

**THE EVALUATION AND EFFECTIVENESS OF AN INTERDISCIPLINARY COURSE
IN ELECTRONIC HEALTH RECORD (EHR) TECHNOLOGY FOR HEALTH AND
REHABILITATION PROFESSIONALS**

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This study examined the effectiveness of an online interdisciplinary course in electronic health record (EHR) technology at the University of Pittsburgh for health and rehabilitation professionals. The purpose of the study was to determine how familiar participants were with EHR technology; determine if attitudes changed toward EHR technology after taking the course; and determine if the course met the needs and expectations of the participants. The goal of the project was to educate health and rehabilitation professionals about EHR technology and to identify a model interdisciplinary course for this topic. Quantitative and qualitative data was collected through questionnaires, practice module exams, and participant interviews. Participants who took the course showed significant gains in their knowledge of almost all of the content areas. The primary strength of the course was its structure, in particular, with the audio presentation. The weaknesses of the course were with regard to the quantity of and time allotted to complete assignments, as well as the desire to have more hands-on vendor component assignments. Although participant attitudes were favorable toward EHR technology before taking the course, they improved after taking the course. Overall participants believed that it is important that EHR technology is implemented in healthcare and benefited significantly from taking the course.

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PREFACE

I would like to thank each of my committee members, Valire Carr Copeland, PhD, MPH; Patti Anania-Firouzan, MSIS, RHIA; and Elaine N. Rubinstein, PhD, for their support, encouragement, expertise, and willingness to serve on my committee as I completed this project. I would like to especially thank my advisor and committee chair Valerie J. M. Watzlaf, PhD, FAHIMA, RHIA, for her belief in me to pursue this accomplishment, her willingness to provide guidance and coaching, and her consistent patience and support as I learned through all aspects of this study. I would also like to thank my family for their encouragement and support of me in reaching this milestone in my academic pursuit.

1.0 RATIONALE FOR EHR TECHNOLOGY IN HEALTHCARE

1.1 INTRODUCTION

According to the Institute of Medicine (IOM) 44,000 to 98,000 deaths occur each year in hospitals due to preventable medical errors, and over 770,000 individuals are either injured or die each year in hospitals due to adverse drug events [1]. Coordination of care and communication among clinicians is poor in the paper based healthcare system. Patients are being hospitalized unnecessarily; duplicate tests are being ordered; adverse drug reactions are occurring because clinicians are not aware of drugs prescribed by colleagues; and patients are receiving conflicting treatment information and advice. The IOM report *To Err is Human: Building a Safer Health System* cites one of the most extensive adverse drug event studies, the Harvard Medical Practice Study, and notes that 58 percent of adverse events due to errors in the study were preventable, 27.6 percent were due to negligence, and 19 percent were due to drug complications which were the most common adverse event. Another study the IOM reported on was the study of adverse events in Colorado and Utah which found that 53 percent of adverse events were preventable and 29.2 percent were due to negligence [2]. In order to: 1.) reduce medical errors, 2.) provide more effective methods of communicating and sharing information among clinicians, and 3.) better manage patient medical records, we need to embrace information technology in healthcare.

In his State of the Union address on April 27, 2004, President Bush endorsed the use of electronic health record (EHR) technology. He stated that “By computerizing health records, we

can avoid dangerous medical mistakes, reduce costs, and improve care [3].” He envisions widespread adoption of interoperable electronic health records and expects that most Americans will have an electronic medical record within the next ten years. Through his Executive Order #13335, the President directed the appointment of a National Coordinator and created the Office of the National Coordinator of Health Information Technology (ONCHIT). On May 6, 2004, Secretary, Tommy G. Thompson appointed David J. Brailer, MD, PhD, to assume this new position. The Executive Order requires Dr. Brailer to develop a strategic plan to guide the nation in both the public and private sectors on the implementation of electronic health record technology [1]. Since medical errors are a leading cause of death in the United States and since paper records can be easily lost, misplaced, or are often illegible, the use of electronic health record technology would eliminate many of these issues and lead to major improvements in the health and safety of patient care. There is a need for the education of clinicians regarding EHR technology if we are to reach President Bush’s goal of most Americans having an EHR within the next ten years. Clinicians of the future need to be trained in order to know how to use the EHR, and many clinicians are opposed to the EHR technology simply because of the fear of the unknown. They lack knowledge about EHR technology, how it works, and how it will affect their job and workload. “This future clinician will likely use a computer to enter findings and diagnoses, take advantage of links that connect these with decision support modules and the medical literature, and communicate with colleagues and others taking care of the patient [4].” It is possible that medical records departments of the future will reorganize and will not only rely on health information managers, but also clinicians and their informatics skills and knowledge in order to create an organizational team reporting to a senior health information management executive. These interdisciplinary organizational teams might include health information

managers, information technology and systems analysts, medical librarians, and clinicians experienced in informatics [5].

Potential impediments to the implementation of the EHR is that not all health and rehabilitation professionals are proficient in its use; allied health schools do not offer an interdisciplinary online course on EHR technology; and many of the EHR products that are available from software companies do not meet existing standards or needs of the health and rehabilitation professional.

To overcome this impediment a distance education course on the EHR will be developed for health and rehabilitation students at the University of Pittsburgh. This is a very innovative approach because there are no distance education EHR courses that focus on health and rehabilitation disciplines. Also, there are no EHR courses that will have a major vendor component in which students will evaluate the existing EHR software systems available from vendors.

1.2 STATEMENT OF PROBLEM

This study will evaluate the effectiveness of an EHR technology online course for the health and rehabilitation professional (physical therapist, occupational therapist, speech/language pathologist, health information management professional, social worker, emergency medicine professional, etc.) It will also examine if the attitudes of health and rehabilitation professionals toward EHR technology change.

1.3 PURPOSE OF STUDY

The purpose of this study is to serve as a pilot study to examine a new online course on Electronic Health Record technology for a group of interdisciplinary health and rehabilitation professionals at the University of Pittsburgh to determine the effectiveness of the course to produce health and rehabilitation students who are more informed and confident regarding electronic health record technology.

The Electronic Health Record Technology course objectives will include:

- Describing the advantages and disadvantages between a paper health record and an electronic health record
- Utilizing the EHR for analysis of patient care including planning a study, developing quality indicators, using statistical analysis, and developing methods for improvement
- Understanding accrediting and/or licensing agency requirements for assessment of electronic health record systems
- Developing data standards and elements related to allied healthcare as components of an electronic health record system
- Discussing clinical terminology systems and standards, and the use, importance, and need for these in a healthcare setting with emphasis on the role the health and rehabilitation professional plays
- Distinguishing the electronic health record components that directly impact reimbursement
- Discussing the development process of electronic health record technology and the impact of the Joint Commission on Accreditation of Healthcare Organizations (JCAHO) and federal regulations such as HIPAA and ONCHIT initiatives

- Assessing risk resulting from improper use, access, disruption, modification, or destruction of data in an electronic health record system
- Recognizing the use of current technology in the effectiveness of disease prevention and health promotion such as reminder systems, computerized physician order entry (CPOE), bar codes, speech recognition, etc.
- Determining how to prevent infectious disease outbreaks and bioterrorism events with the EHR system.

This study will answer the following educational research questions:

- How familiar with electronic health record technology are students of health and rehabilitation before taking the EHR course and after taking the course in the following areas:
 - Design and development of the EHR
 - Implementation and management of the EHR
 - Standards, data elements, structure and content of the EHR
 - Clinical terminology of the EHR
 - Patient safety and the EHR
 - Outcomes research using the EHR
 - The legal EHR
 - Personal Health Record (PHR)
 - Safety, security, ethical issues, and HIPAA safeguards for the EHR
- What are the attitudes of students of health and rehabilitation toward EHR technology before taking the EHR course and after taking the course?

- Do students of health and rehabilitation professions feel confident enough with electronic health record technology to
 - Participate on a team or committee to develop an EHR?
 - Lead a team or committee to develop an EHR?
 - Access data from an EHR for research purposes?
- Did the content of the course meet the expectations and needs of students of health and rehabilitation professions?

1.4 DEFINITION OF TERMS

Collaborative: To work jointly with others or together especially in an intellectual endeavor.

Competency: The ability to do something well or to a required standard.

Contraindication: Something, as a symptom or condition, which makes a particular treatment or procedure inadvisable.

CPOE: Computerized Physician Order Entry

EHR: Electronic Health Record.

EMR: Electronic Medical Record.

HIPAA: Health Insurance Portability and Accountability Act

HIT: Health Information Technology.

Interdisciplinary: Involving two or more academic subjects or fields of study.

Interoperable: Ability of a system to use the parts or equipment of another system.

IOM: Institute of Medicine

JCAHO: Joint Commission on Accreditation of Healthcare Organizations

ONCHIT: Office of the National Coordinator for Health Information Technology

2.0 REVIEW OF LITERATURE

2.1 EHR FUNCTIONALITY AND ADVANTAGES

The Institute of Medicine defines an EHR system as: “a (1) longitudinal collection of electronic health information for and about persons, where health information is defined as information pertaining to the health of an individual or healthcare provided to an individual; (2) immediate electronic access to person- and population-level information by authorized, and only authorized, users; (3) provision of knowledge and decision-support that enhance the quality, safety, and efficiency of patient care; and (4) support of efficient processes for healthcare delivery [6].” Currently there are various forms of an EHR that have different functionality throughout the industry and among vendors; therefore the IOM has identified eight core functionalities that an EHR needs to have:

- Health Information and Data
- Results Management
- Order Entry/Management
- Decision Support
- Electronic Communication and Connectivity
- Patient Support
- Administrative Processes
- Reporting and Population Health Management

Physicians need to have access to patient health information and data in order to make appropriate clinical decisions. Having the capability to manage test results, such as laboratory and radiology results, electronically have many advantages over the paper method. The results are able to be viewed by the physician when and where they are needed, which allows a quicker diagnosis and treatment of the medical problem. Physicians are able to see that a test has already been ordered which would decrease redundancy in test ordering and decrease costs of unnecessary retesting. Electronic test results are also easier to interpret by physicians. The ability to view physician consults and patient consents allows for better coordinated care among multiple providers and facilities [4]. The format in which data can be displayed and viewed can be customized with the EHR to allow physicians of various specialties to see the information that they are the most interested in and need [7]. Order entry/management eliminates lost orders, illegible handwriting errors, monitors for duplicate orders, and creates efficiency in the process so that it takes less time to fill the orders. The use of Computerized Physician Order Entry (CPOE) has proven to be effective and the IOM cites a study by Bates and Gawande (2003) that have shown that even simple systems have reduced medication errors by up to 83 percent by automatically checking medication dose and frequency, displaying relevant laboratories, and checking for allergy and drug interactions. There are also other financial benefits demonstrated by the savings on preprinted forms that are necessary in a paper-based system. Decision support systems can assist physicians to make better clinical decisions with drug prescribing, adverse events, disease outbreaks, and healthcare prevention [2].

Electronic communication and connectivity is critical particularly for those with chronic conditions who have multiple providers at multiple locations who need to coordinate care plans. Improved communication among the laboratory, pharmacy, and radiology departments can also

improve patient safety and the quality of care a patient receives. There are also many advantages over paper with the administrative processes. Electronic scheduling systems create efficiency and timely service to patients. Authorizations and validation of insurance eligibility can eliminate delays, confusion, and paperwork, and improve the billing and claims process. Various reporting needs to occur at the federal, state, and local levels for patient quality, safety, and public health purposes, and with a paper-based system extracting the data manually is time consuming and allows room for error. With electronic standardized terminology and in electronic format, this would reduce costs, increase accuracy, and reduce the time needed to collect the data to report [2].

There are needs and benefits for information technology in the healthcare system for both patients and clinicians. Physicians could eliminate handwriting errors and send their orders directly to the pharmacy by using Computerized Physician Order Entry systems (CPOE). Medical errors could be reduced by the use of decision support tools that would check for drug interactions as well as dosage levels and allergies. The cost of drugs could be compared with other treatments and also checked against the patient's health plan drug formulary. Clinicians could receive alert reminders for preventative care treatments, testing, alerts about various treatment procedures and guidelines associated with the diagnosis. Along with providing the decision support tools, such as reminders and alerts that can help to prevent medical errors, the use of electronic health records would allow clinicians to learn from each other and share knowledge about the latest treatment options for a particular medical condition [1]. Clinicians would have access to laboratory results, medical history, medications, etc. simultaneously from multiple locations without the need for pulling and transferring a patient medical chart. Documentation would be more efficient for clinicians with standard fields, which would also

allow clinicians to be able to query the fields to search for like diagnoses for example for research purposes [8].

There are privacy and security advantages of using EHRs over paper-based medical records systems. One advantage is that there will no longer be a middleman to access, retrieve, or deliver patient information. Searches can be performed in the system by the person needing the information for each patient. EHRs eliminate the need for shredding of paper, the risk of improper shredding and disposal procedures, and persons performing the disposal having access to paper records. Role-based access allows persons access to only the parts of the medical record for which they need to have access. This eliminates a person having access to an entire medical record which occurs in a paper-based record system. EHRs allow for greater accountability since they contain audit features which provide a record of who viewed or entered information and from where this information was viewed or entered. This tends to deter individuals from viewing confidential information if they know that others can audit the information that they have accessed and may require an explanation. Digital signatures can be used to validate the authenticity of the contents of the medical record. In paper-based medical record systems, pages or contents of records could be removed or altered. Faxing of medical records is not necessary in an EHR. In an EHR, the information is available electronically when and where the person needs it. This method will avoid information being sent to an incorrect faxed location, and avoid unnecessary access by additional persons faxing and receiving faxed information for others. EHRs are able to be electronically encrypted so that if lost or stolen accessibility to confidential medical information is denied. In a paper-based medical record, if paper records are lost or stolen there is opportunity for photocopying of the records or replication and distribution of confidential information. EHRs allow the capability of appointment reminders to be sent to

patients electronically via email or text messages to mobile phones rather than a receptionist sending a post card and having access to information that they do not necessarily need to know [9].

Patients and consumers of healthcare want to know their options. They want access to their health information in order to have choices in treatment. With widespread use of the internet and affordable access to the internet, patients are researching their options online and are receiving healthcare information to discuss with their providers. Patients desire the knowledge to be able to make well informed decisions about their care with their physicians [1]. The use of the EHR will allow patients to receive reminders from their physicians regarding preventative care, interpretations of test results and diagnoses, and information regarding the medications that they have been prescribed. This will allow the patients to learn about contraindications and drug interactions related to the medications prescribed, and allow them to compare costs of medications which can lead to a decrease in expenditures for consumer medications. With the availability and power of this knowledge, patient outcomes may improve and this would create higher patient satisfaction with the treatment and care from their healthcare provider [8].

There are also benefits for health service researchers and for public health officials. In order to move forward with public health initiatives such as bioterrorism surveillance, public health monitoring, quality monitoring, and research, health information technology can be widely adopted, standardized, and compatible to facilitate information being collected and shared.

The recent loss of medical records in the Gulf Coast area due to hurricanes, particularly Hurricane Katrina, further demonstrates the need for EHRs and portable health information. The Office of the National Coordinator for Health Information Technology (ONC) within the

Department of Health and Human Services facilitated the creation of an online pharmacy service KatrinaHealth.org. The American Medical Association (AMA), Gold Standard, the Markle Foundation, RxHub, SureScripts, and the Louisiana and Mississippi Departments of Health were primary data contributors to this project along with 150 other organizations. This is a secure online service that allows authorized physicians and pharmacies to retrieve medication and dosage information of evacuees from the Gulf Coast area online from anywhere in the United States [10]. According to a statement made by Mike Leavitt, Secretary of Health and Human Services on October 7, 2005, "...I've been told that 40 percent of the evacuees were taking prescription medications before the storm hit. People were displaced without their medications and, in many cases, had no better understanding of what they were taking than to describe it as "a little, oval-shaped purple pill." "...A woman with breast cancer was able to resume her treatment regimen. A man who took insulin was able to resume his dosage and avoid a diabetic coma. These are just two of the many stories we have heard about how the collaborative breakthrough saved lives [11]." David Brailer, PhD, MD also stated during the American Health Information Management Association (AHIMA) 77th Convention and Exhibit that "The online pharmacy service KatrinaHealth.org is proof of 'what could be done and what has to be done [12].'"

Although the benefits of the EHR are many for patients, healthcare providers, and researchers, there are challenges such as standards, terminology, interoperability, privacy, and security that need addressed and solutions developed before these systems can be implemented nationwide to meet President Bush's vision.

2.2 CLINICIAN ATTITUDES TOWARD EHR

An important factor to consider when implementing an EHR is the attitude of the users of the system toward the use of EHRs and toward computers and technology in healthcare. The attitude of healthcare professionals is vital to the success of a new system or technology. The design and implementation of an EHR can absorb a lot of resources and it is necessary for the healthcare professionals who will use the system to have a positive attitude in order for the project to be successful.

“Nurses contact nearly every other care provider, and the attitudes and perceptions of nurses significantly influence the perceptions of other providers and how they use the EMR.” Nurses often serve as an information resource for other healthcare providers, and are often asked to answer questions regarding use of the EHR [13]. Unfortunately, there is much resistance to technology among nurses. “Many organizations in the process of introducing online clinical documentation and other nursing functionality have experienced resistance – at least initially – from the nursing staff.” Nurses tend to resist technology because they perceive that it takes away from providing patient care and interrupts their workflow [14]. Nurses are also concerned about their workload and fear that the use of the EHR will only increase their already busy workload [15, 16] They fear that online charting will take more time than charting on paper [13, 15].

A study by Moody et al in Southwest Florida in 2004 examined the attitudes of hospital nurses toward their current electronic health record system, and the majority of respondents in the study had a positive attitude toward EHR technology after exposure to it. Of the nurses surveyed, 81 percent indicated that the EHR would be more of a help than a hindrance to patient care, 76 percent of them indicated that the EHR will lead to improved patient care over time, 75 percent indicated that documentation was improved with use of the EHR, 54 percent indicated

that patient privacy was less compromised with use of the EHR over the paper medical record, although the majority (64%) did not believe that their workload decreased by using the EHR system [17].

2.3 TECHNOLOGY IN CLINICAL EDUCATION

Kirkley et al sites the American Nurses Association (ANA) statement that “informatics competencies are needed by all nurses, whether or not they specialize in nursing informatics.” The Institute of Medicine (IOM) 2003 report *Health Professions Education: A Bridge to Quality* states that “All health professionals should be educated to deliver patient-centered care as members of an interdisciplinary team, emphasizing evidence-based practice, quality improvement approaches, and informatics.” Nurses need more than basic computer skills to be able to function with an EHR system. High level cognitive function skills need to be taught in nursing education programs in order for nurses to be able to manage information with technology and document patient care in EHRs [15]. Learning healthcare technology in the classroom would greatly enhance the nursing profession and make the transition to the EHR much smoother and create less of a learning curve if nurses had experience with technology before they began to see patients in the clinical setting [14]. Without implementing healthcare technology in the education program, it will be up to the employer to ensure the competency of the nurses and they will need to train, educate, and provide them with the necessary skills to function as their staff [18]. This puts a great burden on the employer with regard to cost and resources to properly train and keep an up-to-date training program. In order to remove the barriers to technology we need to involve nurses in the design and implementation of the system, demonstrate how the EHR leads to

improved quality of patient care, provide technical tools appropriate for mobility and ease of use (such as laptops or PDAs), and introduce technology in the educational setting in nursing schools so that nurses will have had experience with using these systems prior to working in the field [15].

The literature suggests that nurses are mostly supportive of the concept of an EHR system, but are mostly concerned about the effects that using an EHR will have on direct patient care and the nursing staff. This suggests that proper training of nurses in the areas of computer literacy and functionality of an EHR will have an impact on their attitudes and will motivate nurses to be supportive of EHR technology [19, 20]. There is a need for nurses to possess basic computer skills in order to be able to function effectively as the new knowledge workers using the EHR. Computer literacy is becoming just as vital with the EHR as reading and writing skills are with paper charting. "Computer literacy is defined as 'the ability to exchange information with computers at the level appropriate to the problem the user wishes to solve.'" In a needs assessment and curriculum development study conducted by Inman et al at a mid-western large tertiary care facility, respondents (1,144 respondents/28 percent response rate) identified that basic skills in Windows and Macintosh environments, email, printing, and accessing the areas of the Intranet as the areas needing the most educational training in their facility. Participants also identified hands-on training in a classroom setting to be the most effective method of training to meet their educational needs, and instruction sheets were also noted as being helpful to adult learners [21].

Roger Marion, PhD from the University of Texas Medical Branch has developed the Health Information System Simulation (HISS) project that teaches patient problem solving, treatment planning, and diagnostic skills to medical, nursing, and allied health students through

simulated patient cases in a computerized patient record. The electronic patient record (EPR) includes patient histories, laboratory results, and graphical images of diagnostic tests such as X-rays, EKGs, CT scans, and photographs. This system helps students to learn diagnosis and treatment planning skills, and students are able to interact with the simulated patients as well as with students in other disciplines through networked computers. The project has expanded to include video and sound clips of patient evaluations and interviews. This project has been shared worldwide and is now called the Worldwide Health Information System Simulation Linkage (WHISSL), and faculty from various universities are able to create specific case studies of their own to be added to the program and shared with their classes of students as virtual case study assignments [22].

The University of Kansas - School of Nursing recognizes the need for educating health professional students in the conceptual and practical applications of electronic health record technology and has partnered with Cerner Corporation to create SEEDS (Simulated E-hEalth Delivery System) to give their students a competitive advantage in the workforce. This system includes Cerner's full clinical data repository, clinician order entry, documentation, decision support tools, PowerChart application for patient entry and charting, but is adapted for use in an educational environment. The teaching strategy used is problem-based learning using virtual patients and virtual case studies, and teaches data-driven thinking and data management, which provides the foundation of evidence-based practice. This model provides students with immediate feedback as they work through the case studies. This pilot project was integrated into the curriculum of undergraduate nursing students in August 2002, and some activities will be extended to the Schools of Medicine and Allied Health [23]. Per correspondence with one of the authors regarding the current status of these activities in the fall 2005 they are just beginning to

implement these activities in the School of Allied Health. Physical Therapy has demonstrations of the acute care EHR in one course, but students are not currently using it. They just obtained software for record management and are exploring the use with the faculty in their Health Information Management baccalaureate program [24]. In the School of Nursing, students and faculty were satisfied with the new learning strategies and use of technology, and students reported greater collaboration with faculty and classmates, quick feedback on their work, and found the assignments interesting. “Clearly the nursing programs that promote and enhance the use of technology to support practice will attract the technology-age students who are graduating from high schools today.” This attraction of technology-age high school students can begin to peak the interest in the nursing field and assist in alleviating the nursing shortage [23].

Williams et al, in their study of a group of junior and senior occupational therapist students [1995], found that most of the students believed in the value of the use of computers in their field to save time and create efficiency in their work. The students considered themselves to have a low level of computer literacy, but strongly desired increasing their computer knowledge particularly in the curriculum and during clinical rotations [25]. Another study by Schumacher et al, 1997 further reiterates the need for allied health students to be educated in computers in order to be successful with computer documentation systems. They even suggest that those who plan the curriculum for allied health students consider including an introductory keyboarding course into the curriculum to enhance students skills with the use of computers and documentation. Key results of this study showed that the 53 therapists who participated in this study had positive attitudes about the use of computer documentation systems, but did have some mild anxiety regarding computer use that dissipated with time after using the system. Occupational therapists had the most positive attitudes toward computer documentation and the least anxiety toward

computers in the study, followed by physical therapists, and then speech therapists. Some other interesting results of their study showed that after six months of using a computer documentation system over a paperbased system, therapists began to use email, word processing, developed schedules, and used the computer for a variety of purposes more frequently than they had in the past [26].

Physical therapists are also realizing the need for decision support and clinical information systems in their practice. Physical therapists would like to perform and have access to information provided by general health screenings to determine if a patient has nonmechanical sources of pain and dysfunction. This would help to determine whether the patient is an appropriate candidate for physical therapy treatment, or whether they should be referred to another health professional for more appropriate treatment [27]. The literature suggests that checklists and questionnaires for collecting information about a patient's general health are being formed, and this is a beginning to address the need for standardized information specific to the physical therapy profession for use in an EHR. Zimny and Tandy describe how a health history screening coupler called the Physical Therapy Screening History Coupler (PTSHC) was built for use in an outpatient physical therapy practice. This system enables physical therapists to link findings with diagnostic management options and to search literature from a "knowledge network" that identifies the association between management options and diagnoses [27]. Standards need to be determined to identify what fields of information should be included and are relevant to physical therapists for a general health screening. As with nurses, physical therapists will need to realize the benefits of using a computerized decision support system before it will become widely used in their profession [27].

The University of Michigan School of Social Work has also developed a prototype information system that can support the social work health profession and allow electronic sharing of patient information among diverse healthcare disciplines in a computerized database. Since the role of the social worker focuses on the integration of hospital, family, and community resources, patient care and prevention, and planning of patient discharges, effective decision-making and documentation of the social worker has a great effect on cost control and quality of patient care. Therefore, it is important that patient medical information be available and maintained accurately and up-to-date for when the social worker needs to provide their services. Mutschler states that “To obtain an effective multidisciplinary patient record system, each discipline of health care providers must participate in the development of the system and become skilled in its application.” Along with the importance of participation of healthcare professionals in system development, Mutschler also states that “.....there are few resources designed to train clinicians in computerized information systems and in developing effective computerized patient records.[28]”

2.3.1 Need for EHR Education

A study by Patel et al examines the perceptions of student participants of the National Library of Medicine (NLM)-sponsored Woods Hole Medical Informatics (WHMI) course at the Marine Biological Laboratory (MBL) in Woods Hole, Massachusetts. This course focused on participants such as physicians, librarians, administrators, and educators who were not knowledgeable in the field of medical informatics, but may be able to lead and implement change in their institutions. The study used a mixed methods approach of data collection through interviews as well as questionnaires and participant observation. The focus of the study was on

both short-term and long-term perceptions of students who took the course to help identify appropriate training methods and evaluate new curriculum in the new and growing medical informatics field. The authors identify the importance and need for evaluation of new curricula and training in medical informatics which supports the purpose of this study [29].

As the literature suggests, there is a need for health and rehabilitation professionals to be educated in technology in order to be successful practitioners of the future, particularly with the advent of the EHR. The literature also suggests that there is a lack of training in technology in the educational curriculum for health and rehabilitation professionals. Both of these needs serve as the basis and foundation for conducting this study. This study of students taking the online course on EHR technology at the University of Pittsburgh will begin to examine the educational gaps that currently exist in today's curriculum. This study will examine the need for technology in health and rehabilitation education; the changes in attitude of health and rehabilitation students toward the use of EHR technology in healthcare before and after taking the course; and the effects that education in EHR technology has on the comfort level and competence of health and rehabilitation students to participate in EHR projects as members of interdisciplinary teams.

3.0 METHODOLOGY

The study will be conducted utilizing a convenience sample of the health and rehabilitation professional students at the University of Pittsburgh who choose to take the elective course *Electronic Health Record Technology*. A mixed methods approach will be used utilizing both quantitative and qualitative methods of data collection. Several different questionnaires will be developed to collect the data for this study. The first questionnaire will collect demographic information at the beginning of the course (See Appendix A for Demographic Questionnaire). A pre/post test instrument will be administered before and at the end of the course to evaluate the use, experience, attitude toward, confidence, and comfort level with using an EHR before and after taking the course (See Appendix B for EHR Technology Student Questionnaire). Module tests of each module will be administered pre/post module to evaluate student knowledge of module content to assist in determining the effectiveness of the course content (See Appendix C for a sample Practice Exam for Module 1). Qualitative interviews will be conducted at the end of the course with students taking the course via telephone call or in person as convenient for the student. (See Appendix D for Interview Questionnaire). The analysis of the data collected through all methods of data collection will determine the effectiveness of the interdisciplinary online course; which components of the course students found most useful to them; which aspects of EHR technology were missing from the course, or how the course could be improved; if attitudes toward EHRs change before and after taking the course; examine the comfort level of

students with EHR technology who took the course, and how this knowledge can be utilized in current professional health and rehabilitation roles. Analysis of the data will consist of frequencies and percentages of the demographic information for each student; means and medians of the ordinal data for the EHR technology questionnaire; average gain in exam scores both pre and post module; and a qualitative analysis of common themes for the interview data.

4.0 RESULTS

There were thirteen (13) participants in this study who took the course *Electronic Health Record Technology*. Of the participants who took the course, females were dominant participants (10, 76.9%) compared to the males (3, 23.1%). The majority of the participants were under the age of 29 years (11, 84.6%), with the rest of the participants in the 30 – 39 years age group (2, 15.4%). The course was offered to both undergraduate and graduate students with no prerequisites; however, more students at the graduate level chose to take the course (10, 76.9%) over students at the undergraduate level (3, 23.1%). The participants represented a variety of program majors including Audiology (3, 23.1%), Rehabilitation Science (3, 23.1%), Social Work (2, 15.4%), and Health Information Systems (5, 38.5%). The participants were asked if they were currently working in the healthcare field or had ever worked in the healthcare field, and in what type of healthcare settings. The participants were closely divided with those currently working in the field (6, 46.2%) opposed to those not currently working in the field (7, 53.8%). The results were much the same with past work experience in the healthcare field with participants who previously had worked in the healthcare field (7, 53.8%) opposed to those who did not previously work in the healthcare field (6, 46.2%). The diverse settings noted of those who either are currently working or had previously worked in the healthcare field are as follows: hospitals, health centers, assisted living facilities, health insurance, healthcare vendors, physical therapy,

audiology, and long-term care. All of the participants who reported working in the healthcare field reported working for less than five years.

When students were asked why they choose to take this course, four main reasons emerged from the results as shown in the table below. Some students reported more than one reason; however, they all were captured within these four categories. The predominant reason (9, 69%) was the importance of technology, particularly EHR technology, within the health care field. Students noted by their comments that they knew that they needed to have knowledge in this area in order to pursue a future career in healthcare. The second most popular reason (5, 38%) noted was that this course sounded very interesting and beneficial to them. The other reasons noted for taking the course were for a different outlook on healthcare and prevention of medical errors (1, 8%), and the appeal of the online course format (1, 8%).

Table 4.1: Reasons for Taking Course

Reason #1:	Important role in health information systems. Learn more about technology, and the use of technology in hospitals. The EHR is a valuable asset and to increase internship opportunities. The importance of computers and being up-to-date on EHR technology. Preparing for paperless hospital work environment and to learn more about EHR technology. To gain familiarity with the EHR, the future of the health system. The right choice for a degree in Health Information Systems. To be better prepared for a career within the health field after graduation. For a career in Health Information Management there is a need to know everything that there is to know about the EHR.
Reason #2:	Interesting and helpful. Interesting learning experience. EHR technology is interesting to me. Interesting and beneficial. Interesting.
Reason #3:	Different outlook on healthcare and preventing medical errors.
Reason #4:	The online class format is appealing for busy schedule and to meet graduation requirements.

When students were asked what they expected to obtain from taking this course, four main reasons emerged. One of the two primary reasons (6, 46%) is that they expected to have a better understanding of the current status, issues, and challenges of the EHR with regard to HIPAA regulations, privacy issues, safety, terminology, standards, and the effects these will have on the patient and practitioner. The other one (6, 46%) is that they expected to learn how to implement and become skilled with EHR technology as a practitioner for efficiency. Students were interested (3, 23%) in learning about the advantages over and differences between paper and paperless records management. Students were also interested (3, 23%) in health information systems with regard to what the EHR is and how it will be implemented and used.

Table 4.2: Expectations from Taking Course

Expectation #1:	Better understanding of current status, issues, and challenges of EHR. How to use the EHR while complying with HIPAA regulations. Privacy issues and the responsibilities of the practitioner. Learn EHR terminology and standards. Effects on patients and if it provides better quality of care. The impact on patient health, safety, and privacy.
Expectation #2:	In-depth knowledge of EHR systems and how they function to assist healthcare personnel. To become skilled with the EHR to make work time more efficient. The processes with medical documentation. To use and implement EHR technology as a practitioner. Skills that allow me to work more efficiently in a clinical setting. How to use the EHR to analyze patient data.
Expectation #3:	A minimum level of knowledge of EHR management as it moves from paper to paperless. To learn advantages of EHR over paper. The positive and negatives and why change from paper.
Expectation #4:	The implementation and use of the EHR. The application of the EHR in health information systems. What the EHR is and how it is applied in health information systems.

The results of the usage of the EHR from the EHR Technology Student Questionnaire before taking the course showed that 15 percent (2) of students had used an EHR and 85 percent (11) of the students had not used an EHR to perform their job. Of the 15 percent (2) of students who did use an EHR, they used it for less than one year in acute inpatient, outpatient, and rehabilitation settings. The functions that they reported using the EHR for included chart review, documentation, referral management, and communications and remote access. Some of the students reported that the EHR systems that they used were interfaced with a laboratory system, hospital information system, and one reported other systems, but was not aware of the type of system.

The results of the survey after taking the course showed that an additional 16 percent of students now use an EHR to perform their job with results of 31 percent (4) using an EHR and 69 percent (9) of students not using an EHR. Of the 31 percent (4) who reported using an EHR to perform their job, half of them (2) reported using an EHR for less than one year and half (2) reported using one for one to two years. The additional functions that they reported using an EHR for that were not reported before taking the course include security, results review and reporting, and coding and charge capture. A practice management system was reported as being interfaced with the EHR system in addition to the other systems previously mentioned on the pre-course questionnaire results.

The attitude of students toward EHR usage was captured on the EHR Technology Student Questionnaire using a likert scale and the results are displayed in Table 4:3. Questions were given based on three primary areas of interest: attitude regarding an EHR course, attitude regarding the use of and importance of an EHR in healthcare, and comfort level with an EHR. The pre- and post-course attitude results were examined with a Wilcoxon test and only one result proved to be statistically significant at a two-tailed significant level, which was the statement that “the use of the EHR will improve patient care” ($Z = -1.930$, $p < .05$). However, the statement that “the EHR will improve the accuracy of information that I receive” approached significance ($p < .10$) at a two-tailed significance level and demonstrated significance ($p < .05$) at a one-tailed significance level. Although most of the results were not statistically significant, most changes of attitude were in the right direction. Participants were generally positive already on the pretest which could explain the lack of significance toward a change in attitude.

Table 4.3: Attitude toward EHR Usage Results

Statement		Strongly Agree	Agree	Neither Agree or Disagree	Disagree	Strongly Disagree	Not Answered	Z	p
Interaction of multiple disciplines in a class will increase my learning experience presenting different perspectives/issues related to the EHR course content.	Pre	4	8	1				-1.000	.317
	Post	6	7						
The EHR technology course is a necessary course for all health and rehabilitation professionals.	Pre	5	7	1				.000	1.000
	Post	7	4	1	1				
It is important to utilize technology in the health and rehabilitation program curriculum.	Pre	8	5					-.707	.480
	Post	10	3						
I will be able to apply the material that I have learned about EHR technology to make my job easier to perform.	Pre	7	6					-1.473	.141
	Post	4	6	3					
I find use of an EHR easier for retrieving patient information	Pre	6	7					.000	1.000
	Post	7	5	1					
My job will be more satisfying using an EHR.	Pre	3	3	7				-1.232	.218
	Post	3	8	2					
I will perform my job better using an EHR.	Pre	2	4	7				-.855	.392
	Post	4	4	5					

Statement		Strongly Agree	Agree	Neither Agree or Disagree	Disagree	Strongly Disagree	Not Answered	Z	p
I will make better treatment decisions using an EHR.	Pre	2	5	6				-.306	.760
	Post	2	8	2		1			
I will accept the changes in workflow required in order to use an EHR.	Pre	3	8	2				-1.265	.206
	Post	6	6				1		
The EHR will improve the accuracy of information that I receive.	Pre	6	5	2				-1.667	.096
	Post	9	4						
It is important that EHRs are implemented.	Pre	4	8	1				-1.508	.132
	Post	8	5						
Use of the EHR will improve patient care.	Pre	5	6	1	1			-1.930	.054
	Post	11	1	1					
Use of the EHR will reduce medical errors.	Pre	6	5	2				-1.265	.206
	Post	8	5						
I will need more help from others to use an EHR.	Pre	5	7	1				.073	.942
	Post	4	7		1		1		
I will spend less time searching for information with an EHR.	Pre	3	8	2				-1.265	.206
	Post	6	5	1			1		

Statement		Strongly Agree	Agree	Neither Agree or Disagree	Disagree	Strongly Disagree	Not Answered	Z	p
Benefits of EHR implementation outweigh the costs.	Pre	2	5	6				-1.058	.290
	Post	5	4	3			1		
I am comfortable enough to participate on a team/committee to implement an EHR.	Pre	4	4	2	2	1		-.183	.855
	Post	3	6	2	1	1			
I am comfortable enough to lead a team/committee to develop an EHR.	Pre	4	2	2	5			-.516	.606
	Post	3	3	4	3				
I am comfortable with accessing data from an EHR for research purposes.	Pre	3	7	1	2			-.171	.864
	Post	4	7		1	1			

The results of the pre/post module tests of the content areas showed a total average gain improvement of 36.29 percent after taking the course. The table below depicts the pre/post tests mean scores for the class in each content area as well as the average gain between the pre and post module scores. Students were the least knowledgeable before taking the course in the areas of design and development of the EHR (46.15%), clinical terminology (47.69%), and the legal EHR (46.92%). The areas that students were most familiar with before taking the course were in privacy, security, ethical issues, and HIPAA safeguards for the EHR (73.81%), implementation and management of the EHR (67.69%), and outcomes research (63.08%). Students had the least

improvement demonstrated by the average gain in the areas of privacy, security, ethical issues, and HIPAA safeguards (15.08%), implementation and management of the EHR (26.15%), and outcomes research (30.77%). Students had the most improvement in the areas of design and development of the EHR (48.35%), clinical terminology (47.69%), and patient safety and the EHR (44.62%). Although the privacy, security, ethical issues, & HIPAA safeguards for the EHR module did not reach a level of significance with a two-tailed test, it did reach significance ($p < .05$) with a one-tailed test. One reason for this difference may have been that one student took the pretest, but did not take the posttest for this module. A paired-samples t test was calculated to compare the mean pretest scores to the mean posttest scores of the modules. The mean of the pretest scores was 55.82 (sd = 5.37), and the mean of the posttest scores was 92.11 (sd = 7.48). A significant increase from pretest to posttest was found ($t(12) = -16.45, p < .001$).

Table 4.4: Pre/Post Module Evaluation

<i>Content</i>	<i>Pre-Test Mean</i>	<i>Post-Test Mean</i>	<i>Std. Dev.</i>	<i>Average Gain</i>	<i>p-value</i>	<i>t-value</i>
<i>Design & Development of the EHR</i>	46.15%	94.50%	19.81	48.35%	.000	-8.800
<i>Implementation & Management of the EHR</i>	67.69%	93.85%	18.95	26.15%	.000	-4.977
<i>Standards, Data Elements, Structure, & Content</i>	53.85%	86.92%	19.32	33.08%	.000	-6.174
<i>Clinical Terminology</i>	47.69%	95.38%	20.88	47.69%	.000	-8.236
<i>Patient Safety & the EHR</i>	52.31%	96.92%	16.64	44.62%	.000	-9.667
<i>Outcomes Research</i>	63.08%	93.85%	19.35	30.77%	.000	-5.734
<i>The Legal EHR</i>	46.92%	88.46%	25.77	41.54%	.000	-5.812
<i>Personal Health Record (PHR)</i>	50.00%	89.74%	18.68	39.74%	.000	-7.670
<i>Privacy, Security, Ethical Issues, & HIPAA Safeguards for the EHR</i>	73.81%	88.89%	26.50	15.08%	.074	-1.971
<i>Mean of all modules</i>	55.82%	92.11%	7.95	36.29%	.000	-16.45

The qualitative post-course interviews of the course participants identified strengths and weaknesses of the course, and participant expectations and suggested changes for the course. Of the thirteen participants, eleven subjects participated in the post course interview process via telephone or in person. Table 4:4: Course Evaluation demonstrates participant comments made followed by the number of times the comment was made in parentheses for each area. The course structure was the primary strength of the course, with the audio presentation as the predominant strength of course structure noted by the participants. The assignments were the

primary weakness of the course. Participants noted the time to complete assignments or having too many assignments as a weakness. The other primary weaknesses were that there were not enough hands-on assignments with vendor software programs and that the discussion board assignments were too specific and did not allow for more class interaction. The predominant change that participants would like to see made with the course is to have more hands-on assignments with vendor software programs. The majority of course participants were satisfied with the content of the course and felt that this was a good course and a good overview to EHR technology.

Table 4.5: Course Evaluation

	<i>Strengths</i>	<i>Weaknesses</i>	<i>Expectations</i>	<i>Changes</i>
<i>Course Structure</i>	<p>Audio presentation (7). Lecture notes (4). Online/Flexibility (2). PowerPoint Slides (2). Nicely organized (1). Gave references (1). Use of Courseweb features (1). Meeting in-class for demonstration (1). Good use of non-traditional learning tools (1).</p>	<p>More in-class meetings (2). Could only listen to audio while online (1). PowerPoint slide background too dark (1).</p>		<p>Citations at end rather than on slides (1). Prefer bulleted notes (1). More hands-on for in-class demonstration (1). First day an in-class session (2). More in-class meetings (2). Downloadable audio to listen to offline (1).</p>
<i>Assignments</i>	<p>Assignments good (4). Discussion boards (1). Learn by yourself through research forces you to learn the material (1).</p>	<p>Time to complete assignments (6). More hands-on assignments with vendor software (4). Assignment expectations not known (3). Too many assignments (4). Discussion board assignments too specific (4). Assignments differ from module material (1).</p>		<p>More hands-on assignments with vendor software (8). More detail on assignment expectations (1). More time to complete assignments (3). Less assignments (1). More diverse assignments (3). Discussion board assignments less specific to allow for more interaction (1).</p>

Content	Good overview (3)	More detail needed (1). Topic itself broad, ever-changing, relatively new (1).	Good overview (6). Helped in internship job (1). Learned a lot (3). Went into good detail (5). More detail needed (2). Not as expected from course description (2).
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Participants were asked if their attitudes toward the EHR changed as a result of the course and if so, how. In general participants already had a positive attitude toward the EHR, although 64 percent (7) interviewed said that it did change their attitude in a more positive way and they would be more likely to implement one now. Below are some examples of a few of the participant comments:

It did. I learned a vast amount of information about it and importance of it. Without interconnection between health systems we cannot function. It really is important and is the new wave of the future.

I always knew it was important to have an EHR, but now I think that it is an essential element and that everyone should have an EHR. I really liked the course because it really made you put your thinking cap on.

I think I would be more likely to implement one now that I understand all of the different facets of it, and where to research information within one.

I had no attitude toward it in the beginning, but now see it as a more positive thing. If I were looking for a job I would view a job opportunity as a better opportunity than another if they had an EHR system.

Of the 36 percent (4) of participants interviewed that said that it did not change their attitude, only one participant stated that it did not because they had no hands-on experience in the course. The remainder of the 36 percent stating no change in attitude noted that they already had an

understanding of it and felt that EHR technology was a positive evolution. Participants were asked if they felt more confident using an EHR than before taking the course, and 55 percent (6) responded that they did feel more confident, while 45 percent (5) responded that they did not feel more confident. Of the five participants who did not feel more confident, three participants noted that it was because they did not have hands-on experience using an EHR, while the other two participants noted that it was because they already knew about EHR technology before taking the course and had an understanding of it. One participant commented:

I would be much more likely now to suggest an implementation of an EHR system and be a part of doing it.

When participants were asked in what specific areas of EHR technology that they were more confident they noted the areas illustrated in Figure 4:1.

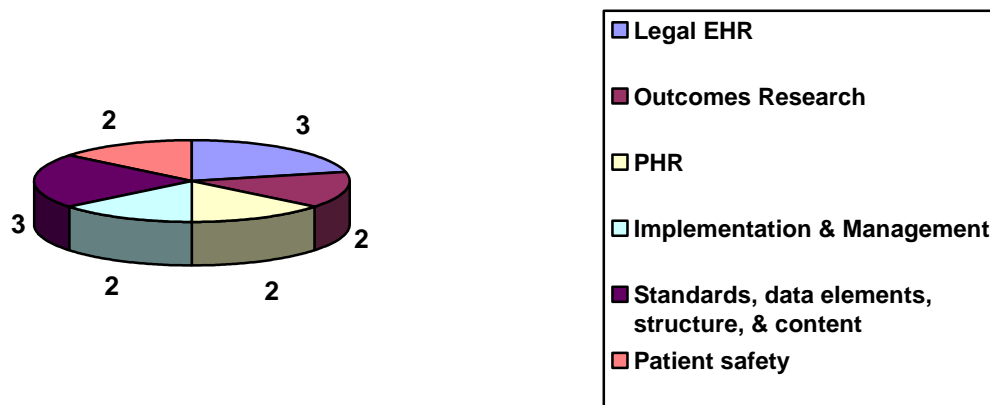


Figure 4.1: Participant Interview Confidence Results

Of the participants interviewed, 91 percent (10) noted that their increased knowledge of EHR technology would help them in their career, whether they were currently working in the field or would be in the future, and that the adoption of the EHR would have a beneficial impact on their

work responsibilities. The primary reason noted that it would help them in their career was for better management of patients. Participant comments included:

In the long term it will be absolutely beneficial.

It would definitely benefit my responsibilities. Sometimes there is a problem keeping up with files and legibility is a huge issue.

It will be a positive influence in the workplace. It will save time and keep costs down.

All participants unanimously agreed that although this course focused on the health and rehabilitation student that it could be a course for any person interested in learning more about EHR technology. Some participant comments included:

Before taking the course I did not know much, but now I feel like I really know about it and why we need it so that people can benefit from it.

This course is beneficial for any consumer of the health system.

5.0 DISCUSSION

Although the results of the pretest and posttest module evaluations demonstrated some familiarity with EHR technology the participants who took the course showed significant gains in their knowledge in almost all content areas. This was evidence that the content of the course was appropriate for the participants and demonstrated learning by the participants at a statistically significant level. It is of interest to note that the areas of content that participants had the least knowledge in before the course demonstrated the highest average gain values. Overall, all of the course content seemed to be of value to the participants and I would not recommend removal of any portion of the content to future courses in EHR technology. The content of the course not only met the needs of health and rehabilitation professions, but also was proven to be a course of interest for anyone interested in learning more about EHR technology. It would be interesting to open the course to other health professions including medicine, nursing, pharmacy, and public health for further interdisciplinary evaluation.

The attitude of health and rehabilitation professionals toward EHR technology was very positive before taking the course. The results discussed earlier demonstrated that although they were initially positive they did improve after taking the course and made participants stronger advocates of EHR technology. Participants that did not note a change in attitude was due primarily to the fact that they were already familiar with EHR technology and understood its importance in the future of healthcare before taking the course. This can be further demonstrated

by the attitude statement “It is important that EHRs are implemented” that approached significance with a one-tailed test ($p < .10$).

Although some participants noted that they were more confident with EHR technology to suggest an implementation and be a part of it, none of the results were statistically significant for the following:

- I am comfortable enough to lead a team/committee to develop an EHR.
- I am comfortable enough to participate on a team/committee to implement an EHR.
- I am comfortable enough with accessing data from an EHR for research purposes.

Of these three areas of interest based on pretest and posttest EHR technology survey results participants were most confident in the order that the items are listed above. One reason for this noted by participants could be the lack of more hands-on assignments with vendor software within the course. From the personal interviews it was evident that participants who had access to an EHR through their current jobs or internships were able to reap the benefits of the course and gain confidence more than those who had little or no hands-on experience with an EHR system.

The literature suggests that clinician attitudes are critical to the success of an EHR system, and that clinicians need to realize the benefits of an EHR in order to fully understand and become an advocate of these systems. In order to reach the goals of President Bush’s charge it is necessary to demonstrate the need for an EHR system and illustrate how an EHR can help to eliminate some of the issues with paper-based medical records. Issues such as lost, misplaced, or illegible records need to be remedied in order to avoid medical errors, reduce costs, and improve patient care. The short-term goal of this online course in Electronic Health Record (EHR) Technology was to educate health and rehabilitation professionals in EHR technology and to

identify a model course for health and rehabilitation professionals. The long-term goal is to expand this model in the future to educate health professionals in other health science disciplines. Figure 5:1 EHR Course Model illustrates the content areas, structure, and components that a model course on EHR technology should have based on the findings of this study.

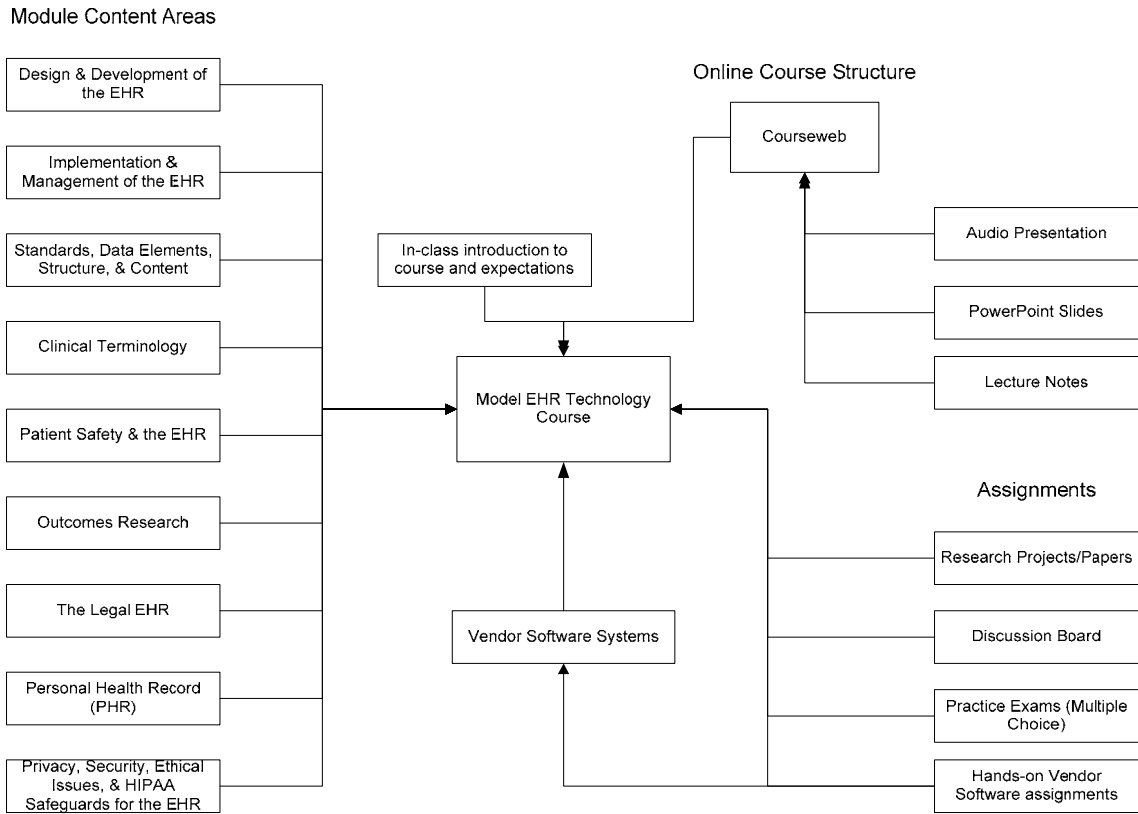


Figure 5:1 EHR Course Model

6.0 LIMITATIONS OF STUDY

The limitations of this study are that the small sample of students cannot be representative of each of the disciplines of all health and rehabilitation professionals within these disciplines. This study is limited to health and rehabilitation professionals at the University of Pittsburgh who participated and took the course and is not representative of all health professionals. The course was an elective course for students and is a limitation because perhaps only students interested in technology chose to take the course.

Further research could be done to investigate the differences in results between students who elect to take the course and students who are required to take the course in the curriculum. Further research could be performed after collecting data on a larger sample of health and rehabilitation professionals from each discipline who took the course after a longer period of time and data collection. Another area of research could be to investigate the results of the use of the EHR course in the curriculum of other health science disciplines such as Schools of Nursing, Medicine, Pharmacy, and Public Health. A future research possibility is that the course will serve as a model EHR technology online course and could be offered online globally and comparisons made on the effects of students taking the course in various geographical areas.

APPENDIX A

DEMOGRAPHIC QUESTIONNAIRE

Please respond to all questions checking only one item per question or noting your response in the text box provided.

1. Gender
 Female Male

2. Age
 Under 29 years 30 – 39 years
 40 – 49 years 50 years or older

3. Degree level pursuing (check only one)
 Undergraduate Graduate

4. Program/Major
 Physical Therapy
 Occupational Therapy
 Speech Language Pathology
 Audiology
 Rehabilitation Science
 Emergency Medicine
 Social Work
 Health Information Management

Health Information Systems

Other

5. Are you currently working in the healthcare field?

Yes

No

If yes, title

If yes, what type of healthcare setting?

If yes, how many total years have you worked in the healthcare field?

Less than 5

5-10 years

10 – 15 years

15 – 20 years

More than 20 years

6. Why did you choose to take this course?

7. What do you expect to obtain from taking this course?

APPENDIX B

EHR TECHNOLOGY STUDENT QUESTIONNAIRE

Please respond to all of the following questions after reading the following definition:

Electronic Health Record (EHR): The Electronic Health Record (EHR) is a secure, real-time, point-of-care, patient-centric information resource for clinicians. The EHR aids clinicians' decision-making providing access to patient information as needed and incorporating evidence-based decision support. The EHR automates and streamlines the clinicians' workflow and efficient communication. The EHR supports data for billing, quality management, outcomes reporting, and public health disease surveillance and reporting.

Section 1: Usage of EHR

1. I have used/currently use an EHR to perform my job

Yes

No

If you answered yes to #1, please answer questions #2-5. If you answered no to #1, please skip to question #6.

2. How long have you used an EHR?

Less than one year

1 – 2 years

- 2 – 4 years
- 4 – 6 years
- 6 – 10 years
- More than 10 years

3. What functions did/do you use the EHR to perform? Please check all that apply.

- | | |
|-----------------------------------------------------|-----------------------------------------------------------|
| <input type="checkbox"/> Chart review | <input type="checkbox"/> Order Entry |
| <input type="checkbox"/> Documentation | <input type="checkbox"/> Referral Management |
| <input type="checkbox"/> Preventative Care Tracking | <input type="checkbox"/> Communications and Remote Access |
| <input type="checkbox"/> Prescription Writing | <input type="checkbox"/> Patient Education |
| <input type="checkbox"/> Security | <input type="checkbox"/> Coding and Charge-capture |
| <input type="checkbox"/> Practice Analysis | <input type="checkbox"/> Paperless Workflow |
| <input type="checkbox"/> Other | |

4. Did/Does your EHR interface with another system? Please check all that apply.

- | | |
|-----------------------------------------------------|------------------------------------------------------|
| <input type="checkbox"/> Practice management system | <input type="checkbox"/> Commercial pharmacies |
| <input type="checkbox"/> Laboratory system | <input type="checkbox"/> Hospital information system |
| <input type="checkbox"/> Radiology system | <input type="checkbox"/> Other |

5. In what type of healthcare setting do you use the EHR?

- | | |
|------------------------------------------|--------------------------------------------|
| <input type="checkbox"/> Acute inpatient | <input type="checkbox"/> Long-term care |
| <input type="checkbox"/> Outpatient | <input type="checkbox"/> Behavioral health |
| <input type="checkbox"/> Rehabilitation | |

Section 2: Attitude toward EHR usage

Please read each of the following questions carefully and select the number which best describes your opinion.

1=strongly agree	2=agree	3=neither agree nor disagree
	4=disagree	5=strongly disagree

6. Interaction of multiple disciplines in a class will increase my learning experience presenting different perspectives/issues related to the EHR course content.	1	2	3	4	5
7. The EHR technology course is a necessary course for all health and rehabilitation professionals.	1	2	3	4	5
8. It is important to utilize technology in the health and rehabilitation program curriculum.	1	2	3	4	5
9. I will be able to apply the material that I have learned about EHR technology to make my job easier to perform.	1	2	3	4	5
10. I find use of an EHR easier for retrieving patient information.	1	2	3	4	5
11. My job will be more satisfying using an EHR.	1	2	3	4	5
12. I will perform my job better using an EHR.	1	2	3	4	5
13. I will make better treatment decisions using an EHR.	1	2	3	4	5
14. I will accept the changes in workflow required in order to use an EHR.	1	2	3	4	5
15. The EHR will improve the accuracy of information that I receive.	1	2	3	4	5
16. It is important that EHRs are implemented.	1	2	3	4	5
17. Use of the EHR will improve patient care.	1	2	3	4	5
18. Use of the EHR will reduce medical errors.	1	2	3	4	5
19. I will need more help from others to use an EHR.	1	2	3	4	5

20. I will spend less time searching for information with an EHR.	1	2	3	4	5
21. Benefits of EHR implementation outweigh the costs.	1	2	3	4	5
22. I am comfortable enough to participate on a team/committee to implement an EHR.	1	2	3	4	5
23. I am comfortable enough to lead a team/committee to develop an EHR.	1	2	3	4	5
24. I am comfortable with accessing data from an EHR for research purposes.	1	2	3	4	5

Section 1 of this survey was partially adapted from the EMR Survey Questionnaire from *Electronic Health Records: A User-Satisfaction Survey* by Kenneth G. Adler, MD, MMM, and Robert L. Edsall. Reproduced with permission from *Family Practice Management*. Copyright © 2005 American Academy of Family Physicians. All Rights Reserved.

Section 2 of this survey was partially adapted from *Adaptation of an Instrument to Measure Attitudes Toward the Implementation of an Electronic Medical Record* by Pramod David Jacob. Reproduced with permission from author via email. Copyright © 2003. All Rights Reserved.

APPENDIX C

PRACTICE EXAM FOR MODULE 1

1. Familiar to user and portability are some examples of advantages of the:

- A. Electronic health record (EHR)
- B. Computer-based patient record (CPR)
- C. Paper medical record
- D. Personal health record

Answer: C

2. This record system is specifically designed to support users by providing accessibility to complete and accurate data, alerts, reminders, clinical decision support systems, links to medical knowledge, and other aids. It is called:

- A. Electronic health record (EHR)
- B. Computer-based patient record (CPR)
- C. Paper medical record
- D. Personal health record

Answer: B

3. Individuals own and manage the information in this record system which comes from healthcare providers and the individual. It is maintained in a secure and private

environment, with the individual determining rights of access. It is separate from and does not replace the legal record of any provider. It is called:

- A. Electronic health record (EHR)
- B. Computer-based patient record (CPR)
- C. Paper medical record
- D. Personal health record

Answer: D

4. Based on the testimony provided by AHIMA to the NCVHS on automated coding, how can automated or computer-assisted coding (CAC) be readily adopted?

- A. Continue efforts to encourage widespread adoption of EHRs
- B. Recommend further research in the evaluation of use of CAC technologies in EHR settings
- C. Evaluate the potential of CAC software used with the EHR to relieve coding workforce shortages
- D. All of the above

Answer: D

5. What is the major difference between the HL7 RIM model and the EHR model ?

- A. The HL7 RIM focuses on the relationships whereas the EHR model must focus on content
- B. The HL7 RIM focuses on the content while the EHR model focuses on the interconnectivity.
- C. HL7 interconnects with SNOMED and the EHR model does not
- D. The HL7 RIM model focuses on coding and the EHR model focuses on standards.

Answer: A

6. The most common standard and most common clinical terminology system used in the EHR are:

- A. ASTM and Read codes
- B. ASTM and UMLS
- C. HL7 and SNOMED CT
- D. HL7 and UMLS

Answer: C

APPENDIX D

INTERVIEW QUESTIONNAIRE

1. What were the strengths of the course?
2. What were the weaknesses of the course?
3. Did the content of the course meet your expectations? Explain.
4. Is there anything that you would like to see changed regarding the course?
5. Did your attitude toward the EHR change as a result of the course? If so, how?
6. Do you feel more confident using an EHR than you did before taking this course? If so, in what ways?
7. In what specific areas of EHR technology do you feel more confident?
8. Will your increased knowledge of the EHR help you in your career? If so, how? If not, why? Please explain.
9. Will the adoption of the EHR impact your work responsibilities? (Beneficial/hindrance?) If so, how? Please explain.
10. Do you think this course focused on the health and rehabilitation student or could be a course for any person interested in learning more about EHR technology?

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