FACTORS THAT PRESENT CHALLENGES TO HEALTHCARE STAFF DURING EMR IMPLEMENTATION: AN INTEGRATIVE REVIEW OF LITERATURE

by

Amy Lynn Howland

A professional paper submitted in partial fulfillment
of the requirements for the degree

Master

of

Nursing

MONTANA STATE UNIVERSITY
Bozeman, MT

November 2013

©COPYRIGHT

by

Amy Lynn Howland

2013

All Rights Reserved

APPROVAL

of a professional paper submitted by

Amy Lynn Howland

This professional paper has been read by each member of the professional paper committee and has been found to be satisfactory regarding content, English usage, format, citation, bibliographic style, and consistency and is ready for submission to The Graduate School.

Dr. Susan Luparell

Approved for the College of Nursing

Dr. Helen Melland

Approved for The Graduate School

Dr. Ronald W. Larsen

STATEMENT OF PERMISSION TO USE

In presenting this professional paper in partial fulfillment of the requirements for a master's degree at Montana State University, I agree that the Library shall make it available to borrowers under rules of the Library.

If I have indicated my intention to copyright this professional paper by including a copyright notice page, copying is allowable only for scholarly purposes, consistent with "fair use" as prescribed in the U.S. Copyright Law. Requests for permission for extended quotation from or reproduction of this professional paper in whole or in parts may be granted only by the copyright holder.

Amy Lynn Howland

November 2013

DEDICATION

This paper is dedicated to my family, friends, mentors, and pets. Without your support, understanding, and unconditional love this achievement would not have been possible.

TABLE OF CONTENTS

1. RESEARCH PROBLEM 1

Introduction 1
Background and Significance of Study 2
History of the Electronic Medical Record 2
Regulatory Health Policies 4
Purposes of the Electronic Medical Record 5
Nursing Roles in Electronic Medical Record Implementation 5
Nursing Views on Electronic Medical Record Implementation 6
Purpose 7
Definitions 8
Differences Among Medical Record Terminology 9

2. THEORETICAL FRAMEWORK 10

Conceptual/Theoretical Framework 10
Whittemore and Knafl's Integrative Review Methodology 10
Locsin's Theory of Technological Competency as Caring in Nursing 14

3. METHODS 18

Overview 18
Inclusion/Exclusion Criteria 18
Librarian 19
Search Terminology 20
Databases Searched 20
CINAHL 20
MEDLINE (PubMed) 21
CIN (Computers, Informatics, Nursing) 22
Additional Sources 23
Evaluating Evidence 23

4. RESULTS 25

Overview 25
Personal and Professional Factors (**P**) 28
Organizational Factors (**O**) 33

TABLE OF CONTENTS - CONTINUED

Quality....36
Summary....39

5. DISCUSSION....40

Overview....40
Strengths....41
Limitations....41
Implications for Clinical Practice....42
Implications for the Clinical Nurse Leader Role....44
Implications for Research....47
Relationship to Theoretical Framework....48
Summary....49

REFERENCES CITED....50

APPENDICES....56

APPENDIX A: Detailed Database Search for Literature....57
APPENDIX B: Polit & Beck's (2008) Qualitative Research Guidelines....61
APPENDIX C: Polit & Beck's (2008) Quantitative Research Guidelines....63
APPENDIX D: Evidence Table....66

LIST OF FIGURES

Figure Page

1. Visual relationship between Locsin's Model, EMR Implementation, and Nursing Practice. 16

2. Visual Relationship between EMR, technology, Locsin's model, and the patient. 17

3. Personal and Professional Factors Bar Graph. 28

4. Organizational Factors Bar Graph. 33

ABSTRACT

Over twenty years ago, the Institute of Medicine began urging the medical community to embrace the conversion from paper-based charting to electronic medical records (EMR) (National Assembly on School Based Health Care [NASBHC], n.d.). However, it has only been in recent years following the offering of financial incentives by the Department of Health and Human Services that hospitals and doctors' offices have begun the transition in documentation to an EMR (Haupt, 2011). As of the year 2009, it was reported that only 11.9% of US hospitals were using either a basic or comprehensive EMR, and only 2% of hospitals were using an EMR robust enough to comply with the federal government's "meaningful use" criteria (Jha DesRoches, Kralovec, & Joshi, 2010). One reason that so few healthcare organizations have completed the transition to an EMR system of documentation is due to the tedious implementation process and the challenges that arise during this process. The purpose of this integrative review of literature is to explore the factors that present challenges to healthcare staff during EMR implementation in healthcare organizations.

This integrative review was performed by mining relevant literature from predetermined databases and all reference lists of the located literature. A total of 26 articles met the predetermined inclusion criteria. The results indicated that the factors that present challenges can be organized into two themes: personal/professional factors and organizational factors. Personal/professional factors include adequate time, inadequate computer skills, workflow disruption, user friendliness, negative impact on patient-provider relationship, security, and poor understanding of the EMR benefits. Organizational factors include cost, inadequate EMR standardization, information technology issues, and issues with implementation. After determining these factors that present challenges to healthcare staff during EMR implementation through careful literature review, the reviewer concluded that a standardized plan for successful EMR implementation in all healthcare settings including remedies for these challenges should be formulated. This standardized plan would offer healthcare organizations the best chance for smooth EMR implementation into practice for the staff, patients, and organization as a whole.

CHAPTER ONE

RESEARCH PROBLEM

Introduction

In an era where technology and staying "connected" is ever- advancing, it is only appropriate for modern day healthcare to follow in the same direction. The influential Institute of Medicine began urging the medical community to embrace the conversion to electronic medical records (EMR) over twenty years ago (National Assembly on School Based Health Care [NASBHC], n.d.). However, only in recent years, after financial incentives were offered to hospitals and doctor's offices by the Department of Health and Human Services, has documentation by providers in the healthcare setting begun shifting from paper-based charting to electronic medical record systems (Haupt, 2011).

The development of an electronic medical record, as a means to transition healthcare information into electronic documentation, has become one of the newest priorities in healthcare (Jha, DesRoches, Kralovec, & Joshi, 2010). This development is attributed, in part, to the effects of regulatory health policies that were initiated by the Accreditation Association for Ambulatory Healthcare, The Joint Commission, former President George W. Bush, and current President Barrack Obama (Edwards, 2012). Universal adoption of electronic health records (EHRs) as a means to improve health outcomes in the United States was initially proposed by President Bush in 2004 (Tellez, 2012). In 2009, President Obama reserved $19 billion to assist in accelerating the development of EHRs by signing the American Recovery and Reinvestment Act (ARRA)

(Tellez, 2012). The Health Information Technology for Economic and Clinical Health Act (HITECH Act) is part of the ARRA that, according to the US Department of Health and Human Services, "delineates a timeline for the implementation of meaningful use requirements and the schedule distribution of monetary incentives and penalties offered through Medicare and Medicaid payments" (as cited in Tellez, 2012, p. 229). With the signing of these acts, the transition from paper-based charting to electronic medical record systems in every healthcare facility should be occurring at an increased rate.

Background and Significance of Study

History of the Electronic Medical Record

Early ideations of the electronic medical record (EMR) first surfaced in the late 1960's when the concept of the Problem Oriented Medical Record was introduced into medical practice by Larry Weed (NASBHC, n.d.). Before this concept was introduced, documentation on patients seen by healthcare providers was recorded strictly in paper-based charting. As a result, typically only pertinent diagnoses and the treatment provided were recorded by providers in the patient chart during each visit (NASBHC, n.d.). The lack of additional documentation of information in the patient's chart was due to the fact that paper-based charting was a very redundant and voluminous task for healthcare providers. Additionally, the lack of adequate documentation in patient charting was contributing to a lack of communication and fragmentation in patient care from provider to provider (NASBHC, n.d.). Missing from these paper charts was readily available information to be used for reimbursement, communication among clinicians, and a

reminder system allowing for quality patient care. "With the growing concern over the cost and quality of medical care, it [the medical record] serves as the basis for quality assurance by health care organizations, insurance companies and other payers, and the federal government" (Hersh, 1995, p. 772). It is due to this concern that the lack of documentation needed to be addressed by an expanded, more technologically advanced form of a medical record. Weed's overall goal was to generate a medical record that would allow verification of a diagnosis by a third party. Although this concept was seen as a major advancement in practice due to its ability to decrease fragmentation in care and provide a modality for communication, most physicians were resistant to implement this breakthrough in technology into their practice (NASBHC, n.d.).

In 1991, the Institute of Medicine in the United States made a recommendation that all physicians implement the use of computers in their practice by the year 2000 to improve patient care (NASBHC, n.d.). The rationale behind this recommendation was that using computers would improve patient care by saving time, decreasing fragmentation in valuable patient health information, increasing the ability to communicate between practitioners, and improving patient outcomes (NASBHC,n.d.). In addition, the IOM made policy recommendations on how to achieve the year 2000 goal. Despite a great amount of evidence that showed electronic medical record implementation resulted in time savings and improved clinical outcomes, most patient information continued to be manually recorded in paper-based charting throughout the 1990's (Hersh, 1995).

Regulatory Health Policies

As stated previously, implementation of electronic medical records is emphasized in recent regulatory health policies and is a priority of the U.S. healthcare agenda (Edwards, 2012). In the year 2009, 11.9% of hospitals in the US were using either a basic or comprehensive electronic medical record (Jha et al., 2010). A basic EMR is comprised of only the most essential technology based on the provider's needs, most notably note-taking capabilities. However, it is notable that when reported in 2009, only 2% of the US hospitals currently using an electronic medical record were reported as having EMR's that were robust enough to comply with the federal government's "meaningful use" criteria (Jha et al., 2010). According to the US Department of Health and Human Services, "meaningful use starts with capturing health data electronically but seeks to use the data to derive clinical information and consequently improve health outcomes" (as cited in Tellez, 2012, p. 229). Furthermore, the requirements associated with meaningful use are intended to place pressure on healthcare practices and hospitals to make the transition from paper charting to EMR systems in an effort to capture important clinical data in a standardized electronic form (Tellez, 2012). Priorities associated with "meaningful use" include coordination of care, patient engagement, improved safety and efficacy, and reduction of racial disparities (Jha et al., 2010). "Meaningful use" criterion is the basis of financial incentives that are being offered by the Department of Health and Human Services (Haupt, 2011). The American Recovery and Reinvestment Act (ARRA) authorize these incentive payments to providers, through

Medicare and Medicaid, for the implementation of a certified electronic medical record and demonstration of "meaningful use" (Jha et al., 2010).

Purposes of the Electronic Medical Record

The purpose of an electronic medical record can be thought of as an expanded, improved, more accessible version of the previous paper-based record. Much like a paper chart, the goal of an electronic medical record is to serve as a tool for recording patient observations and analysis by the healthcare provider, nurses, and clinical support staff (Hersh, 1995). Nurses use the electronic medical record daily for tasks ranging from recording patient vitals to a means of communication with other healthcare providers involved in a patient's care. Haupt (2011) described the electronic medical record as creating a progress timeline for the patient where one is able to pull together all of a patient's information. Additionally, it allows for remote accessibility, provides up-to-date clinical information and decision support tools, and enables specialists who see a patient to work as a team (Haupt, 2011).

Nursing Roles in Electronic Medical Record Implementation

Nurses are on the forefront of patient care and are thus involved in an active role of the majority of patient charting daily. It is important for nurses to have an active role in the design, development, and implementation of an EMR in order to produce an organizational culture in which the flow of data is efficient and accurate (Edwards, 2012). According to Edwards (2012), "successful implementation of an EMR requires a full understanding of existing systems and the capabilities of the EMR, strong organizational

planning, a design centered on a committed interdisciplinary team, development catered to the needs of the organization, and a supported implementation" (p. 111). Inclusion of the entire healthcare team, especially the nursing staff, is essential in overcoming the factors that present challenges to successful EMR implementation in each and every healthcare setting.

Nursing Views on Electronic Medical Record Implementation

The view of nurses on the implementation and use of an EMR is extremely varied (Anders & Daly, n.d.). Paying close attention to nurses' needs and participation can lead to higher adoption rates during EMR deployment (Anders & Daly, n.d.). Assessing the attitudes of all staff, especially the frontline nursing staff, within any healthcare organization is a critical step in EMR design, implementation, and reception by project managers and administrators (Edwards, 2012). Additionally, it is important to ensure a high-level end-user satisfaction in choosing an EMR system in order to influence positive nursing views related to EMR implementation (Edwards, 2012). Successful adoption is also thought to be dependent on each nurse's individual computer skill set and exposure to electronic information (Anders & Daly, n.d.). "Understanding why nurses embrace and resist EHR systems is a vital consideration when implementing an EHR system" (Anders & Daly, n.d., p. 2). The involvement of nursing in all steps of the EMR transition process can "lead to the best choices and optimal efficiency in creating a smooth cultural transformation" (Edwards, 2012, p. 112). Therefore, with nurses being a main point of care to patients in healthcare settings and having an active role in EMR

usage, it would be reasonable to think that nurses would also have an important view on what factors present challenges to successful EMR implementation.

Purpose

Although studies have shown how nurse administrators, nursing leaders, and nursing staff have contributed to an effective transition to an EMR, lack of clarity remains regarding what factors present challenges for nurses during EMR implementation. The factors that present challenges to the healthcare staff during implementation of an EMR are integral to success or failure. Gaining a better understanding of these factors will assist in future EMR implementation by encouraging the nursing staff to find better ways to overcome these issues and prepare for the challenges that lie ahead.

Therefore, the purpose of this integrative review of literature is to investigate factors that present challenges to healthcare staff throughout the transition from paper-based charting to an electronic medical record charting system. This review will focus on the available literature related to EMR implementation in the healthcare setting and the challenges that are encountered during the transition. Careful review of these factors remains important in order to discover solutions to current challenges and assist healthcare settings that have not transitioned to an EMR system in an attempt to make their future transition smoother. An intense review of these factors may also offer insight on the hesitation that still exists among healthcare settings when considering the transition to an electronic medical record system.

Definitions

The reviewer hopes to determine through integrative review of literature the factors that present challenges in successful electronic medical record implementation. Definitions of each of the terms taken from the previous phrase will be supplied using the English language dictionary. The definition for electronic medical record (EMR) will be discussed later on in the differences among medical record terminology section. As defined in the Merriam-Webster Dictionary (2012), the term integrative is translated to mean "serving to integrate or favoring integration; directed towards integration." Review can be defined for the purpose of this paper as "a critical evaluation" (Merriam-Webster Dictionary, 2012). Integrative review is defined by Broome (1993) as being "a specific method that summarizes past empirical or theoretical literature to provide a more comprehensive understanding of a particular phenomenon or healthcare problem" (as cited in Whittemore & Knafl, 2005, p. 546). This integrative review is to be performed on the literature or "the body of writings on a particular subject" (Merriam-Webster Dictionary, 2012) to determine the factors or "ones that actively contribute to the production of a result" (Merriam-Webster Dictionary, 2012) that present challenges to successful EMR implementation. Challenges can be thought of as "confronting or defying boldly" (Merriam-Webster Dictionary, 2012), and successful can be defined as "resulting in a favorable or desired outcome" (Merriam-Webster Dictionary, 2012). Lastly, implementation is the manner or act of "performance of a task" (Merriam-Webster Dictionary, 2012).

Differences Among Medical Record Terminology

In speaking about the transition from paper-charting to electronic charting, two terms are often used interchangeably. One will often hear references to either an electronic medical record (EMR) or electronic health record (EHR). Although the lines between these two terms are blurred due to common usage, there is a distinct difference among them. According to the American Medical Society (n.d.), an EMR can be thought of as an exact replication of what would be found in a patient's paper chart including demographics, insurance information, visit notes, health histories, medication information, diagnostic testing, and laboratory results. On the other hand, EHR's can be thought of as essentially being EMR's with the capacity for greater electronic exchange; for instance, provider-to-provider and office-to-office medical record exchange (AMA, n.d.). For purposes of this integrative review, the reviewer will focus on studies located by use of the term electronic medical record (EMR), but will not disqualify resulting articles that use the term EHR.

CHAPTER 2

THEORETICAL FRAMEWORK

Conceptual/Theoretical Framework

As this paper is based on an integrative review of the factors that present challenges in implementing an electronic medical record system in the healthcare setting, the reviewer has chosen to use both a methodological and theoretical approach to the project. Both the methodology of the integrative review by Whittemore & Knafl, and Locsin's Technological Competency as Caring in Nursing will be the basis of this review.

Whittemore and Knafl's Integrative Review Methodology

According to Whittemore and Knafl (2005), "well-done integrative reviews present the state of the science, contribute to theory development, and have direct applicability to practice and policy" (p. 546). Additionally, the integrative approach includes both experimental and non-experimental research and is a key player in evidence-based practice for nursing. The inclusion of these diverse methodologies allow for a better understanding of the phenomenon of concern (Whittemore & Knafl, 2005). The integrative review methodology itself consists of five stages: problem identification, literature search, data evaluation, data analysis, and presentation (Whittemore & Knafl, 2005). A brief description of each of these stages in the integrative review process will be discussed in the following paragraphs.

The initial stage, or problem identification stage involves the review method setting forth a clear identification of the problem that will be addressed by the review (Whittemore & Knafl, 2005). This stage determines both the variables of interest and the appropriate sample to guide the review, which will facilitate the following stages of the review and assist in differentiating between information that is pertinent and extraneous in the stage of data extraction (Whittemore & Knafl, 2005). Clarity of the purpose of the review in this stage is of utmost importance. According to Whittemore and Knafl (2005), "a well-specified research purpose in an integrative review will facilitate the ability to accurately operationalize variables and thus extract data from primary sources" (p. 548). More specifically, the purpose of this particular integrative review is to explore the factors that present challenges to the healthcare staff in EMR implementation. The factors that will be explored will be specific to the healthcare staff that is involved in the EMR implementation.

The second stage of the integrative review involves a well-defined literature search. Conn, Valentine, Cooper, and Rantz (2003) and Cooper (1998), state that this stage is crucial because inaccurate results can occur if an inadequate database of incomplete or biased research is used due to a lack of rigor on the part of the reviewer (as cited in Whittemore & Knafl, 2005). According to Jadad, Moher, and Klassen (1998), "ideally, all of the relevant literature on the problem or topic of interest is included in the review; yet obtaining this literature can be challenging and costly" (as cited in Whittemore & Knafl, 2005, p. 548). Furthermore, limitations in database searches and publication bias are obstacles to the integrative reviewer (Whittemore & Knafl, 2005). A

well-defined sampling must be decided upon justifiably and made explicit prior to the search (Whittemore & Knafl, 2005). It is imperative that the search process for literature to be included in the integrative review be clearly stated in the methods section and include search terminology, databases used, additional search strategies, and the inclusion and exclusion criteria for determining primary sources of relevance (Whittemore & Knafl, 2005). It is important to devise a well-structured search in this stage in order to maximize the amount of literature that meets the inclusion criteria for review.

The third stage, or data evaluation stage, involves the evaluation of quality of primary studies through the extraction of specific methodological features (Whittemore & Knafl, 2005). Quality scores are typically assigned to studies in this stage of analysis; however, it should be noted that complexity of the evaluation of quality primary sources in the integrative review method increases as diverse primary sources are included (Whittemore & Knafl, 2005). Therefore, the evaluation of quality in an integrative review will vary depending on the sampling frame (Whittemore & Knafl, 2005). According to Whittemore and Knafl (2005), "in an integrative review with diverse empirical studies, it may only be reasonable to evaluate quality in sources that represent outliers (that is, is methodological quality a viable reason for the discrepant finding?)" (p. 550). In a review with a diverse sampling, evaluation of quality similar to the approach used in historical research or techniques of theory analysis and critique may be considered (Whittemore & Knafl, 2005). The evaluation of quality of primary sources in an integrative review is a complex process (Whittemore & Knafl, 2005). This data

evaluation stage is a crucial step in compiling all relevant data prior to the beginning of the data analysis stage.

In the fourth stage, or data analysis stage, Copper (1998) states that data taken from the primary sources are "ordered, coded, categorized, and summarized into a unified and integrated conclusion about the research problem" (as cited in Whittemore & Knafl, 2005, p. 550). The goals of the data analysis stage include interpretation of the primary sources of literature in an unbiased manner along with synthesis of the evidence (Whittemore & Knafl, 2005). This stage of the integrative review is the least developed and has the potential to provide error (Whittemore & Knafl, 2005). Due to its complexity, the data analysis stage is further broken down into stages of data reduction, data display, data comparison, and conclusion drawing and verification (Whittemore & Knafl, 2005). The data that will be analyzed specific to this integrative review will focus on the conclusions that are mined from each piece of evidence analyzed.

The final or presentation stage of integrative review methodology involves the reporting of conclusions drawn from the review in a table or diagrammatic form (Whittemore & Knafl, 2005). The results capture both the depth and breadth of the topic and contribute to an expanded understanding of the topic being explored. Additionally, implications for practice are discussed and implications for research and policy initiatives are emphasized (Whittemore & Knafl, 2005). Lastly, in this stage the reviewer discusses any limitations of the review.

Each step of the integrative review process has equal importance and is critical in producing a thorough, high quality product. "Completion of all stages of this proposed

methodology, with attention to the issues, specific to undertaking an integrative review, have the potential to strengthen the process and the outcomes of integrative reviews" (Whittemore & Knafl, 2005, p. 552). Overall, the use of the integrative review methodology has the potential to bring forth a better understanding of problems that are relevant to both health care and policy (Whittemore & Knafl, 2005).

Locsin's Theory of Technological Competency as Caring in Nursing

In addition to Whittemore and Knafl's methodology of an Integrative Review, Locsin's Theory of Technological Competency as Caring in Nursing will lay a foundation for reference in this integrative review. According to Blum, Hickman, Parcells, & Locsin (2010), "this theory has offered a foundational perspective of technological competency as caring in nursing in which technological knowing, the process of using technologies for health and nursing, is used in order to know persons more fully as whole and complete in the moment" (pp. 42-43). The focus of this theory shifts the focus to patients as being participants in their own care rather than as being objects in nurses' care (Blum et al., 2010). Additionally, technological competency allows for enhancement of the nurse's knowledge of the person by full engagement with the person (Blum et al., 2010). In employing the use of an EMR in healthcare practice, it is important for the nursing staff to be competent in the use of the EMR in order to enhance the quality of care that they are giving to the patient to the fullest.

According to Locsin (2005), the Traditional Model of the Nursing Process "provides care for human beings based upon the evidence-and-cure process in which

nursing functions are narrowly described as the diagnosis and treatment of disease and the administration of medication" (p. 6). Locsin's New Model of Technological Competency as Caring involves a harmonious coexistence between caring in nursing and technology, as they have been seen as two completely separate entities in the past (Locsin, 2005). This new model was founded on the advancing technology in healthcare (Locsin, 2005). It is a situation-specific model which outlines the relationship among nursing practice, technology, and caring (Locsin, 2005).

Furthermore, Locsin's model is influential in taking into account nursing practice as a contemporary profession. The model proposes that vital to the practice of contemporary nursing are high-technology and competency with technology (Locsin, 2005). Locsin was aware of the shift to high-tech nursing practice long before the time of electronic connectedness in healthcare came to be. The time of technological competency is happening now, and the transition to an electronic medical record in healthcare practices is a prime example of what Locsin was describing in his Model of Technological Competency as Caring. It will be important that this EMR transition coexists harmoniously with nursing care delivery as was discussed by Locsin. In summation, "as a model of practice in nursing, technological competency as caring dictates ways of knowing persons as a whole in the moment, a foundational belief that defines practice roles, processes, and products of the human health experience" (Locsin, 2005, p. 7). It is for these numerous reasons that have been discussed that this model has been chosen as a theoretical basis for this integrative review. A visual representation of

the relationship of Locsin's model, EMR implementation, nursing practice, and the patient is depicted in the following two Figures.

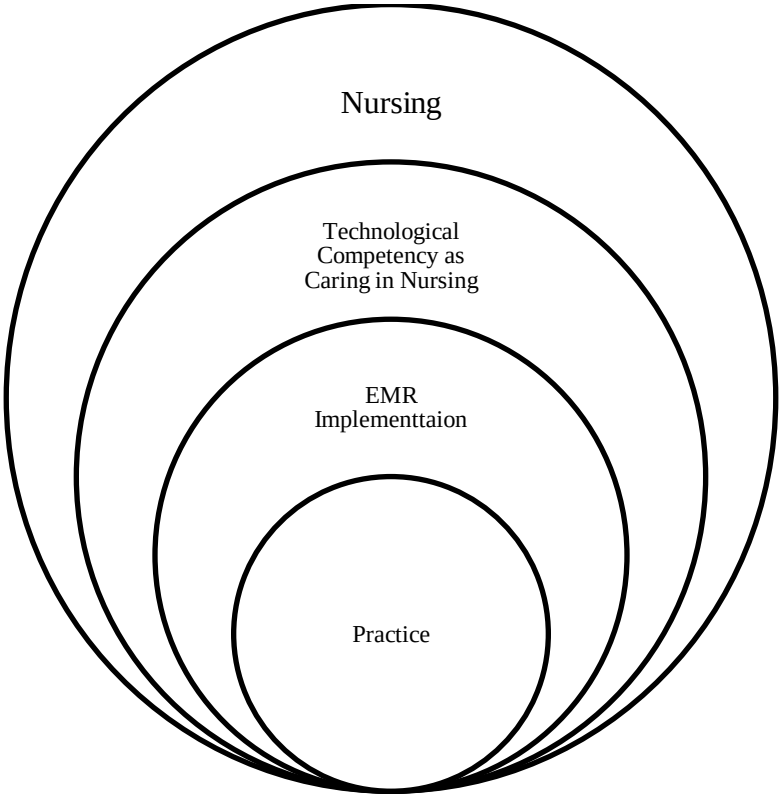


Figure 1. Visual relationship between Locsin's Model, EMR Implementation, and Nursing Practice. This figure illustrates the encapsulated relationship between practice, EMR implementation, Locsin's Model of Technological Competency as Caring in Nursing, and Nursing.

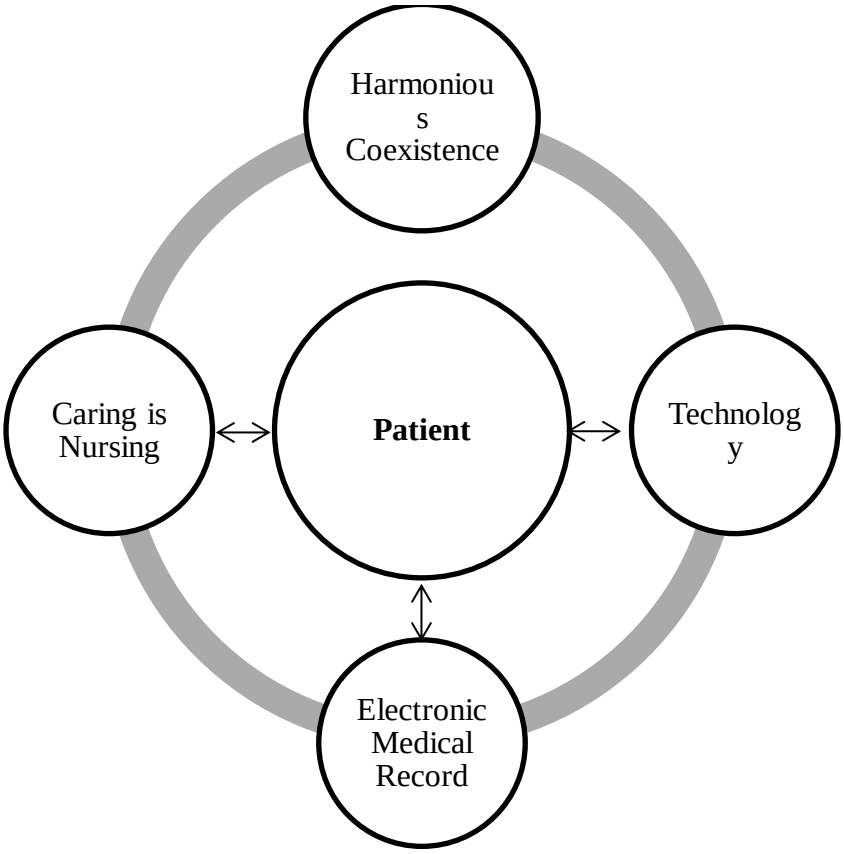


Figure 2. Visual Relationship between EMR, technology, Locsin's model, and the patient. This figure illustrates the patient being at the center of Caring is Nursing, Technology, and the EMR. It also outlines the need for a harmonious coexistence between Caring is Nursing and Technology.

CHAPTER THREE

METHODS

Overview

A thorough literature search was performed as guided by Whittemore and Knafl's Integrative Review Methodology. Research suggestions, terminology, and methodology on how to properly extract literature from each of the databases listed were discussed prior to performing the review with the MSU librarian. A detailed search tracking log was maintained by the reviewer as literature was extracted for use in the review. A detailed table of database, terminology, advanced search limits, and results can be found in Appendix A. Each of these search results will also be discussed in detail according to each database searched.

Inclusion/Exclusion Criteria

In order to avoid an inaccurate search or biased results, a well-defined literature occurred. The first step of this search required the establishment of inclusion and exclusion criteria for the selection of literature. According to Whittemore and Knafl (2005), quality primary studies (both experimental and non-experimental) from peer-reviewed journals should be used to decrease the complexity of the evidence. Therefore, articles that are not based on qualitative and/or quantitative research were not included in this literature search in order to ensure that only the highest quality literature is considered for review.

EMR implementation is not limited to occurring solely among healthcare facilities in the United States, and studies that have been performed internationally were to be included in this review. However, these international studies needed to be written in the English language and held up to the same standards outlined previously: peer-reviewed, primary studies, and research-based. All articles not written in the English language were not reviewed since interpretation of these studies was not an option.

Additionally, due to the ever-changing use of technology in healthcare and notable advances in recent years, it was important to only include literature that is still currently relevant. According to DiCenso, Guyatt, and Ciliska (2005), "the health care literature is continually and rapidly expanding; the task of keeping up with relevant health care information is daunting for all health care professionals" (p. 33). Therefore, literature publication dates were limited to the past 8 years spanning from 2005 through 2013.

Librarian

Consultation with a librarian occurred prior to beginning the search for literature. Access to a librarian was available through the Libraries at Montana State University (MSU). Through this consultation with the librarian, search terminology and the most appropriate databases to search were identified for the reviewer. Additionally, the librarian was the first point of contact for the reviewer in the event that an article could not be located through the MSU Library website.

Search Terminology

The terminology that was used to provide a comprehensive search of the databases listed previously was based on the review question that was brought forth in the purpose of the review. Research terms included *electronic medical record, computerized patient record, medical record system, research, computerized, implementation, factors, challenges, obstacles, nursing, transition, Locsin,* and *technological competency.* These terms were used together in various combinations in the search field of each predetermined database to maximize the articles located.

Databases Searched

A systematic search of the anticipated databases was performed including the Cumulative Index to Nursing and Allied Health Literature (CINAHL) and MEDLINE (PubMed). The use of additional specific journal searches that are based on information technology and nursing were determined as the search of databases was performed. Additionally, each reference list was mined to determine potential evidence for inclusion in the review. Actual databases used in the search for literature were updated as additional data is mined, it was imperative to keep track of these databases throughout the search process.

CINAHL

Different combinations of search terminology were used in an effort to maximize all possible articles to be included in the review. According to the MSU librarian, an advanced search could be used to narrow down articles by relevance; however, it is

important to note that the limitations of "peer reviewed" and "evidence-based practice" could not be used simultaneously in the search inclusion criteria. A total of 16 searches occurred in the CINAHL database using different search terminology and limits as recommended by the MSU librarian.

The different combinations of search terminology included *electronic medical record, computerized patient record, implementation, challenges,* and *obstacles.* Different combinations of this terminology were used to search the CINAHL database as recommended by the MSU Librarian upon consult. Additionally, different combinations of the limits of "peer-reviewed," "evidence-based practice," "boolean/phrase," and "find all terms" were used with the consistent limits of "English language" and "research-based" ranging from the years 2005-2013 to maximize search results from the CINAHL database.

A total of 3 articles retrieved from 57 located articles in CINAHL during this complex search met inclusion criteria for the review. Additional combinations of search terminology including *Locsin* and *technological competency* produced no results for inclusion in this review. A more in-depth breakdown of these 16 CINAHL searches can be located in Appendix A.

MEDLINE (PubMed)

Search terminology entered into the search for MEDLINE first included *electronic medical record, implementation,* and *challenges/obstacles.* Advanced search included articles ranging from the years 2005-2013 and available as an article. This combination of search terminology produced 292 results, many of which were not

research-based. The next combination of search terminology included the term *research* along with the previous terminology. This search narrowed the results down to 72 articles. Review of these articles included duplicates of already included articles, but no additional articles that met inclusion criteria for this review.

Once again, additional combinations of search terminology including *Locsin* and *technological competency* produced no results for inclusion in this review.

Another search of MEDLINE included the terminology recommended by the previous search *medical record system, computerized,* and *research*. This combination of search terminology produced 1,572 search results. These results were further narrowed down by using recommended MeSH headings and MeSH qualifiers. The review of MEDLINE search results was a very tedious process, but the reviewer felt it necessary to review the abstracts and articles of all possible results. Two of the articles in this search were duplicates of the same study. A total of 21 articles met the inclusion criteria for this review.

CIN (Computers, Informatics, Nursing)

Initial search terminology entered into the CIN database from 2005-2013 included *electronic medical record, implementation*, and *challenges/obstacles*. This search produced 1060 articles. This search was further narrowed down by adding the term *research* to the search terminology, which produced 196 articles. These 196 articles were further searched by the reviewer, and 2 articles were found to be duplicates of articles that was already included as meeting inclusion criteria as located in the CINAHL and MEDLINE searches. An additional 2 articles met inclusion criteria and addressed the

barriers to successful EMR implementation; however, these articles were not included in this review since they dealt directly with EMR implementation in developing countries which are not relevant to the purpose of this review. Combinations of search terminology including Locsin and technological competency produced no results for inclusion in this review. A total of 194 articles did not meet inclusion criteria.

Additional Sources

A total of 700 references from the 24 articles meeting inclusion criteria from CINAHL and MEDLINE were mined for possible inclusion in the review. These references were narrowed down by date and type of reference prior to reviewing the literature for possible inclusion in the review. An additional 2 articles were located through the references that met criteria for inclusion in this review.

Evaluating Evidence

Each of the 26 articles that met inclusion criteria were categorized into the hierarchy of strength of evidence for treatment decisions format as outlined in *Evidence-Based Nursing: A Guide to Clinical Practice* (DiCenso, Guyatt, & Ciliska, 2005). This hierarchy is arranged in a top-down format, with the top being the highest level of evidence (systematic reviews of randomized trials) down to the lowest level of evidence (unsystematic clinical observations). The hierarchy itself is not absolute; however it "makes clear that there always exists some form of evidence about the effect of a particular treatment or intervention" (DiCenso et al., 2005, p. 14). The top level of evidence is differentiated from lower levels of evidence based on the potential for biased

results. Therefore, well-done top level evidence should provide results that are more believable, whereas even the most well-done low level types of evidence may include inherent bias, making their results less believable. The literature included in this review was reviewed based on Polit and Beck's (2008) guidelines for evaluation for qualitative and/or quantitative evidence. Quality from these reviews was reported in terms of merit by the reviewer. Even though many of these reviews were deemed "high merit," due to the inherent high bias based on study design, the results were less believable. A table was created to display the evidence, strength, and findings mined from each piece of literature included in the review. This table can be located in Appendix D. Inferences were based on the findings taken from this table format and used as a basis of conclusions related to the review question.

CHAPTER FOUR

RESULTS

Overview

A total of 26 articles met inclusion criteria for this review. The search for literature is displayed in visual detail in the Evidence Table in Appendix D. With these studies, various countries of study origin were represented in the review: 20 studies conducted in the United States including (Cherry, Ford, & Peterson, 2011; DesRoches, Campbell, Rao, Donelan, Ferris, Jha, Kaushal, Levy, Rosenbaum, Shields, & Blumenthal, 2008; Gans, Kralewski, Hammons, & Dowd, 2005; Goldberg, Kuzel, Feng, DeShazo, & Love, 2012; Hier, Rothschild, LeMaistre, & Keeler, 2005; Jha, Bates, Jenter, Orav, Zheng, Cleary, & Simon, 2009; Jha, DesRoches, Campbell, Donelan, Rao, Ferris, Shields, Rosenbaum, & Blumenthal, 2009; Kaushal, Bates, Jenter, Mills, Volk, Burdick, Tripathi, & Simon, 2009; Kemper, Uren, & Clark, 2006; Kossman & Scheidenhelm, 2008; Linder, Schnipper, Tsurikova, Melnikas, Volk, & Middleton, 2006; Menachemi, 2006, Menachemi, Ettel, Brooks, & Simpson, 2006; Poon, Jha, Christino, Honour, Fernandopulle, Middleton, Newhouse, Leape, Bates, Blumenthal, & Kaushal, 2006; Rouf, Chumley, & Dobbie, 2008; Saleem, Patterson, Militello, Render, Orshansky, & Asch, 2005; Scott, Rundall, Vogt, & Hsu, 2005; Sequist, Cullen, Hays, Taualii, Simon, & Bates, 2007; Simon, Kaushal, Cleary, Jenter, Volk, Orav, Burdick, Poon, & Bates, 2007, Simon, Kaushal, Cleary, Jenter, Volk, Poon, Orav, Lo, Williams, & Bates, 2007; Vishwanath & Scamurra, 2007; and Zandieh, Yoon-Flannery, Kuperman, Langsam,

Hyman, & Kaushal, 2008); 2 studies conducted in Canada (Urowitz, Wiljer, Apatu, Eysenbach, Delenardo, Harth, Pai, & Leonard, 2008; and Wiljer, Bogomilsky, Catton, Murray, Stewart, & Minden, 2006); 1 study conducted in Australia (Georgious, Ampt, Creswick, Westbrook, & Braithwaite, 2009); 1 study conducted in Austria (Hackl, Hoerbst, & Ammenwerth, 2009); 1 study conducted in Sweden (Ovretveit, Scott, Rundall, Shortell, & Brommels, 2007); and 1 study conducted in both the United States and Canada (Laramee, Bosek, Kasprisin, & Powers-Phaneuf, 2011). There were 2 studies that met inclusion criteria, but were left out because they dealt with EHR implementation in developing countries which did not pertain to this review. Additionally, multiple studies were located that were not included because they were considered secondary research. All of the studies located and included in this review were either quantitative or qualitative research.

In addition to the multiple countries represented in the literature mined for this review, also represented were multiple professions within the healthcare realm as participants in the study. The largest represented profession among this review was physicians as being participants in 10 of the 26 studies. Physicians were study participants in the following studies: (DesRoches et al., 2008; Hackl et al., 2009; Hier et al., 2005; Jha et al., 2009; Kaushal et al., 2009; Kemper et al., 2006; Laramee et al., 2011; Linder et al., 2006; Menachemi et al., 2006, et al., 2006; and Simon et al., 2007, et al., 2007). Tied with physicians as being the largest represented profession in this review was the category of "mixed" professionals. This "mixed" category of professions included various combinations of the professions of physicians, group practices,

managers, senior health executives, pharmacists, PA's, nurses, administrative staff, project team members, technical staff, patients, and medical directors represented in the study. "Mixed" participants were participants in 10 of the 26 studies, and were reported in the following studies: (Gans et al., 2005; Georgious et al., 2009; Goldberg et al., 2012; Ovretveit et al., 2007; Saleem et al., 2005; Scott et al., 2005; Sequist et al., 2007; Vishwanath & Scamurra, 2007; Wiljer et al., 2006; and Zandieh et al., 2008). CIO's and CEO's as study participants were represented in 2 of the 26 studies: (Jha et al., 2009; and Urowitz et al., 2008). Nurses as participants were represented alone in 1 of the 26 articles included: (Kossman & Scheidenhelm, 2008). Additionally represented participants, each in 1 of the 26 included articles were stakeholders (Poon et al., 2006); medical students (Rouf et al., 2008); and long-term care facilities (Cherry et al., 2011).

From the studies reviewed, there were several identified recurring themes related to factors that create barriers to successful EMR implementation in healthcare settings identified. Upon looking at the literature included in this review, it became apparent that the factors that create challenges for successful EMR implementation resulted from two separate entities within the healthcare organizations. Therefore, these factors were divided by the reviewer into two separate categories: personal/professional factors, and organizational factors. In addition to a thorough discussion of each of the factors contained in these categories, two separate bar graphs were formulated to demonstrate the occurrence of each of the factors in the evidence collected for this review: one represents the personal/professional factors, and another represents the organizational factors.

The personal/professional factors stem from staff, management, stakeholders, CEOs, and/or patient feelings and ideations as to the challenges to successful EMR implementation in healthcare settings. There were seven recurring factors identified from the literature related to this category.

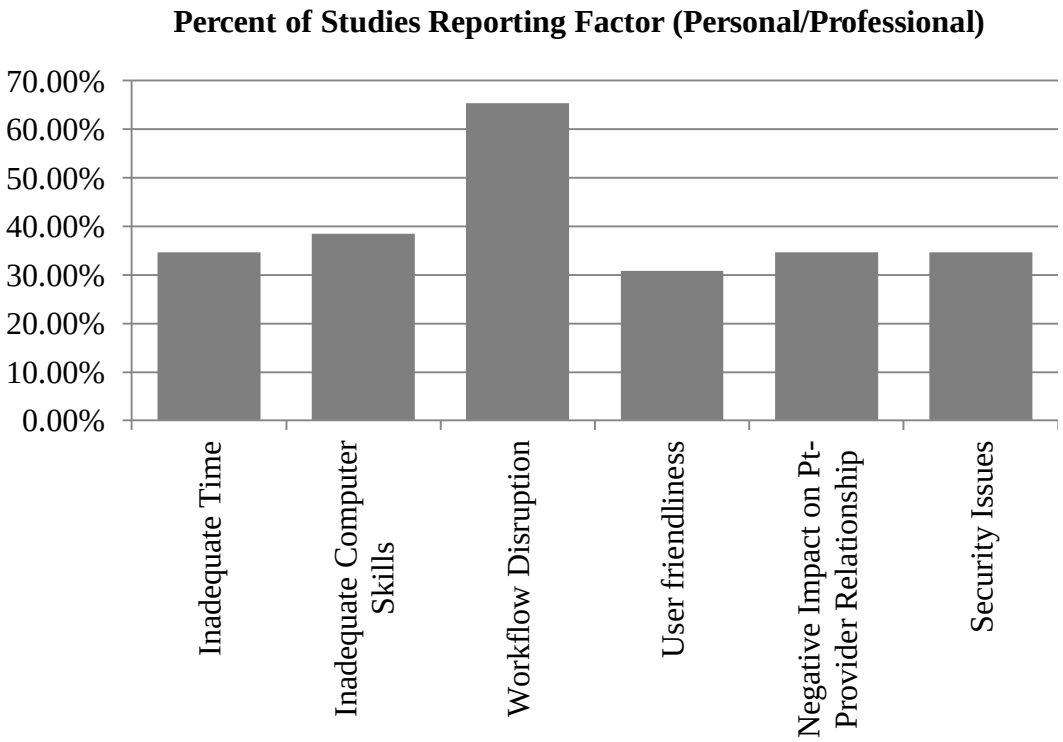


Figure 3. Personal and Professional Factors Bar Graph. This figure indicates the occurrence of each of the factors in the 26 articles located for this review.

Personal and Professional Factors (**P**)

1. Inadequate Time. This factor is a personal/professional factor creating a challenge to successful EMR implementation due to the inadequate amount of time allotted to staff to become comfortable with the EMR system being implemented. Inadequate time to learn the system usually occurs during the redesign of clinical workflows and training on the

EMR system itself. Out of the 26 included articles in this review, 9 articles reported this factor as being a challenge to successful EMR implementation. In addition to the time spent away from patient care due to data entry into the EMR system, "another challenge physicians and staff identified is the time needed to learn new functions and engage in new activities, such as those required for quality measurement and improvement" (Goldberg et al., 2012, p. e51). The articles that reported this factor in the review are as follows: (Cherry et al., 2011; Georgiou et al, 2009; Jha et al., 2009; Laramee et al., 2011; Menachemi, 2006, et al., 2006; Ovretveit et al., 2007; Saleem et al., 2005; Sequist et al., 2007; and Zandieh et al., 2008).

2. Inadequate Computer Skills. This factor includes unfamiliarity of the staff with the software and computer use in general. It can also include inadequate typing skills, and the lack of basic computer and technology knowledge. It was determined that 10 of the 26 included articles reported this factor as being a challenge to successful EMR implementation in healthcare organizations. The possibility of very little exposure to computer use among the staff is always a very real concern when implementing any new technology into the workplace. According to the study performed by Georgiou et al. (2009), "there was worry articulated that some staff had very little prior contact with computers, and there was a level of computer illiteracy that would make training difficult…it was acknowledged that regardless of training there would always be 'computerphobes' in the workplace" (p. 65). The articles that reported this factor in the review are as follows: (Cherry et al., 2011; Gans et al., 2005; Georgiou et al., 2009;

Kemper et al., 2006; Laramee et al, 2011; Linder et al., 2006; Menachemi, 2006, et al., 2006; Ovretveit et al., 2007; Simon et al, 2007, et al., 2007; and Zandieh et al., 2008).

3. Workflow Disruption. The disruption caused during EMR implementation can cause decrease in workplace productivity and efficiency. It can also cause decreased time of the healthcare provider with the patient. This factor was the highest reported factor as a challenge to successful EMR implementation among the included literature, included in 17 of the 26 articles. It was reported in these articles that the majority of practices implementing an EMR system into practice did not plan their normal workflow around the new functions associated with EMR use. The articles that reported this factor in the review are as follows: (Gans et al., 2005; Georgiou et al., 2009; Goldberg et al., 2012; Hackl et al., 2009; Hier et al., 2005; Jha et al., 2009; Kemper et al., 2006; Laramee et al, 2011; Linder et al., 2006; Menachemi, 2006, et al., 2006; Ovretveit et al., 2007; Poon et al., 2006; Saleem et al., 2005; Scott et al., 2005; Sequist et al., 2007; Simon et al., 2007, et al., 2007; and Zandieh et al., 2008).

4. User Friendliness. User friendliness of the EMR system deals with the complexity of the EMR system as reported by staff, as well as the redundancy felt in the documentation process. It was found that 8 of the articles that met inclusion for this review reported user friendliness of the EMR system to be a factor as presenting a challenge to successful EMR implementation. This factor was the lowest reported factor among the literature included in this review. It can be thought that this is the lowest reported factor presenting a challenge due to the fact that when a healthcare organization purchases an EMR for

implementation, they do strive to find the EMR with the "best fit" to their specific organization. The articles that reported this factor in the review are as follows: (Cherry et al., 2011; Hackl et al., 2009; Laramee et al, 2011; Linder et al., 2006; Menachemi, 2006, et al., 2006; Ovretveit et al., 2007; and Saleem et al., 2005).

5. Negative Impact on Patient-Provider Relationship. The implementation of an EMR system can result in less interaction between the patient and the healthcare profession, including less communication and less eye contact. Additionally, the lack of interaction between the patient and the healthcare professional along with the quality care prompts of the EMR system can result in the decreased use of the professional's critical thinking skills. It was found that 9 of the articles included in this review reported concerns of a negative impact on the patient and provider relationship as a factor that presents a challenge to successful EMR implementation. With more time being spent with computerized charting and less time giving the patient complete attention, there is concern among many healthcare professionals that the EMR would have a negative impact on the patient-provider relationship. According to the study conducted by Georgiou et al. (2009), "some participants felt that more time would be spent on the computer, and less in face-to-face interaction" (p. e64). The articles that reported this factor in the review are as follows: (Georgiou et al., 2009; Hackl et al., 2009; Kemper et al., 2006; Kossman & Scheidenhelm, 2008; Linder et al., 2006; Menachemi, 2006, et al., 2006; Saleem et al., 2005; Sequist et al., 2007; and Wiljer et al., 2006).

6. Security. This factor deals with the possibility of hackers into the electronic system along with possible HIPAA issues that may be encountered by having a computer in the exam room. Of the 26 articles included in this review, 9 reported security as being a factor that presented a challenge to successful EMR implementation. For instance, it was reported in Zandieh et al. (2008), that "despite the fact that at all the EHR-based practices, patient data are secured with several layers of protection, all leaders of EHR-based systems had concerns" (p. 759). The articles that reported this factor in the review are as follows: (Georgiou et al., 2009; Hackl et al., 2009; Hier et al., 2005; Kemper et al., 2006; Menachemi, 2006, et al., 2006; Simon et al., 2007, et al., 2007; Vishwanath & Scamurra, 2007; Wilijer et al., 2006; and Zandieh et al., 2008).

7. Poor Understanding of EMR Benefits. This factor occurs when the healthcare staff and patients are unaware of the benefits of the EMR system and therefore do not use it to its full intended potential. Additionally, healthcare professionals often question the return on investment associated with the implementation of an EMR into their healthcare setting. It was found that 11 of the studies included in this review found that a poor understanding of EMR benefits was a factor that presented a challenge to successful EMR implementation in healthcare. Laramee et al. (2011), report that "support individuals need to understand not only the system, but also the clinical significance of the data that are being documented" (p. 474) in order for the staff to fully understand the benefits of the EMR system. The articles that reported this factor in the review are as follows: (DesRoches et al., 2008; Goldberg et al., 2012; Hackl et al., 2009; Hier et al.,

2005; Jha et al., 2009; Kaushal et al., 2009; Kemper et al., 2006; Laramee et al., 2011; Rouf et al., 2008; Saleem et al., 2005; and Scott et al., 2005).

The second category of factors identified in the literature that create challenges to successful EMR implementation in healthcare settings deal directly with factors related to the healthcare organization itself. The reviewer identified 4 organizational factors that had recurring themes within the literature included in this review.

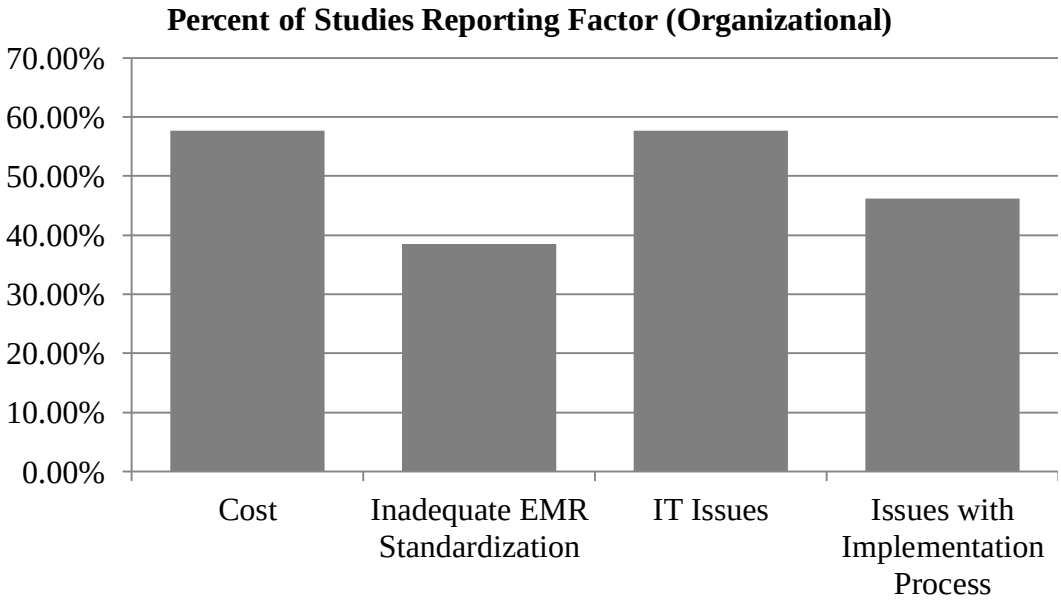


Figure 4. Organizational Factors Bar Graph. This figure indicates the occurrence of each of the factors in the 26 articles located for this review.

Organizational Factors (**O**)

1. Cost. This factor pertains to the cost of the entire implementation process, from choosing an EMR system to the cost of time needed to train employees on the system. There are always up-front and hidden costs associated with any change in practice in healthcare. This factor was found to be a reported factor causing a challenge to

successful EMR implementation in 15 of the articles included in this review. Many healthcare organizations do not fully realize the complete scope of costs associated with the successful implementation of an EMR into the workplace. These costs are described in more detail in the study by Cherry et al. (2011): "potential costs of widespread EHR adoption are one-time expenses for hardware, software, and training to promote adoption, implementation, and meaningful use. Ongoing expenses include ongoing software licensing fees, continual training for newly hired caregivers, information technology support, Internet access, and hardware maintenance, repair, and replacement" (p. 272). The articles that reported this factor in the review are as follows: (Cherry et al., 2011; DesRoches et al., 2008; Gans et al., 2005; Georgiou et al., 2009; Goldberg et al., 2012; Hackl et al., 2009; Jha et al., 2009; Jha et al., 2009; Kaushal et al., 2009; Kemper et al., 2006; Menachemi, 2006, et al., 2006; Ovretveit et al., 2007; Poon et al., 2006; Simon et al, 2007, et al., 2007; and Vishwanath & Scamurra, 2007).

2. Inadequate EMR Standardization. The lack of interoperability between all of the different EMR systems can lead to decreased workflow and decreased productivity in the healthcare setting. The lack of standardization of EMR systems was found to be a factor presenting a challenge to successful EMR implementation in 10 of the studies included in this review. The lack of standardization stems from the abundance of different EMRs currently available, the ability of each system to meet the healthcare organization's unique needs, and the lack of communication between EMR systems. Additionally, concern exists that the system chosen will not meet all of the organization's needs, and

that the system will eventually become obsolete (DesRoches et al., 2008). The articles that reported this factor in the review are as follows: (DesRoches et al., 2008; Goldberg et al., 2012; Jha et al., 2009; Jha et al., 2009; Kaushal et al., 2009; Kemper et al., 2006; Poon et al., 2006; Simon et al., 2007, et al., 2007; Vishwanath & Scamurra, 2007; and Wiljer et al., 2006).

3. Information Technology Issues. This factor presents the possibility of system, computer, and internet issues with the EMR. Additionally, there is often an unavailability of resources including computers, devices, printers, and information technology (IT) staff. IT issues was an identified factor that presents challenges to successful EMR implementation in 15 of the 26 articles included in this review. "Internet outages, system downtime, and computer glitches were reported as creating frustration for staff who depend on 24/7 access to computerized documentation systems" (Cherry et al., 2011, p. 270). The articles that reported this factor in the review are as follows: (Cherry et al., 2011; Gans et al., 2005; Georgiou et al., 2009; Hier et al., 2005; Jha et al., 2009; Jha et al., 2009; Kaushal et al., 2009; Kemper et al., 2006; Kossman & Scheidenhelm., 2008; Laramee et al., 2011; Linder et al., 2006; Sequist et al., 2005; Simon et al., 2007, et al., 2007; Vishwanath & Scamurra, 2007; and Zandieh et al., 2008).

4. Issues with Implementation. There is often an overabundance of systems to choose from, and the threat of choosing a system that is unable to meet the organization's needs is possible. It was determined that 12 of the studies included in this review cited issues with implementation as a factor that presents a challenge for successful EMR

implementation. This factor deals with the process of EMR implementation itself. This factor pertains to everything from organizational culture to conflict experienced during the implementation process (Scott et al., 2005). The articles that reported this factor in the review are as follows: (Cherry et al., 2011; DesRoches et al., 2008; Gans et al., 2005; Georgiou et al., 2009; Goldberg et al., 2012; Hackl et al., 2009; Kemper et al., 2006; Laramee et al., 2011; Menachemi, 2006, et al., 2006; Scott et al., 2005; Sequist et al., 2007; Simon et al., 2007, et al., 2007; and Urowitz et al., 2008).

Quality

Each article was carefully reviewed using qualitative and/or quantitative research guidelines as found in *Nursing Research: Generating and Assessing Evidence for Nursing Practice* (Polit & Beck, 2008) by the reviewer in an attempt to determine quality. Polit & Beck's criteria for qualitative research can be found in Appendix B, and for quantitative research in Appendix C. Quality was described in terms of "merit" in the Evidence Table in Appendix D. Merit is defined as "the quality of being good, important, or useful," (Merriam-Webster Dictionary, 2012) and was used by the reviewer in terms of the type of study design being reviewed. In terms of merit, the reviewer focused on the methods, results, discussion, and global issues of each of the research articles. The main focus lied in the quality of the research study design being used in each articles. It was acknowledged by the reviewer that the study designs that would be used in the research to look at these factors that present challenges would sit lower on the hierarchy of evidence; however, that did not mean that the design itself wasn't of high

merit. The reviewer determined that 18 of the 26 articles were of high merit for the type of study design that was used, or meeting the majority of the review guidelines described by Polit and Beck (2008): (Cherry et al., 2011; DesRoches et al., 2008; Georgious et al., 2012; Jha et al., 2009; Jha et al., 2009; Kaushal et al., 2009; Kemper et al., 2006; Laramee et al., 2011; Menachemi et al., 2006, et al., 2006; Ovretveit et al., 2007; Poon et al., 2006; Rouf et al., 2008; Saleem et al., 2005; Sequist et al., 2007; Simon et al., 2007, et al., 2007; Urowitz et al., 2008; Wiljer et al., 2006; and Zandieh et al., 2008). It was determined that the remaining 8 of the 26 articles were of moderate merit for the study design used, or meeting at least two-thirds of the review guidelines described by Polit and Beck (2008): (Gans et al., 2005; Goldberg et al., 2012; Hackl et al., 2009; Hier et al., 2005; Kossman & Scheidenhelm, 2008; Linder et al., 2006; Scott et al., 2005; and Vishwanath & Scamurra, 2007). There were no articles included in this review that were determined to be of low merit based on study design, or less than two-thirds of the review guidelines described by Polit and Beck (2008).

Additionally, as mentioned early, each study was categorized by the reviewer into DiCenso's (2005) *Hierarchy of Strength of Evidence for Treatment Decisions*. Although all of the studies included in this review were determined to rank among the lower portion of the hierarchy due to study design it is important to note that "this hierarchy is not absolute. If intervention effects are sufficiently large and consistent, for instance, observational studies may provide more compelling evidence than most RCTs (randomized controlled trials)" (DiCenso et al., 2005, p.13). Some of the studies ranked lower on the hierarchy than others, but some had larger and more consistent intervention

effects. Therefore, inferences based on the mined evidence included in this review that ranks low on the hierarchy of evidence should not be overlooked.

Lastly, the reviewer determined each article that met inclusion in this review's level of potential bias. The potential for bias was based on a number of criteria including study design, data analysis methods, included discussion of potential bias, etc. In many cases in this review, an article was determined to have high merit based on study design, but to also have inherent high potential for bias based on the study design itself. Based on this criterion for potential bias, the reviewer determined that 20 of the 26 articles included in this review had a high potential for bias: (Cherry et al., 2011; Gans et al., 2005; Georgious et al., 2009; Goldberg et al., 2012; Hackl et al., 2009; Hier et al., 2005; Jha et al., 2009; Kemper et al., 2006; Kossman &Scheidenhelm, 2008; Laramee et al., 2011; Linder et al., 2006; Ovretveit et al., 2007; Poon et al., 2006; Rouf et al., 2008; Saleem et al., 2005; Scott et al., 2005; Urowitz et al., 2008; Vishwanath & Scamurra, 2007; Wiljer et al., 2006; and Zandieh et al., 2008). It was determined that 6 of the 26 articles included in this review had a moderate potential for bias: (DesRoches et al., 2008; Jha et al., 2009; Kaushal et al., 2009; Menachemi et al., 2006, et al., 2006; Sequist et al., 2007; and Simon et al., 2007, et al., 2007). There were no articles included in this review determined by the reviewer to be of low potential for bias. Although the majority of articles in this review were deemed to be high merit, the inherent high potential for bias did distract from many of the articles' credibility.

Summary

After careful review of the literature that met inclusion in this integrative review that discussed factors that present challenges to healthcare staff during EMR implementation, the data was further analyzed and results were drawn by the reviewer. Results were discussed as they pertained to the two themes that arose related to the factor that present challenges: personal/professional, and organizational. The reviewer also chose to display these factors in a bar graph format to represent the occurrence of each of the factors occurring in the literature included for review. The occurrence of each of these factors is important to review when determining the most important challenges to address when implementing an EMR into practice.

CHAPTER FIVE

DISCUSSION

Overview

The purpose of this integrative review of literature was to explore the factors that present challenges to healthcare staff for successful EMR implementation in healthcare organizations. Through this review, the reviewer aimed to discover these factors as a reference to inform healthcare organizations the will implement the EMR into practice in the future. A better understanding of these factors will allow for a better prepared healthcare organization for EMR implementation. Through a rigorous literature search, 26 articles were found by the reviewer to meet all of the criteria for inclusion in this review. The reviewer was surprised to locate such a robust amount of available literature discussing these factors that present challenges to successful EMR implementation. With this amount of literature available that discusses these factors, it would seem that more organizations would use these studies as a reference on how to lessen the barriers of EMR implementation. Two separate categories of themes were identified as being factors that present challenges to EMR implementation: personal/professional factors, and organization factors. The personal/professional factors identified included inadequate time; inadequate computer skills; workflow disruption; user friendliness; negative impact on patient-provider relationship; security issues; and poor understanding of the EMR benefits. The organizational factors identified included cost; inadequate EMR standardization; IT issues; and issues with implementation.

Strengths

A substantial number of studies were located and met inclusion criteria for this review: 26 articles total were included. All of these studies were reviewed using Polit and Beck's (2008) qualitative and/or quantitative research criteria (Appendices B & C) and organized into an evidence table (Appendix D). The majority of the included research was determined to be of high merit for the study design that was used. All of the studies included for review were very thorough and descriptive in exploring the factors that present challenges to successful EMR implementation in healthcare organizations. Additionally, a wide range of healthcare professionals, healthcare settings, and countries of study origin were represented in the literature included in this review.

Limitations

Limitations can be defined as "aspects of a study that are potentially confounding to the main study variables" (Fain, 2009). As with any research study, there were limitations associated with this specific integrative review. Time was a major limiting factor in this project, as there was only approximately one calendar year to put together a comprehensive integrative review. Another factor that was limiting was the amount of research that was available to the researcher since the electronic medical record is still a relatively new area of research. In addition, not all applicable articles available may have been included in this study if they weren't available in the databases that were utilized.

After all of the literature meeting inclusion criteria was thoroughly reviewed, it was determined that evidence in this review was both quantitative and/or qualitative.

High potential for bias was found in many of the studies based on the study design itself. Many of the studies had a small sample size and/or did not include all members of the profession being surveyed due to voluntary participation in the study. Additionally, the largest population of healthcare professionals represented among all of these studies was physicians. Due to the time frame of interest (2005-2013) and the reviewer's chosen inclusion criteria for this review, many studies of high quality with applicable focus may not have been included as well.

Implications for Clinical Practice

Through the signing of the HITECH Act as part of the American Recovery and Reinvestment Act by President Obama to assist in accelerating the development of EHR's, it is only a matter of time before all healthcare settings have converted from paper-based charting to an EMR system of documentation. The implementation of these EMR systems is already currently happening in numerous healthcare settings across the United States and on a global level. It is important for these EMR implementations to occur as smoothly as possible in an attempt to ensure success.

The purpose of this integrative review of literature was to explore factors that present challenges to healthcare staff throughout EMR implementation. Exhaustive review of the applicable literature revealed two categories of themes for factors that present barriers: personal/professional factors, and organizational factors. Personal/professional factors included inadequate time; inadequate computer skills; workflow disruption; user friendliness; negative impact on patient-provider relationship;

security issues; and poor understanding of EMR benefits. Organizational factors included cost; inadequate EMR standardization; IT issues; and issues with implementation. The knowledge of these factors can be used by healthcare organizations desiring to implement an EMR system into practice by assuring them that having an understanding of these factors presenting barriers can assist them in preventing them from occurring. Although some of the factors that present challenges cannot be avoided, such as the cost of the EMR system, a well thought-through plan for implementation of the EMR system into practice can at least lessen these factors to some extent. Additionally, an emphasized focus should be placed on the factors that present challenges that were most frequently encountered in the included studies since there exists an increased likelihood of reoccurrence in future implementations.

After completion of this integrative review of literature, one extremely important need for successful EMR implementation was brought to light: there needs to be in existence a standardized plan for successful EMR implementation formulated to address the factors that present challenges to implementation in all healthcare settings. Although most of the studies included in this review offered some insight on how to overcome these factors and successfully implement an EMR into practice, a standardized implementation plan based on the findings from this review would be very valuable as the findings from this review offer insight from different types of healthcare settings, different healthcare professionals, and different countries undergoing EMR implementation.

Implications for the Clinical Nurse Leader Role

The Clinical Nurse Leader (CNL) position is responsible for leadership and change; interdisciplinary relationships; knowledge transfer; outcomes management; practicing as a clinician at the point of care; and professional development (Monaghan & Swihart, 2010). More specifically, the CNL position is achieved by a Registered Nurse who "is educated to graduate level with a master's degree or higher; works with intra and interdisciplinary team members; applies evidence-based practice (EBP); minimizes risk and maximizes the quality of clinical care delivered; contributes to the assessment of a cohort of assigned patients with complex healthcare needs; has an entrepreneurial spirit; and is equipped to meet the rigors and demands of the ever-changing healthcare agenda in a particular clinical environment" (Monaghan & Swihart, 2010, p. 3). CNLs in practice provide horizontal leadership to the nursing staff daily. They are trained with the unique ability to look at a system or process within any healthcare setting, identify the need for change, and provide guidance and expertise on how to make a change successful in practice. Therefore, it would be expected that CNLs would have an extremely important role during EMR implementation in their healthcare setting.

The CNL would be able to take the knowledge of the factors that present challenges to healthcare staff during EMR implementation gained from this integrative review, determine what factors can and cannot be fixed, and propose solutions to these fixable factors taken from evidence-based practice. Having a CNL in practice during this implementation would be an extremely valuable asset for ensuring intra- and interdisciplinary teamwork and assisting in meeting the demands of the changing care

environment in their healthcare setting. Additionally, the CNL would offer leadership and support to the healthcare team during the transition to an EMR.

One particular factor that presents a challenge to healthcare staff during EMR implementation that could be addressed through the assistance of a CNL is workflow disruption. As discussed previously, workflow disruption occurs when healthcare practices do not plan their normal workflow around the new function associated with EMR use. This lack of adequate planning can lead to poor outcomes in any healthcare setting. Along with providing the healthcare facility with much-needed guidance through leadership and change, encouraging and facilitating interdisciplinary relationships, and providing knowledge transfer during EMR implementation, the CNL is responsible for the management of these outcomes as well. Therefore, if a practice is experiencing workflow disruption during EMR implementation, the CNL would be concerned with how this challenge is affecting outcomes and attempt to determine ways to improve upon this challenge using evidence-based practice. The CNL would address the workflow disruption by performing a clinical audit which "provides a systematic approach to implementing clinical evidence to practice, then identifying where change is required in order to maximize improvement in clinical outcomes (Monaghan & Swihart, 2010, p.78). A well designed clinical audit consists of the following 7 stages (Monaghan & Swihart, 2010):

1. Identify the practice to be audited. In this case, the practice being audited would be the workflow in a practice where an EMR is being implemented.

2. Design the audit tool. Evidence would need to be examined and an audit tool developed with key points of measuring practice (such as length of time to look up patient information in the EMR, area where additional time needs to be allotted for EMR usage, length of time to dictate an H & P, etc.).

3. Collect the data. Data would be collected through observation of workflow and staff feedback regarding where workflow is disrupted by EMR use.

4. Evaluated the data and identify gaps. Results would be measured based on data collected and then evaluated compared with the evidence that was used to develop the audit tool.

5. Share data. Data obtained would be shared with the appropriate professionals and solutions would be discussed. Staff should be engaged in this solution process.

6. Plan and deliver the intervention. This step would involve an interdisciplinary collaborative team approach if outcomes are to be improved upon.

7. Re-audit the practice. This step would measure the effectiveness of the intervention and determine whether workflow disruption during EMR implementation was improved upon.

The CNL can repeat the audit steps listed above as many times are needed until an improvement in outcomes is seen related to the workflow disruption caused by EMR implementation. Reducing the issue with this extremely common challenge encountered

by practices undergoing EMR implementation will encourage a more open culture of change through the assistance of the CNL's unique role in practice. Overall, having a CNL in practice during EMR implementation would be a gatekeeper of quality in assuring that everything possible is being done to avoid the factors that present challenges that were outlined in this review of literature.

Implications for Research

Although a total of 26 studies were located for inclusion in this integrative review of literature, there exists room for more research in this area of factors that present challenges to healthcare staff for successful EMR implementation. Possible solutions for these factor presents another are of research that should be explored in an effort to offer insight to inform healthcare organizations facing EMR implementation in the future.

As discussed previously, one major area discovered through performing this review where further research is needed exists in the creation of a standardized plan for successful EMR implementation in all healthcare settings. This plan should include remedies to overcoming these factors that present barriers to successful EMR implementation for healthcare staff. A standardized implementation plan would offer healthcare organizations the best chance for a smooth EMR implementation into practice for the staff, patients, and the organization as a whole.

Relationship to Theoretical Framework

Locsin's Theory of Technological Competency as Caring in Nursing was chosen and used by the reviewer to lay a foundation for this integrative review of literature. This theory presents a view of technological competency as being part of the nursing process by which nurses are able to know their patients more fully by use of technology for health and nursing (Blum et al., 2010). Additionally, this theory suggests that a harmonious coexistence between nursing and technology must occur in order for the nurse to be able to maximize this relationship and result in the ability to know the patients more fully and in the moment (Blum et al., 2010).

Successful EMR implementation into healthcare settings is an essential element for nursing staff to be able to use the technology to its full potential in knowing their patients. By exploring the factors that present challenges to healthcare staff during EMR implementation in this integrative review, a better understanding of the challenges faced by nurses during EMR implementation was gained. Knowledge of these factors that present challenges can be used in an effort to avoid these challenges during EMR implementation and allow for the harmonious coexistence between nursing and technology to occur. Therefore, by preventing these factors that present challenges during EMR implementation identified in this review, nurses will be enabled to know the patients that they are caring for more fully and in the moment as Locsin had described.

Summary

The purpose of this integrative review of literature was to explore the factors that present challenges to successful EMR implementation for healthcare staff. A total of 26 studies were located by the reviewer that met criteria for inclusion in this review. These factors were found to include inadequate time; inadequate computer skills; workflow disruption; user friendliness; negative impact on patient-provider relationship; security issues; poor understanding of EMR benefits; cost; inadequate EMR standardization; IT issues; and issues with implementation. The reviewer quantified these factors and presented them in bar graph format to represent their occurrence in these studies. These factors presented challenges to successful EMR implementation in a variety of healthcare settings to a variety of healthcare staff in a variety of countries and should be used to inform healthcare organizations implementing an EMR in ensuring a successful EMR implementation process.

REFERENCES CITED

American Medical Association (n.d.). Electronic Medical Records and Electronic Health Records. Retrieved October 10, 2012, from https://www.ama-assn.org/ama/pub/physician-resources/health-information-technology/health-it-basics/emrs-ehrs.page.

Ander, J., & Daly, T. (n.d.). The crucial role of the nurse in EHR implementation. *Med3000 White Pater*. Retrieved October 10, 2012, from http://www.med3000.com/Portals/46580/docs /pdf/the%20role%20of%20the%20nurse%20in%20ehr%20implementation%20white%20paper%20by%20med3ooo%20(2).pdf.

Blum, C.A., Hickman, C., Parcells, D.A., & Locsin, R. (2010). Teaching caring nursing to RN-BSN students using simulation technology. *International Journal for Human Caring* 14(2), 41-50.

Cherry, B.J., Ford, E.W., & Peterson, L.T. (2011). Experiences with electronic health records: early adopters in long-term care facilities. *Health Care Management Review*, 36(3), 265-274.

DesRoches, C.M., Campbell, E.G., Rao, S.R., Donelan, K., Ferris, T.G., Jha, A., Kaushal, R.,Levy, D.E., Rosenbaum, S., Shields, A.E., & Blumenthal, D. (2008). Electronic health records in ambulatory care – a national survey of physicians. *New England Journal of Medicine*, 359(1), 50-60.

DiCenso, A., Guyatt, G., & Ciliska, D. (2005). *Evidence-Based Nursing: A Guide to ClinicalPractice*. St. Louis, MO: Elsevier Mosby.

Edwards, C. (2012). Nursing leaders serving as a foundation for the electronic medical record. *Journal of Trauma Nursing*, 19(2), 111-114.

Fain, J.A. (2009). *Reading, Understanding, and Applying Nursing Research* (3rd ed.). Philadelphia, PA: F.A Davis Company.

Gans, D., Kralewski, J., Hammons, J., & Dowd, B. (2005). Medical groups' adoption of electronic health records and information systems. *Health Affairs*, 24(5), 1323-1333.

Georgiou, A., Ampt, A., Creswick, N., Westbrook, J.I., & Braithwaite, J. (2009). Computerized provider order entry – what are health professionals concerned about? *International Journal of Medical Informatics*, 78(1), 60-70.

Goldberg, D.G., Kuzel, A.J., Feng, L.B., DeShazo, J.P., & Love, L.E. (2012). EHRs in primary care practices: benefits, challenges, and successful strategies. *American Journal of Managed Care*, 18(2), e48-e54.

Hackl, W., Hoerbst, A., & Ammenwerth, E. (2009). The electronic health record in Austria: physicians' acceptance is influenced by negative emotions. *Studies in Health Technology& Informatics*, 150, 140-144.

Haupt, A. (2011, July 18). The era of electronic medical records. *US News and World Report.* Retrieved October 10, 2012, from http://health.usnews.com.

Hersh, W.R. (1995). The electronic medical record: Promises and problems. *Journal of The American Society for Information Science*, 46(10), 772-776.

Hier, D.B., Rothschild, A., LeMaistre, A., & Keeler, J. (2005). Differing faculty and housestaff acceptance of an electronic health record. *International Journal of Medical Informatics*, 74(7-8), 657-662.

Jha, A.K., Bates, D.W., Jenter, C., Orav, E.J., Zheng, J., Cleary, P., & Simon, S.R. (2009). Electronic health records: Use, barriers and satisfaction among physicians who care for Black and Hispanic patients. *Journal of Evaluation in Clinical Practice*, 15(1), 158-163.

Jha, A.K., DesRoches, C.M, Campbell, E.G., Donelan, K., Rao, S.R., Ferris, T.G., Shields, A., Rosenbaum, S., & Blumenthal, D. (2009). Use of electronic health records in US hospitals. *The New England Journal of Medicine*, 360(16), 1628-1638.

Jha, A.K., DesRoches, C.M., Kralovek, P.D., & Joshi, M.S. (2010). A progress report on electronic health records in U.S. hospitals. *Health Affairs*, 29(10), 1951-1957.

Joanna Briggs Institute (2008). *Joanna Briggs Institute reviewer's manual: 2008 edition.* Adelaide, Australia.

Kaushal, R., Bates, D.W., Jenter, C.A., Mills, S.A., Volk, L.A., Burdick, E., Tripathi, M., & Simon, S.R. (2009). Imminent adopters of electronic health records in ambulatory care. *Informatics in Primary Care*, 17(1), 7-15.

Kemper, A.R., Uren, R.L., & Clark, S.J. (2006). Adoption of electronic health records in primary care pediatric practices. *Pediatrics*, 118(1), e20-e24.

Kossman, S.P. & Scheidenhelm, S.L. (2008). Nurses' perceptions of the impact of electronic health records on work and patient outcomes. *CIN: Computers, Informatics, Nursing*, 26(2), 69-77.

Laramee, A.S., Bosek, M., Kasprisin, C.A., & Powers-Phaneuf, T. (2011). Learning

from within to ensure a successful implementation of an electronic health record. *Computers, Informatics, Nursing*, 29(8), 468-477.

Linder, J.A., Schnipper, J.L., Tsurikova, R., Melnikas, A.J., Volk, L.A., & Middleton, B. (2006). Barriers to electronic health record use during patient visits. *AMIA….Annual Symposium Proceedings/AMIA Symposium*, 499-503.

Locsin, R.C. (2005). *Technological Competency as Caring in Nursing: A Model for Practice*. Indianapolis, IN: Sigma Theta Tau International.

Menachemi, N. (2006). Barriers to ambulatory EHR: who are 'imminent adopters' and how do they differ from other physicians? *Informatics in Primary Care*, 14(2), 101-108.

Menachemi, N., Ettel, D.L., Brooks, R.G., & Simpson, L. (2006). Charting the use of electronic health records and other information technologies among child health providers. *BMC Pediatrics*, 6(21), 1-8.

Merriam-Webster Dictionary (2012). Retrieved October 10, 2012, from http://www.merriam-webster.com/ .

Monaghan, H.M., & Swihart, D.L. (2010). *Clinical nurse leader: transforming practice, transforming care*. Sarasota, FL: Visioning HealthCare, Inc.

National Assembly on School Based Health Care (n.d.). *History of the Electronic Medical Record System.* Retrieved October 10, 2012, from www.nasbh.org.

Ovretveit, J., Scott, T., Rundall, T.G., Shortell, S.M., & Brommels, M. (2007). Improving quality through effective implementation of information technology in healthcare. *International Journal for Quality in Health Care*, 19(5), 259-266.

Polit, D.F., & Beck, C.T. (2008). *Nursing research: generating and assessing evidence for nursing practice*. St. Louis, MO: Lippincott, Williams, & Wilkins.

Poon, E.G., Jha, A.K., Christino, M., Honour, M.M., Fernandopulle, R., Middleton, B., Newhouse, J., Leape, L., Bates, D.W., Blumenthal, D., & Kaushal, R. (2006). Assessing the level of healthcare information technology adoption in the United States: a snapshot. *BMC Medical Informatics & Decision Making*, 6(1), 1-9.

Rouf, E., Chumley, H.S., & Dobbie, A.E. (2008). Electronic health records in outpatient clinics: Perspectives of third year medical students. *BMC Medical Education*, 8(13), 1-7.

Saleem, J.J., Patterson, E.S., Militello, L., Render, M.L., Orshansky, G., & Asch, S.M. (2005). Exploring barriers and facilitators to the use of computerized clinical reminders. *Journal of the American Medical Informatics Association*, 12(4), 438-447.

Scott, J.T., Rundall, T.G., Vogt, T.M, & Hsu, J. (2005). Kaiser Permanente's experience of implementing an electronic medical record: A qualitative study. *British Medical Journal*, 331(7528), 1313-1316.

Sequist, T.D., Cullen, T., Hays, H., Taualii, M.M., Simon, S.R., & Bates, D.W. (2007). Implementation and use of an electronic health record within the Indian Health Service. *Journal of the American Medical Informatics Association*, 14(2), 191-197.

Simon, S.R., Kaushal, R., Cleary, P.D., Jenter, C.A., Volk, L.A., Orav, E.J., Burdick, E., Poon, E.G., & Bates, D.W. (2007). Physicians and electronic health records: a statewide survey. *Archives of Internal Medicine*, 167(5), 507-512.

Simon, S.R., Kaushal, R., Cleary, P.D., Jenter, C.A., Volk, L.A., Poon, E.G., Orav, E.J., Lo, H.G., Williams, D.H., & Bates, D.W. (2007). Correlates of electronic health record adoption in office practices: a statewide survey. *Journal of the American Medical Informatics Association*, 14(1), 110-117.

Tellez, M. (2012). Nursing Informatics Education Past, Present and Future. *Computers, Informatics, Nursing*, 30(5), 229-233.

Torda, P., Han, E.S., & Scholle, S.H. (2010). Easing the adoption and use of electronic health records in small practices. *Health Affairs*, 29(4), 668-675.

Urowitz, S., Wiljer, D., Apatu, E., Eysenbach, G., Delenardo, C., Harth, T., Pai, H., & Leonard, K.J. (2008). Is Canada ready for patient accessible electronic health records? A national scan. *BMC Medical Informatics & Decision Making*, 8(33), 1-7.

Vishwanath, A. & Scamurra, S.D. (2007). Barriers to the adoption of electronic health records: Using concept mapping to develop a comprehensive empirical model. *Health Informatics Journal*, 13(2), 119-134.

Whittemore, R., & Knafl, K. (2005). The integrative review: updated methodology. *Journal of Advanced Nursing*, 52(5), 546-553.

Wiljer, D., Bogomilsky, S., Catton, P., Murray, C., Stewart, J., & Minden, M. (2006).

Getting results for hematology patients through access to the electronic health record. *Canadian Oncology Nursing Journal*, 16(3), 154-164.

Zandieh, S.O., Yoon-Flannery, K., Kuperman, G.J., Langsam, D.J., Hyman, D., & Kaushal, R. (2008). Challenges to EHR implementation in electronic- versus paper-based office practices. *Journal of General Internal Medicine*, 23(6), 755-761.

APPENDICES

APPENDIX A

DETAILED DATABASE SEARCH FOR LITERATURE

Database	Search Terminology	Advanced Search	Results
CINAHL	*electronic medical record implementation challenges*	English Research-based Peer-reviewed Boolean/Phrase 2005-2013	4 articles produced 0 articles met inclusion criteria
CINAHL	*electronic medical record implementation challenges*	English Research-based Evidence-based practice Boolean/Phrase 2005-2013	0 articles produced
CINAHL	*electronic medical record implementation challenges*	English Research-based Peer-reviewed Find all terms 2005-2013	17 articles produced 3 articles met inclusion criteria 2 articles duplicate 12 articles did not meet inclusion criteria
CINAHL	*electronic medical record implementation challenges*	English Research-based Evidence-based practice Find all terms 2005-2013	1 article produced 0 articles met inclusion criteria
CINAHL	*electronic medical record implementation obstacles*	English Research-based Evidence-based practice Boolean/Phrase 2005-2013	0 articles produced
CINAHL	*electronic medical record implementation obstacles*	English Research-based Peer-reviewed Boolean/Phrase 2005-2013	0 articles produced
CINAHL	*electronic medical record implementation obstacles*	English Research-based Evidence-based practice Find all terms 2005-2013	1 article produced 0 articles met inclusion criteria

CINAHL	*electronic medical record implementation obstacles*	English Research-based Peer-reviewed Find all terms 2005-2013	1 article produced 0 articles met inclusion criteria
CINAHL	*computerized patient record implementation challenges*	English Research-based Evidence-based practice Boolean/Phrase 2005-2013	1 article produced 1 article met inclusion criteria
CINAHL	*computerized patient record implementation challenges*	English Research-based Peer-reviewed Boolean/Phrase 2005-2013	14 articles produced 2 articles duplicates 12 articles did not meet inclusion criteria
CINAHL	*computerized patient record implementation challenges*	English Research-based Evidence-based practice Find all terms 2005-2013	1 article produced 0 articles met inclusion criteria
CINAHL	*computerized patient record implementation challenges*	English Research-based Peer-reviewed Find all terms 2005-2013	15 articles produced 3 articles duplicates 12 articles did not meet inclusion criteria
CINAHL	*computerized patient record implementation obstacles*	English Research-based Evidence-based practice Boolean/Phrase 2005-2013	0 articles produced
CINAHL	*computerized patient record implementation obstacles*	English Research-based Peer-reviewed Boolean/Phrase 2005-2013	1 article produced 0 articles met inclusion criteria
CINAHL	*computerized patient*	English	0 articles produced

	record implementation obstacles	Research-based Evidence-based practice Find all terms 2005-2013	
CINAHL	*computerized patient record implementation obstacles*	English Research-based Peer-reviewed Find all terms 2005-2013	1 article produced 0 articles met inclusion criteria
MEDLINE	*electronic medical record implementation challenges/obstacles research*	Article 2005-2013	72 articles produced numerous duplicates 0 articles met inclusion criteria
MEDLINE	*medical record system computerized research*	Article MeSH headings MeSH qualifiers 2005-2013	1,572 articles produced articles narrowed down using MeSH headings and qualifiers 21 articles met inclusion criteria 1,551 articles did not meet inclusion criteria
CIN	*electronic medical record implementation challenges/obstacles research*	2005-2013	196 articles produced 2 articles duplicates 194 articles did not meet inclusion criteria
Included article reference lists		Type of reference 2005-2013	700 references reviewed 2 articles met inclusion criteria 698 articles did not meet inclusion criteria

APPENDIX B

POLIT & BECK'S (2008) QUALITATIVE RESEARCH GUIDELINES

Title	Is the title fitting for this study? Does the title adequately describe the phenomenon being studied, and does it clearly state the group or population under study?
Introduction	Are the problem statement and research questions clearly stated? Is there appropriate literature review for the topic? Is there a clearly defined conceptual framework, ideology, or philosophical basis for the study, and is it appropriate?
Methodology	Are the rights of the participants protected? Is the research design adequate? Is the sample and setting adequately sufficient for the study, and is it described in detail? Is the methodology for data collection and procedures described in detail? Is bias minimized? Is trustworthiness of the data enhanced by the methodology, and is it described in detail?
Results	Are the data analysis methods sufficient, and are they described in detail? Are the findings summarized adequately and supported by evidence? Is the analysis of the data meaningful? Are the results integrated theoretically?
Discussion	Are the findings interpreted without bias and adequately discussed? Are interpretations consistent with limitations of the study? Are implications for clinical practices or further inquiry discussed, and are the implications complete and reasonable?
Global Issues	Is the study well-written and organized with sufficient descriptions of the components of the study? Are the researchers' qualifications and experience credible to the enhancement of the findings and interpretation of the study? Is there confidence in the results and does the study appear trustworthy? Can the results be used in nursing practice and discipline?

APPENDIX C

POLIT & BECK'S (2008) QUANTITATIVE RESEARCH GUIDELINES

Title	Does the title suggest key variables and adequately describe the study population? Is the title fitting for the study?
Abstract	Are the main features of the report including methods, results, and conclusions, clearly and concisely summarized in the abstract? Is a solid basis for the new study provided in the literature review? Is a state-of-the-art synthesis of evidence on the research problem provided in the review?
Introduction	Is the problem statement easy to identify and stated unambiguously? Is a persuasive argument for the new study built by the problem statement? Is a quantitative approach appropriate for this study? Are research questions or hypotheses stated clearly, appropriately worded, and consistent with the conceptual framework and literature review? Is the literature review up-to-date and based mainly on primary sources? Are the key concepts adequately defined conceptually? Is a conceptual/theoretical framework included, and is it appropriate?
Methods	Were participants' rights safeguarded using appropriate procedures? Given the purpose of the research, was the most rigorous design used? Were biases and threats to the internal and external validity of the study minimized by the design? Were the population and sample identified and described? Was the sample size adequate? Were key variables operationalized using the best possible method and with adequate justification? Was evidence provided in the report that the data collections methods yielded data high on reliability and validity? Was there an intervention? Was the staff collecting the data adequately trained?
Results	Were each research question or hypothesis tested using analysis? Was the most powerful analytic method used, and were appropriate statistical methods used? Are findings summarized adequately with use of tables and figures? Were the findings reported in a way that facilitates meta-analysis and with enough evidence for evidence-based practice?
Discussion	Were the findings discussed within the context of prior research and/or the conceptual framework? Does the report address the generalizability of the study, and are interpretations consistent with the results and limitations? Are the implications for clinical practice or further research

	discussed, reasonable, and complete?
Global Issues	Is the report well organized, well written, and sufficiently detailed for analysis? Do the clinical, substantive, or methodological qualifications and experience of the researchers enhance confidence in the findings? Do the findings appear valid despite limitations? Can the evidence be used in nursing practice?

APPENDIX D

EVIDENCE TABLE

Author/ Location	Study Design/ Data Analysis/ Methodology	Participants /Setting	Purpose/Research Question	Results/Findings Factors discussed: Professional/Personal Factors (P) Organizational Factors (O)	Strengths/Limitations	Strength of Evidence (described in terms of merit) /Potential for bias. Based on study design.
Cherry et al., 2011 **United States**	Online and telephone survey. Face-to-face interviews. Reflective focus groups of 4-6 nursing administrators and DONs. Transcribed coding. Post EHR implementation. 2008.	n=10 LTC facilities. Long term care facilities.	To investigate LTC facilities' EHR adoption, implementation, and use experiences.	Positive LTC facility employee EHR experiences. Reported improvements related to cost avoidance, increased access to resident info., implementation of evidence-based practices, and increased documentation accuracy. P: 1, 2, 4 O: 1, 3, 4	S: Clear inclusion and exclusion criteria; thorough data collection procedure. L: Generalizability d/t mall sample size and geographic location of the facilities in the same state. Small sample population. LTC facilities assessed tended to be above average in size and quality, and were on the forefront of technology implementation.	High merit. High potential for bias.
DesRoches et al., 2008	Mailed survey. Multivariate	n=2,758 Physicians from mixed	What proportion of physicians report that outpatient	Physicians using electronic health records report	S: Clear inclusion and exclusion criteria; random	High merit. Moderate

United States	analysis. Post EHR implementation. 9/2007-3/2008.	specialties. Mixed healthcare setting (clinics and hospitals).	electronic health records are available to them in office practice? How satisfied are physicians who use such systems, and what effect, if any, do they believe these systems have on the quality of care they provide to their patients?	positive effects of the systems on several dimensions of quality of care and high levels of satisfaction. Decisions about the adoption of EHR's were most affected by financial barriers. P: 7 O: 1, 2, 4	selection of participants; decent response rate. Excellent use of visuals. L: Potential for response bias; small number of respondents with a large margin of error; respondents with EHR systems are different from respondents without them; and small number of adopters in the study.	potential for bias.
Gans et al., 2005 **United States**	Mailed, online, and telephone survey. Regression analysis. Pre- and Post-EHR implementation.	n=2,879 Group practices with three or more physicians. Mixed healthcare setting (clinics and hospitals).	Intended to assess medical group practices' current use of information technology. What can these EHR's do? What are the perceived benefits of EHRs? What are the barriers to EHR adoption? What could	EHR adoption is progressing slowly, especially in smaller practices. Many group practices plan to implement an EHR within the next 2 years. The process of choosing and implementing an	S: Clear study methods; 97% telephone survey response rate provided excellent data to detect nonresponse bias in the combined Web and mail survey results. L: Only a small	Moderate merit. High potential for bias.

	1/2005-2/2005.		increase the rate or decrease the difficulty of implementing EHRs?	EHR appears to be very complex and varied. There exists a greater need for support for practice if EHR benefits are to be realized. P: 2, 3 O: 1, 3, 4	portion of the group practices had EHRs. Limitations were not discussed in detail as they were in many other studies.	
Georgiou et al., 2009 **Australia**	Semi-structured interviews n=20. Focus groups n=6. Interview transcriptions with open coding. Pre EHR implementation. 1/2005-2/2006.	n=50 Physicians, managers, senior health executives, pharmacists, and nurses. Australian hospital.	The purpose was to identify the main concerns of a broad range of hospital staff about the implementation of a new Computerized Provider Entry (CPOE) system for medication management.	There were 20 recurrent themes related to 9 areas of shared concern including software/hardware, education and training, work practices, relationships/communication, and inexperienced staff and deskilling. Further analysis identified 4 interrelated constructs that	S: Strong theoretical consideration, methods, data analysis, and results section. L: Generalizability is limited by the sample size and the contextual circumstances of the hospital being studied.	High merit. High potential for bias.

				highlighted what people are concerned about: Will it help? Will we cope? Will it work? Will it impair existing interaction? P: 1, 2, 3, 5, 6 O: 1, 3, 4		
Goldberg et al., 2012 **United States**	Qualitative Case Study. Descriptive surveys and interviews. Telephone and on-site interviews. Post EHR implementation. 2010-2011.	n=38 Clinicians and administrative staff. Clinics.	Intended to gain an understanding of the current use of EHRs in small primary care practices. Also to explore experiences and perceptions of physicians and staff toward the benefits, challenges, and successful strategies for meaningful use of advanced EHR functions.	Increased efficiency in retrieving medical records, coordination of care, office functions and storing patient info. were reported. Barriers reported for meaningful use of EHRs included lack of knowledge of EHR functions, costs, and problems transforming	S: Clear data collection and analysis procedures; use of different data collection methods and various key informants at each practice allowed for a more complete picture of the practices and a more robust set of conclusions; closer data analysis when inconsistencies were identified. L: Small sample size;	Moderate merit. High potential for bias.

				office operations. Also reported were major disruption to patient care and difficulty performance tracking. Facilitators for EHR functions included communication, training, alternative strategies for patient care during implementation, development of new processes and work flow procedures, team-based care, and adequate technical support. P: 3, 7 O: 1, 2, 4	no thorough discussion of limitations.	
Hackl et al., 2009	Qualitative, problem-	n=8 Physicians	Determine if anxiety and fear	Physicians feel uninformed and	S: Thorough description of	Moderate merit.

Austria	centric interviews. Pre EHR implementation. 2008.	and specialists in private practice. Mixed healthcare setting (clinics and hospitals)	can be observed in Austrian physicians related to electronic health record implementation; to detect what kinds of anxiety and fear can be found; how distinct they are; and what can be done about those fears.	snubbed, and fear unknown changes, increased costs, workload, and surveillances without having advantages form using EHR in daily practice. P: 3, 4, 5, 6, 7 O: 1, 4	methods; easily understandable for the reader. L: Small sample size; may not claim general validity of the obtained results.	High potential for bias.
Hier et al., 2005 **United States**	Mailed survey. Standard deviations, means, chi-square tests, t-tests, analysis of variance, & Fisher exact test. Post EHR implementation. 2000.	n=330 Physicians and residents. Teaching hospital.	This study aimed to determine whether differences exist between housestaff and faculty physician acceptance of an electronic health record system.	Housestaff showed a higher acceptance for the EHR than did faculty. P: 3, 6, 7 O: 3	S: Solid introduction, methods, and results sections. L: The survey was completed early after implementation of the EHR and performance and functionality have improved since the time of the survey; low response rate of 35.2%, with the assumption that non-respondents may hold	Moderate merit. High potential for bias.

					more negative EHR views than respondents.	
Jha et al., 2009 **United States**	Mailed survey. Telephone contacts between survey mailings. Logistic regressions, bivariate comparisons. Pre- and Post-EHR implementation. 6/2005-11/2005.	n=330 Physicians and residents. Teaching hospital.	This study sought to answer three questions: Do providers that care for large-minority populations have lower rates of adoption of EHRs? Do these providers face different barriers to adoption of EHR systems? Is their satisfaction with EHR systems comparable with providers who predominantly care for white Americans?	No evidence that minority-serving providers has lower EHR adoption rates, faced different barriers to adoption or were less satisfied with EHRs in a state with a diverse minority population. The study failed to find evidence of a new digital divide, given the importance of ensuring that minority-serving providers have equal access to EHR systems. P: 3, 6, 7 O: 3	S: Very strong abstract; descriptive introduction, methods, and results sections. L: Data was collected only from a single state, Massachusetts, and may not be representative of other states; physicians' self-report of racial composition was used, and since there was no "gold-standard" method of measuring racial composition providers may have been misclassified; this study did not measure any objective way whether minority – serving physicians do	High merit. High potential for bias.

					in fact obtain the same benefits from an EHR.	
Jha et al., 2009 **United States**	Mailed survey. Telephone calls and reminder letters to non-responding hospitals. Multivariate models, logistic regression. Pre- and Post-EHR implementation. 3/2008-9/2008.	n=2,952 CIOs. Acute care hospitals.	Respondents were asked to report on the presence of absence of 32 clinical functionalities of an electronic-records system and the implementation status of their hospital. Respondents were asked to identify whether certain factors presented barriers to the adoption of and electronic-records system and whether specific policy changes would have a positive/negative effect on their decision to adopt such a system.	Larger hospital, in urban areas, and teaching hospitals were more likely to have electronic-records systems. Capital requirements and high maintenance costs were the primary barriers to implementation cited. A policy strategy focused on interoperability, training of technical support staff, and financial support may be necessary to spur adoption of electronic-records systems in US hospitals. P: 7	S: Well-done abstract, intro, methods, and results section. Good use of visuals. L: The hospitals that did not respond to the survey were somewhat different from those that did respond, and although the study did try to compensate for nonresponse bias, the adjustments aren't perfect; the study focused on adoption and couldn't accurately gauge the actual use or effectiveness of electronic-records systems; whether the systems that were adopted had been independently	High merit. Moderate potential for bias.

			The relationship of adoption of EHRs to specific hospital characteristics and factors that were reported to be barriers to or facilitators of adoption were identified.	O: 1, 2, 3	certified was not ascertained; there was limited power to identify predictors of the adoption of comprehensive electronic-records systems as compared with basic systems given the low adoption levels; satisfaction of the use of EHRS was not ascertained.	
Kaushal et al., 2009 **United States**	Mailed survey. Pre- and Post-EHR implementation. 6/2005-11/2005.	n=1,082 Physicians from mixed specialties. Mixed healthcare setting (clinics and hospitals)	Intended to compare the characteristics of physicians who are imminent adopters of EHRs with EHR users and non-users.	Imminent adopters were younger, more experienced in technology, and more often in practices engaged in quality improvement that non-adopters. Financial considerations appear to play a role in adoption decisions. P: 7	S: Decent sample size; high response rate; clearly stated survey formulation procedure and survey administration procedure; descriptive statistical analysis section. Also captured responses from a wide variety of providers and settings. L: Only conducted in	High merit. Moderate potential for bias.

				O: 1, 2, 3	one state, Massachusetts.	
Kemper et al., 2006 **United States**	Descriptive mailed survey Fisher exact test, Pearson chi-square test. Pre- and Post-EHR implementation. No dates given.	n=526 Primary care pediatricians. Clinics.	Measure the penetration and functionality of EHRs into primary care pediatric practice; identify plans for the adoption of EHRs; understand the common barriers to the adoption of EHRs; and evaluate attitudes toward EHRs among those with and without one.	The likelihood of having an EHR increased with practice size. Cost was a barrier for nearly all of those without an EHR; 50% of respondents questioned whether EHRs lead to quality of care improvement and many couldn't find an EHR that would meet their practice requirements. P: 2, 3, 5, 6, 7 O: 1, 2, 3, 4	S: In-depth sampling, survey, and data analysis procedures; L: Low response rate; inability to directly assess how the EHRs were actually used within the practice and the effect of the EHR on practice operation and patient outcome;	High merit. High potential for bias.
Kossman & Scheidenhelm, 2008 **United States**	Descriptive qualitative study. Interviews, questionnaire	n=46 Nurses. Hospital.	Sought to answer several research questions related to nurses' experience with the phenomenon of	Community hospital nurses perceived EHR use affected their work and patient outcomes. They	S: Clear explanations of methodology, setting, sample, and findings. L: Small sample size,	Moderate merit. High potential for bias.

	survey, observations Post EHR implementation. No dates given.		EHRs: How do community hospital nurses use EHRs? What effect do they think HER use has on their ability to perform nursing care? What effect does HER use have on patient outcomes?	perceived EHR use as extensive and time consuming; both helping and hindering their work; and having both negative and positive effects on patient outcomes. Additionally, it is preferred over paper charts but should perform better to support nursing work. P: 5 O: 3	self-report methodology, and use of one EHR system in which physicians did not fully participate.	
Laramee et al., 2011 **Canada and United States**	Descriptive exploratory qualitative research design, mailed survey. Chi-square. Binary logistic	n=4,203 Physicians including general, pediatric, pediatric sub-specialists, & family practice.	What factors do interdisciplinary healthcare team members at a rural academic medical center perceive led to a previous successful implementation of an EHR? What	Four major themes were described by participants as being fundamental to the successful transition to an EHR based on participants' previous experience with	S: Thorough description of background, methods, sample, data analysis, and results. L: Limited generalizability of findings; based on	High merit. High potential for bias.

	regression model. Pre- and Post-EHR implementation. 3/2005-6/2005.	Mixed healthcare setting (clinics	strategies do interdisciplinary healthcare team members at a rural academic medical center perceive as being effective in overcoming barriers, addressing expectations, quelling fears, and helping to create positive attitudes and perception during a previous transition to an EHR?	initiating a departmentally based EHR: it will take one hundred charts; self-discovery; clear processes; and make the EHR support a customer-focused service. P: 1, 2, 3, 4, 5, 6 O: 1, 4	participant perception and recall; there may exist a positive difference between when the EHR implementation occurred 5 years ago and implementation today; passage of time and anticipation of impending EHR implementation may have impacted the participants' perceptions and recall.	
Linder et al., 2006 **United States**	Cross-sectional online survey. Post EHR implementation. No dates given.	n=225 Primary care physicians. Mixed healthcare setting (clinics and hospitals).	Intended to assess clinicians' EHR use during patient visits; to identify characteristics of clinicians who use the EHR intensively during patient visits; and to identify perceived barriers to EHR use during	The majority of clinicians do not fully utilize the EHR during patient visits due to social, workflow, technical, and professional barriers. Non-physician clinicians were	S: Decent background, methods, data analysis, and results description. L: Low response rate may not be representative of all clinicians surveyed; may not generalize due to conduction of	Moderate merit. High potential for bias.

			patient visits.	marginally less likely to use the EHR during patient visits. P: 2, 3, 4, 5 O: 3	the survey in an academically affiliated, electronically sophisticated group of primary care clinics; incentive may have influenced more trainees; assessed only self-reported behavior and barriers; definition of the degree of EHR use during visits were proxies for actual interaction with the EHR and EHR-based clinical decision support.	
Menachemi, 2006, et al., 2006 **United States**	Mailed survey. Chi-square. Binary logistic regression model. Pre- and Post-EHR implementatio	n=4,203 Physicians including general, pediatric, pediatric sub-specialists, & family practice. Mixed	This study aimed to identify imminent adopters of the EHR and compared their barriers to other physicians.	Imminent adopters are less likely to be in solo practice; more likely to be in an urban area or a multi-specialty practice; and more likely to be practicing family medicine or obgyn. Imminent	S: Well-done abstract, introduction, methods, and results sections. This study failed to identify the presence of response bias in the sample after employing common methodologies used to detect bias.	High merit. Moderate potential for bias.

	n. 3/2005-6/2005.	healthcare setting (clinics and hospitals).		adopters perceive EHR barriers differently than their colleagues: they are less likely to consider upfront cost of hardware/software or that an inadequate return on investment was a major barrier. They also differed in respect to numerous other productivity-related and technical-related barriers. P: 1, 2, 3, 4, 5, 6 O: 1, 4	L: Survey response rate; did not capture information from each physician regarding their role and financial stake in the EHR adoption process; generalizability to other locales should be done with caution; and more research should examine barriers and adoption intentions of physicians and determine how they change over time.	
Ovretveit at al., 2007 **Sweden**	Qualitative case study. Telephone interviews. Discussions	n=30 Senior clinicians, managers, project team members, physicians, and nurses.	Describe the implementation of one EMR system in one hospital, the perceived impact, the factors thought to help and hinder	Swedish implementation was achieved within a year and for under half the budget with a generally popular	S: Use of theory to guide research; well-defined methods and findings of the study; incorporation and description of previous research;	High merit. High potential for bias.

	with a panel of experts. Pre- and Post-EHR implementation. 2003.	Swedish teaching hospital.	implementation, and the success of the system and to compare this with theories of effective IT implementation. Draw on previous research. Empirical data from this study was used to develop IT implementation theory.	EMR thought to save time and improve the quality of patient care. These results suggest that key factors for cost effective implementation and operation were features of the system itself, the implementation process and the conditions under which the implementation was carried out. P: 3 O: 1, 2	good description of practical implications. Research was carried out prospectively and concurrently, drew on detailed project documentation and involved a systematic comparison with a theory of information technology implementation derived from research evidence and a previous study before the empirical data gathering. L: Generalizations must be made with caution; limited sample of informants; study did not change-over from a paper system but replace and old system.	
Poon et al., 2006	Telephone interviews.	n=52 Stakeholders from eight	This study was conducted to estimate more	It was found that the adoption of functionalities	S: Well-written abstract, introduction, methods, and results	High merit. High potential for

United States	Discussions with a panel of experts. Pre- and Post-EHR implementation. 2003.	different areas. Mixed healthcare setting (clinics and hospitals).	comprehensively the current level of HIT adoption in healthcare in eight key sectors, and to assess the most significant barriers to further adoption.	with financial benefits far exceeds adoption of those with safety and quality benefits. Adoption remains limited especially in ambulatory EHRs and physician-patient communication. Enormous financial challenges in adopting HIT and concerns about its impact on productivity are still issues. Adoption will likely remain slow unless significant financial resources are made available. P: 3 O: 1, 2	sections. L: Qualitative methods may yield less precision than quantitative methods; a good agreement between the estimates of HIT in the two markets and the estimate provided by the expert panel exists, and the expert panel was probably influenced by the market analysis performed; contacts were made in Boston and Denver, and not all potential informants participated in the interviews which could be subject to selection and responder bias; the national adoption estimates derived from the expert panel were likely	bias.

					influenced by personal biases; limited resources prevented studying in-depth the adoption of HIT in more than two markets, and regional variation in HIT adoption would have been difficult to discern.	
Rouf et al., 2008 **United States**	Online survey. Post EHR implementation. 8/2005-2/2006.	n=33 Medical students (3rd year). Clinics.	This study sought to gain insight regarding the impact of electronic health records on third year medical students' learning in the ambulatory care setting.	There was a 62% response rate. The majority of respondents reported that they liked the EHR's ability to organize information, that essential information was easier to find, that documentation was improved, that they were satisfied with the doctor-patient communication with the EHR, and that more history	S: Solid abstract, introduction, methods, and results sections. L: Small sample size; electronic distribution of the survey may have biased the respondents; results were based on students' self-report and the data must be interpreted carefully; and lack of knowledge about attending physicians' behaviors and role modeling in an HER-	High merit. High potential for bias.

				questions were asked due to EHR prompts. Generally, positive attitudes towards the EHR were reported, but significant concern about the potential impact of the EHR on the ability to conduct the doctor-patient encounter was reported. P: 7	enabled setting requires further research.	
Saleem et al., 2005 **United States**	Qualitative field observations. Observation/ Ethnography. Post EHR implementation. 1/2004 & 6/2004.	n= 55 Primary care physicians, and n=35 nurses. Mixed healthcare setting (within VA healthcare hospitals).	The purpose of this study was to conduct observations to determine barriers and facilitators to the effective use of clinical reminders since clinician adherence to clinical recommendations is quite variable	Optimal use of the clinical reminder system was impeded by using the reminders while not with the patient, workload, poor interface usability; lack of clinical reminder flexibility, and lack of coordination	S: Well-written abstract, introduction, methods, and results sections. Excellent visuals. L: Convenience sampling of intake nurses, providers, and patients; only visited 4 of the 163 VA medical centers; evidence of	High merit. High potential for bias.

			and declines over time.	between nurses and providers. Facilitators included integration of reminders into workflow, the ability to document system problems and receive prompt feedback, strategic location of the computer workstations; and limiting the number of reminders at a visit. P: 1, 3, 4, 5, 7	facilitators is not as strong as the barriers since there was less evidence to support findings; generalizability of results to non-VA hospitals may be limited due to unique factors of the VA system; and the decline of clinical reminder effectiveness over time remains unclear.	
Scott et al., 2005 **United States**	Qualitative study based on semi-structured interviews. Pre- and Post-EHR implementation.	n=12 Senior clinicians, n=9 project team members, and n=5 managers. Mixed	This study aimed to examine users' attitudes to implementation of an electronic medical record system in Kaiser Permanente Hawaii.	Critical components of implementation included perceptions of the system selection, adaptation of the organization to the new electronic	S: Well-written abstract, introduction, methods, and results. L: The study only captures a snapshot view during a volatile phase of implementation and	Moderate merit. High potential for bias.

	3/2003-4/2003.	healthcare setting (clinics and hospitals).		environment, early testing, and adaptation of the system to the larger organization. Leadership, professional ideals, and culture were organizational factors that played complex roles in facilitating and/or hindering implementation at various points. Adoption of the system was associated with a transient climate of conflict. P: 3, 7 O: 4	transition; overall findings highlight issues likely to be faced by organizations implementing or modifying an EMR system.	
Sequist et al., 2007 **United**	Mailed survey. Multivariate logistic	n=125 Primary care physicians, PAs, and	This study was intended to evaluate attitudes regarding the	The use of information technology is supported by	S: Well-written abstract, introduction, methods, and results section. Relevant	High merit. Moderate potential for bias.

States	regression model. Post EHR implementation. No dates given	nurses. Mixed healthcare setting (clinics and hospitals).	utility of electronic health records and other forms of information technology in improving care; and predictors of regular use of key functions of the new EHR that impact quality of care in the IHS.	clinicians in underserved settings, but due to potentially limited use of key functions within the EHR many felt it was not currently fulfilling its potential in the Indian Health Service. P: 1, 3, 5 O: 3, 4	visuals. L: IHS clinics represent the early wave of clinics that have implemented the EHR, potentially biasing the findings towards a group of "early adopter" clinicians; no information regarding the usability of the new EHR and how this might have affected both clinician perceptions and use of key functions with the system; no current information regarding the impact of the new EHR on clinical measures of health care quality, which is vital to understanding the importance of this new technology.	
Simon et al., 2007, et	Mailed survey.	n=1345 Physicians	This study sought to determine the	This study showed considerable	S: Well-written abstract, introduction,	High merit.

al., 2007 **United States**	Multivariate analysis. Pre- and Post-EHR implementation. 6/2005-11/2005.	from mixed practices. Mixed healthcare setting (clinics and hospitals).	degree to which physicians used the various functions available in their HER systems and to identify factors that correlate with use. It also assessed physician views about how computers affect healthcare, and examined the relationship between HER use and physicians' reported levels of satisfaction with their practice and other indicators of professional fulfillment.	variability in the functions available in EHRs and in the extent to which physicians use them. Overall, about 1 in 4 physicians reported dissatisfaction with medical practice; there was no difference in this measure by EHR adoption or use. P: 2, 3, 6 O: 1, 2, 3, 4	of visuals. Large sample size. L: The study was conducted in a single state, Massachusetts; estimates of EHR function availability and use were based on the self-report of responding physicians, they may have reported having or using more functions than they actually have or use.	Moderate potential for bias.
Urowitz et al., 2008 **Canada**	Online survey . Descriptive, cross tabulations.. Pre EHR	n=83 CEOs. Hospitals.	In order to assess the readiness for the implementation and adoption of EHRs and PHRs in Canada, a national	Financial recourses were identified as the most important barrier to providing patients access to their	S: Well-written abstract, introduction, methods, and results section. L: Small response rate to survey;	High merit. High potential for bias.

	implementation. No dates given.		scan of Canadian general and acute care hospitals was conducted to determine organization and staff values related to patients care access to their records, and organizational perceptions of patients desires and needs. This study reports on the results of this scan and draws on conclusions in an attempt to elucidate the trends in the adoption of EHRs in Canadian hospitals, and movement towards adoption of PHRs and patient accessible EHRs.	EHR. A divergence in perceptions from healthcare providers and what they though patients would want in terms of access to the EHR was identified, with providers being less willing to provide access and patients' desire for greater access to the full record. O: 4	response rate may not be completely accurate due to the complex methodology for distributing the questionnaire to the broadest pool of respondents; no method for tracking the number of questionnaires that were forwarded to multiple recipients within each institution; at least 3 hospitals had multiple respondents, and 1 respondent completed a single questionnaire for 13 separate hospitals; results may not be representative of all Canadian general and acute care hospitals.	
Vishwanath &	Focus groups.	n=11 phase 1, n=16	The purpose of this study was to	Nine major barriers that	S: Well-written introduction,	Moderate merit.

Scamurra, 2007 **United States**	Concept mapping. Post EHR implementation. No dates given.	phase 2, & n=58 phase 3 Physician leaders. n=17 Technical staff. Mixed healthcare setting (clinics and hospitals).	develop a comprehensive, empirically based conceptual model of the barriers to HER adoption among physicians.	inhibit the physicians' adoption of EHRs were identified and further broker down into a series of related issues. Based on these findings, interventions can be created that focus on individual elements within each barriers. P: 6 O: 1, 2, 3	methods, and results sections. Excellent use of visuals. L: Lacking abstract section; limitations not discussed in text; small sample size.	High potential for bias.
Wiljer et al., 2006 **Canada**	Patient questionnaire, open-ended staff surveys. No dates given.	n=46 patients, n=7 staff members. Hematology clinic.	To conduct a needs assessment to identify patient and provider perceptions about providing patients with access to the EHR in order to develop an online system that is appropriate for all stakeholders.	Hematology oncology patients are more interested in using the internet to monitor their clinical information than to find health information. Staff members viewed patient online	S: Included surveys of both patients and staff members; studied multiple elements. Well-written abstract. L: Small sample size of patients who regularly visit the clinic and are typically very	High merit. High potential for bias.

				access to the record favorably, but expressed the importance of providing the necessary patient support and education. P: 5, 6 O: 2	involved and well informed about their condition; study was done in Canada with fully insured and accessible health care; decreased applicability to patients with other types of cancer and chronic illness.	
Zandieh et al., 2008 **United States**	Semi-structured interviews. Pre- and Post-EHR implementation. 1/2006-5/2006.	n=12 Medical directors and n=11 practice managers. Teaching hospital.	This study aimed to determine how ambulatory leaders differentiate implementation approaches between practices that are currently paper-based and those with a legacy EHR system (EHR-based).	Paper-based leaders prioritized workflow education to ensure a successful transition to a paperless medical practice, a high existing comfort level of practitioners and support staff with IT, a physician IT champion at the practice, and sufficient work stations and	S: Well-written abstract, background, methods, and results section. L: This is a qualitative study and generates hypotheses that need further investigation; all respondents were faculty associated with 2 academic-based institutions affiliated with 1 hospital, thereby limiting generalizability;	High merit. High potential for bias.

	printers. EHR-based leaders prioritized sufficient protection of patient privacy, open recognition of physician resistance, and improved technical training and ongoing technical support. EHR-based leadership also believed that comfort level with IT and adjustments to workflow changes would not be difficult challenges to overcome. P: 1, 2, 3, 6 O: 3	perspectives of staff practitioners, support staff, or patients potentially limiting the view of barriers and facilitators of implementation were not obtained; EHR implementation is a dynamic process with this preimplementation study assessing anticipated challenges at only 1 point in time.	