Start-up financial costs	☐1	☐2	☐3
e) Ongoing financial costs	☐1	☐2	☐3
f) Training and productivity loss	☐1	☐2	☐3
g) Physician skepticism	☐1	☐2	☐3
h) Privacy or security concerns	☐1	☐2	☐3
i) Lack of uniform standards within industry (e.g. having to use multiple systems used by different providers and plans)	☐1	☐2	☐3
j) Technical limitations of systems	☐1	☐2	☐3

16. How much of a role do/did each of the following organizations play in deciding whether to adopt a new electronic health record system in your practice?

	Very much	Some what	Very little	Not at all	N/A or don't know
a) Your practice group (S)	☐1	☐2	☐3	☐4	☐5
b) Physician Hospital organization (s) (PHOs) or Independent Practice Association(s) (IPAs)	☐1	☐2	☐3	☐4	☐5
c) Integrated Delivery System(s) (IDS)	☐1	☐2	☐3	☐4	☐5
d) Managed care plans you work with	☐1	☐2	☐3	☐4	☐5

e) Pennsylvania Medical society	☐1	☐2	☐3	☐4	☐5
f) Your speciality's professional society (e.g., AAP, AAFP, ACP, ACS, etc)	☐1	☐2	☐3	☐4	☐5
g)PMSCO or DOQ-IT	☐1	☐2	☐3	☐4	☐5
h) Pennsylvania eHealth Initiative	☐1	☐2	☐3	☐4	☐5
i) The LeapFrog Group	☐1	☐2	☐3	☐4	☐5
j) Other (i. specify;_____)	☐1	☐2	☐3	☐4	☐5

Section III: Computers and Health Care

17. For each outcome listed below, indicate whether you think the effect of computers is, or would be very positive, somewhat positive, no effect, somewhat negative, or very negative:

Effect of computers on…	Very Positive	Somewhat Positive	No Effect	Somewhat Negative	Very Negative
a) Controlling costs of health care	☐1	☐2	☐3	☐4	☐5
b) Quality of health care	☐1	☐2	☐3	☐4	☐5
c) Interactions within the health care team	☐1	☐2	☐3	☐4	☐5
d) Patient-physician communication	☐1	☐2	☐3	☐4	☐5
e) Patient privacy	☐1	☐2	☐3	☐4	☐5
f) Clinicians' access to up-to-date knowledge	☐1	☐2	☐3	☐4	☐5
g) Efficiency of providing care	☐1	☐2	☐3	☐4	☐5
h) Medication errors	☐1	☐2	☐3	☐4	☐5

Section IV: Financial Considerations

18. Please indicate below whether the following factors (through bonuses, return withholdings, or other incentive payments) contribute to **either** your **practice's income,** or **your personal earnings**?

	Practice's Income		**Personal Income**	
	Yes	No	Yes	No
a) Types of electronic information systems you **have** (e.g., THE EHR**s,** E-prescribinig)	☐1	☐2	☐1	☐2
b) The amount you **use** electronic information	☐1	☐2	☐1	☐2
c) Patient survey results (e.g. satisfaction)	☐1	☐2	☐1	☐2
d) Clinical quality (e.g., "Pay for performance')	☐1	☐2	☐1	☐2

19. Approximately what percent of your 2007 **clinical practice income** was earned in the form of bonuses, returned withholds, or incentive payments **based on the use of the electronic health record systems or electronic prescribing?**

☐1 0% of income

☐2 1-5% of income

☐3 6 – 10% of income

☐4 more than 10% of income

☐5 Not sure

20. Practices vary with respect to the capital they have available for expansion and improvement. What financial resources does your main practice have for expansion or improvements of any kind?

☐1 Extensive resources

☐2 Moderate resources

☐3 Limited resources

☐4 No resources

21. If you decided that a new computer system would improve health care quality and was worth the financial investment, how difficult would it be for your practice to purchase such a system if the cost was

	Not at all Difficult	Somewhat Difficult	Very Difficult	Impossible
a) Less than $10,000 per physician	☐1	☐2	☐3	☐4
b) $10,000 - $25,000 per physician	☐1	☐2	☐3	☐4
c) Greater than $25,000 per physician	☐1	☐2	☐3	☐4

Section V: The Office Practice Environment

22. Please indicate your agreement or disagreement with the following statements, considering your main office practice:

	Strongly Agree	Agree	Neither Agree Nor Disagree	Disagree	Strongly Disagree
a) The office staff are innovative	☐1	☐2	☐3	☐4	☐5
b) The physician(s) are innovative	☐1	☐2	☐3	☐4	☐5
c) Among my colleagues, I am usually one of the first to find out about a new diagnostic test or treatment	☐1	☐2	☐3	☐4	☐5
d) We are actively doing things to improve quality of care	☐1	☐2	☐3	☐4	☐5
e) After we make changes to improve quality, we evaluate their effectiveness	☐1	☐2	☐3	☐4	☐5
f) We have quality problems in our practice	☐1	☐2	☐3	☐4	☐5
g) Our procedures and systems are good at preventing errors	☐1	☐2	☐3	☐4	☐5

from occurring

Section VI: Personal Characteristics

We would like to end this survey by asking about general background information that may help us interpret survey findings and determine how representative our sample is.

23. In what year did you graduate from medical school?

_ _ _ _ Year graduated

24. In what year were you born?

_ _ _ _ Year

25. Are you

☐1 Male

☐2 Female

26. What is your race? **Select one or more** of the following –

☐1 Asian

☐2 American Indian or Alaska Native

☐3 Black or African American

☐4 Native Hawaiian or Other Pacific Islander

☐5 White

☐6 Other

27. Date survey completed: ___ ___/ ___ ___/___ ___ ___ ___
Month Day Year

Please return the survey in the stamped return envelope.

Thank you for your help.

APPENDIX D: Proposal for a Seminar on Health Care Information Technology and Electronic Health Record (EHR)

Introduction:

In today's world and economy, healthcare is receiving prime focus. United States spent about 16 percent of its Gross Domestic Product on healthcare in 2005 or $6,697 per person versus 8 to 10 percent in other industrialized nations. One of the measures which can cut this cost is the use of healthcare information technology. Recognizing the importance and role of information technology in reducing healthcare cost, in April, 2004 President Bush signed an executive order establishing an Office of National Coordinator for Health information Technology and appointed Dr. David J. Brailer as the national coordinator. Dr. Brailer formulated a national strategy by establishing four goals and twelve strategies for national adoption of healthcare information technology. Our current President Mr. Barack Obama is also proposing to invest $10 billion a year in health care information technology to help reduce health care cost and improve quality of care.

On the heels of the leadership shown by our government leaders and the need to reduce the health care cost and improve quality, this seminar is being proposed.

Need for the Seminar and Prospects:

In light of the national mandate for the health care information technology and its usefulness in cutting the cost, the need for well trained management and technical personnel is obvious. According to one forecast healthcare information technology field may see an increase of about 26.7 percent jobs from 2002 to 2012. President Elect Mr. Barack Obama is also promising to make healthcare reform one of his first priority. Mr. Obama has also called for increased use of information technology to help reduce the cost.

The City of Pittsburgh is home to three different healthcare systems which are aggressively pursuing use of information technology to be able to provide quality care to their patients and cut the cost. Among the three different networks University of Pittsburgh Medical Center (UPMC) is one of the biggest employers offering employment to over 50,000 people. The other two networks West Penn Allegheny health system and Heritage Valley healthcare system also employ about 10,000 people within the region. These networks also project a significant overall job growth as they strive to increase their market share in the region and especially UPMC which has been expanding its services to other regions within the United States and overseas. Naturally, healthcare information technology jobs will be growing as these networks increase their market share.

Furthermore, the above mentioned developments create great opportunities and the need for educational institutions to show leadership in designing and offering seminars in healthcare information technology and EHR. The seminars should be designed to participants in three specific areas, technical, management and administration. A session on the technical part would educate participants in the mechanical part of information technology workings. Sessions on management and administration of the healthcare information technology would offer knowledge on the strategic planning, financing, acquisition, deployment and operation of the information technology.

Objectives:

The seminar will familiarize participants in the following:

-Need for the healthcare information technology and the Electronic Health Record (EHR).

-Stakeholder analysis and objectives for the use of information technology and EHR.

-Overview of healthcare information technology and EHR components.

-Discussion of the technology planning and adoption process.

-Discussion of the financing for the technology and EHR.

-Discussion of execution, maintenance and upgrade of the technology and EHR.

-Planning of continuous technology assessment process.

-Development of healthcare information and the technology security.

-Hardware and software needs assessment.

-Develop and manage technology human resources.

Learning Outcomes:

The following are the intended learning outcomes:

-Identification of the healthcare information technology and EHR need and resources.

-Assessment of stakeholder needs and service requests.

-Identify and relate the inter-working relationships of healthcare information technology components.

-Be able to objectively review current organizational resources, needs and develop a systematic technology acquisition plan.

-Be able to assess and design continuous review procedures.

-Oversee implementation and execution of the security procedures.

-Monitor hardware and software operations.

-Manage the human resources.

-Healthcare organizations and the existence of the technology.

Teaching methods:

- Hand-outs

- Group discussions

- Audio-visual presentations

- Online discussion groups

- Web-based seminar

Assessment methods:

- Group discussions

- Surveys

- Case studies

- Health care technology and EHR adoption models

Potential Beneficiaries:

- Physicians.

- Ancillary care providers.

- Nurses

- Medical office support staff

- Administrators

- Patients

- Government leaders and officials

- Insurance company employees

APPENDIX E: A list of the Health Care Information Technology and Electronic Health Records Organizations.

Agency for Healthcare Research and Quality (AHRQ)
http://www.ahrq.gov/

American Medical Informatics Association (AMIA)
http://www.amia.org/

Association of Medical Directors of Information Systems (AMDIS)
http://www.amdis.org/

Center for Healthcare Information Technology (CENTERFORHIT)
http://www.centerforhit.org/

Center for Studying Health System Change (HSCHANGE)
http://www.hschange.com/

Commission on Accreditation for Health Informatics and Information Management Education (CAHIIM)
http://www.cahiim.org/

Electronic Health Initiative (EHEALTH)
http://www.ehealthinitiative.org/

E-journal of the Association of Medical Directors of Information Systems and the Improve-IT Institute (INFORMATICS-REVIEW)
http://www.informatics-review.com/

Government Health Information Technology (GOVHEALTHIT)
http://www.govhealthit.com

Health Care Informatics Society of Ireland (HCSI)
http://www.hisi.ie/

Health Care Information and Management Systems Society (HIMSS)
http://www.himss.org/ASP/index.asp

Health Informatics Society of Australia (HISA)
http://hisa.org.au/

Health Informatics Europe (HIE)
http://www.hi-europe.info/index.html

Health Informatics New Zealand (HINZ)
http://www.hinz.org.nz/

Health Informatics Journal (HIJ)
http://jhi.sagepub.com/

Health Information Technology Summit (HITSUMMIT)
http://www.hitsummit.com/

Health Informatics World Wide (HIWW)
http://www.hiww.org/

Health Insurance Portability and Accountability Act of 1996 (HIPAA)
http://www.hipaa.org/

Health Level Seven (HL7)
http://www.hl7.org/

Health on Net Foundation (HON)
http://www.hon.ch/

Institute of Medicine (IOM)
http://www.iom.edu/

International Journal of Healthcare Technology and Management (IJHTM)
http://www.inderscience.com/browse/index.php?journalID=16&year=2000&vol=2&issue=1/2/3/4

Journal of American Medical Informatics Association (JAMIA)
http://www.jamia.org/

Medical Group Management Association (MGMA)
http://www.mgma.com/

Medical Records Institute
http://www.medrecinst.com/

National Institute of Health (NIH)
http://www.nih.gov/

National Library of Medicine (NLM)
http://www.nlm.nih.gov/

Pennsylvania eHealth Initiative (PAEHI)
http://www.paehi.org/

Office of the National Coordinator for Health Information Technology (ONC)
http://www.hhs.gov/healthit/chiinitiative.html

Prescription for Pennsylvania
http://www.gohcr.state.pa.us/prescription-for-pennsylvania/Prescription-for-Pennsylvania.pdf

Public Health Informatics Institute (PHII)
http://www.phii.org/

Rand Corporation (RA)
http://www.rand.org/

United Kingdom Health Informatics Society (UKHIS)
http://www.bmis.org/

Volunteer eHealth Initiative (Volunteer-eHealth)
http://www.volunteer-ehealth.org/