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Electronic Medical Records: A Systematic Review of Published Reports on the Effect of Implementation in Primary Care/Office-Based Settings

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Electronic Medical Records: A Systematic Review of Published Reports on the Effect of
Implementation in Primary Care/Office-Based Settings.

by

Patricia T. Vigil

A Master's Thesis Presented in Partial Fulfillment
Of the Requirements for the Degree
Master of Science, Health Service Administration

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December, 2010

FINAL APPROVAL OF MASTER'S PROJECT

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I have **READ AND ACCEPTED**

the Master's Thesis by:

Patricia T. Vigil

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Submitted in partial fulfillment of
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Master of Science in Health Services Administration
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Primary Research Advisor: Maureen McGuire PhD

Date: December 2010

Abstract

With the push to streamline medical records and the use of electronic medical records system technology on the rise, successful implementation is important. The push is due in part for the need to reduce unnecessary paperwork, increase reimbursement, increase quality of medical records and increase overall quality of care. Factors to consider are the effects of implementation on quality of care, quality of medical records, physician and staff perceptions, working conditions, patient satisfaction, cost and barriers. Implementation may have a positive, negative or neutral effect on these factors making the need to review literature and report outcomes significant.

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Chapter 1: Introduction

As health care providers focus on the importance of quality of care and the ever changing demand to keep up with a more complex, fast paced health system, electronic medical record systems (EMR) and are becoming the standard. “In 2006, 29.2 percent of office-based physicians were using full or partial EMR systems, which represents a 22% increase since 2005 and 60% increase since 2001” (Hing, Burt, & Woodwell, 2007). In addition, the same study above projected that 23.9% of office-based physicians reported that they plan on installing an EMR system or replace their current one with the next three years (Hing, Burt, & Woodwell, 2007, p.3). The use of electronic medical records systems are rising quickly in part because health care providers need for information to make medical decisions promptly about their patients has also increased.

With current practices, the accessibility of patient’s information is still limited or poor. Paper records lose reliability as their quality deteriorates over time due to faxing, coping, and other factors. In addition, the timeliness of receiving patient’s data is critical for physicians to offer the highest quality of care for patients. Due to these issues many organizations such as the Future of Family Medicine and the American Medical Association are endorsing the use of information technology in healthcare to improve quality and efficiency of care (Irani, Middleton, Marfatia, Omana & D’Amico, 2009, p.553). The United States federal government has also announced initiatives to increase the use of electronic medical records systems in healthcare because of the benefits.

Statement of the Problem

Implementing an electronic medical records system provides key benefits to increasing working conditions, medical records and quality of patient care to name a few. Additionally, benefits include the ability to store, exchange and utilize patient's information quickly and legibly rather than the use of paper records. An electronic medical record system will allow access to patients chart twenty-four hours a day seven days a week, assist in tracking patient medications, reducing medical mistakes such as prescription errors, the ability to have lab results sent directly to the patient's charts, reduce billing miscalculations, increase provider reimbursement, create patient summaries for referrals and letters, and encourage preventative health measure. A study by Karsh, Beasley, & Hagenauer found that family physicians that used an electronic medical records system perceived that their medical records were better than paper records.

Although these benefits are significant, it was important to look at the effects of implementation on primary care and office based providers. Providers should not lose sight of the relationships they have built with their patients over a period of time. In addition to patient relationships, organizations should be aware of any concerns staff have about the use of an EMR system. This type of technology may cause some apprehension for patients, physicians and staff.

Privacy and confidentiality issues are a major concern for patients as computers pose a greater threat to privacy and are vulnerable to unauthorized access. The concern was that patient information is entered into provider databases and can be accessed by others or be subject to identity theft. In a 2004 systematic review on computer-based patient record systems (CBPRS) and quality of care by Delpierre, Cuzin, Fillaux, Massip, & Lang they analyzed two patient

satisfaction studies and found that a patient's greatest fear was concerning data confidentiality. However, over the past several years with HIPPA regulations this fear has subsided.

The second concern was the issue of competency amongst providers and staff. The accuracy and consistency of information entered into the system was pertinent for both patients and providers to maintain effective medical records. Efficiency in charting practices will need to be emphasized. This was critical as patient information will be shared and the reliability of that information is important to their quality of care. Additionally, without proper training for physicians and staff, this can affect working conditions and cause frustration.

Listening and attentiveness was another area of concern for patients as computers may affect the consultation process by lengthening the time of their visit and focus received from providers. The issue was that in order to enhance the outcome of patient information, providers are tasked with entering data during the consultation to ensure accuracy however, this minimizes focus on patients. A 2004 systematic review by Delpierre, Cuzin, Fillaux, Massip, & Lang, showed that of the six studies analyzed three illustrated an increase in the length of the consultation by 2.2 to 9.3 minutes per patient. However, statistics were not the same for all providers. In a 2001 article by Mitchell & Sullivan they found that in 20 out of 26 studies reviewed there was no significant difference in consultation length for three of the four doctor's studies. So although EMR systems can increase the consultation length it may not be directly related to computerized systems.

Communication and education was also an issue because not all patients and providers realize the importance of technology and therefore communication and education is essential. Patients may be unwilling to be completely frank about their problems with providers thus,

affecting the outcome of their care. Useful EMR integration such as communication tools including email links, online bulletin boards, chat rooms, and online consultation services change the norm (Winkelman, Leonard, & Rossos, 2007). This type of communication gives patients greater personal control and allows them to interact with physicians and strengthen the outcome of their care.

Finally, a big concern for providers was patient satisfaction. The patient's satisfaction is very important to providers as it allows them to maintain a positive relationship with their clients and continue to offer the highest quality of care. In a 2009 article by Irani, Middleton, Marfatia, Omana, & D'Amico they found that physicians perceive a decrease in patient satisfaction after the implementation on an EMR system. In another study, the use of electronic health records (EHR) in the exam room found that there was mostly a positive or neutral effect on patient satisfaction (Irani, Middleton, Marfatia, Omana, & D'Amico, 2009).

Purpose of the Study

As a result of potential impacts, the effects of implementation on primary care/office based providers were looked at to determine if there was enough evidence to create a best practice method. This study looked at extensive literature using the libraries of CINAHL, Academic Search Premier, Business Source Premier, EBSCOhost, Google Scholar and MEDLINE, in addition to doing internet searches that focus on the subject.

Research Question

The research addresses the following questions: Was their sufficient data available to propose best practices for implementation in primary care/office-based settings? If so, what method was best for implementation?

Significance of the Study

Although there are many benefits to the implementation of electronic medical records technology, it was important to look at the impact it had on the provider patient relationship, quality of medical records, working conditions and quality of care. This is important for health care providers as the push to centralize the health care industry through electronic medical records technology is on the rise. It was critical to look at “patient compliance, health outcomes, perceptions of physician competence, and the incidence of malpractice (Irani et al., 2009, p. 553).” These are all significant issues as they showed the possible positive and negative effects that an electronic medical records system has on primary care and office based practices.

The impact to health care providers is the adaptation of using electronic medical records systems, while maintaining positive interaction with their patients. “Rather than continually describing its capabilities, research must move forward to evaluate key outcomes for patients, practices, and the health service as a whole” (Mitchell & Sullivan, 2001, p.29).

Definition of Terms

Electronic medical record (EMR): An electronic record that is a computerized medical record created by health care providers. EMRs are computerized legal clinical records created in Care Delivery Organizations (CDOs), such as hospitals and physician offices.

Electronic medical records system: Part of the health information system that allows storage, retrieval and manipulation of records.

Primary Care: Is a nonspecialist care where the level of health care of a patient is evaluated and treated by a family doctor or nurse, or, if necessary, is referred to a specialist

Office-based: Otherwise known as primary care.

Health care provider (Physicians/staff): A health professional who delivers proper health care. A person who helps in identifying or preventing or treating illness or disability

Patient: A person who requires medical care. A person that may be waiting for this care or may be receiving it or may have already received it.

Implementation: Carrying out, execution, or practice of a plan, a method, or any design for doing something.

Assumptions and Limitations

Subsequently, the impact to the primary care/office based providers was that to date only a few studies have analyzed the perceived needs and preferences for use of electronic medical record systems. In addition, few studies have focused on outcomes such as patient satisfaction, increase in medical record quality and physician/staff perceptions. It was critical for health care providers to reach out and ask for feedback to determine areas of concern in order to make improvements. This was a limitation for this study.

Organization of the Remainder of the Study

The following chapters of this study will address the methodology, data collection and analysis, and the results, conclusions and recommendations.

Chapter 2: Methodology

Purpose/Question

In comparison to paper records, the use of an electronic medical record system is a quick and effective method to safeguard important patient medical information. In addition, electronic medical record systems can assist in increasing the quality of care that patient's receive and increase the working conditions of health care providers. There is a push by the government and medical associations to streamline the entire healthcare industry by means of electronic medical technology. Hsiao, Beatty, Hing, Woodwell, Rechtsteiner, and Sisk (2009) stated that the adoption of health information technology has increased since 2004 and the goal set by the federal government is for most providers to offer electronic medical records by 2014. Because of this driving force, it was important to look at the impact that this type of implementation will have on health care providers and patients as a whole. The question this study will address whether or not "there was sufficient data available to propose best practices for implementation in primary care/office-based settings? If so, what method was best for implementation?"

Method or Approach to the Problem

The purpose of a systematic review was to summarize the research on a specific question by combining the results found in published results and studies. The Campbell Collaboration Library of Systematic Reviews (2009) states that a "systematic review uses transparent procedures to find, evaluate and synthesize the results of relevant research (Campbell Collaboration, 2009, p. 1)." The purpose of a systematic review is to decrease bias. In regards to healthcare, the Cochrane Library defines a systematic review as the summary of available

healthcare studies which provide a high level of evidence on the effectiveness of healthcare interventions (Cochrane Library, n.d.).

A systematic review allows a study to focus on a clear single question by looking at the results of previous studies in order to provide a better understanding of the subject. The goal was to provide an unbiased approach by involving an objective way of searching for the information by applying inclusion and exclusion criteria. Usually only studies that meet the inclusion criteria are analyzed and included in the results.

A systematic review can be a useful tool for decision maker's because it will allow them to review large amounts of information and intervene and find solutions where necessary. In the case of healthcare providers a systematic review can assist on making decision about what types of health care to provide, in addition to increasing awareness and possibly generating new knowledge. The amount of information available to healthcare providers is abundant, so in order to improve healthcare decision making a systematic review is a good approach.

Research Design

To identify published research a systematic review was done for this study. The information surrounding electronic medical record technology was very wide and offered a large number of published reports. Based on the amount of information available a systematic review was chosen for this study because it was a good way to summarize the research evidence already reported on by other researchers. The purpose of this study aided in viewing the effects of implementation of electronic medical record systems on primary care and office-based providers in order to determine if there was sufficient data available to propose best practices for implementation

Sampling Strategy

In order to gather the information needed for this study, the databases of CINAHL, Academic Search Premier, Business Source Premier, EBSCOhost, Google Scholar, and MEDLINE within the Regis Library were utilized. The search criteria included full text published reports from 1999 to 2010 and used key terms:

- Implementation*
- Electronic health records*
- Electronic medical records*
- Health care providers*
- Physicians*
- Patients*
- Satisfaction*
- Perceptions*
- Outcomes*
- Quality*
- Working conditions*
- Office based*
- Primary care*
- Best practices*

In addition, search engines such as Google, Yahoo, MSN and the Cochrane Library were also used to obtain articles from other sources such as magazines, newspapers, etc. Government sites such as the National Center for Health Care Statistics and Department of Health and Human Services were also used in the search method.

Inclusion Criteria

The inclusive criteria used for this study was based on the relevance of published reports and studies. The following are the inclusion criteria for this study:

1. Articles published between 1999 and 2010
2. Reports on implementation and use of an electronic medical record system in primary care and office based settings only.
3. Perceptions of healthcare providers and patients in regards to the use of EMR systems during office visits.
4. Reports or studies that contained information on outcomes of patient satisfaction, quality of care, working conditions and increase in quality of medical records due to the use of an EMR system.

Any study design that meets one or more of the inclusion criteria above, not included in systematic reviews, study designs, literature or articles were also included. All forms of methods used in published reports and studies were included in this study. Expert opinion and other evidence surrounding the inclusion criteria were also used.

Exclusion Criteria

The following are the exclusion criteria for this study:

1. Published reports or studies that focused on the patient confidentiality in regards to laws differing across states.
2. Implementation and use of an electronic medical records system outside of the United States.
3. Implementation and use of electronic medical record systems in a hospital based settings was excluded from this study.
4. Articles, reports or studies published prior to 1999.

Grading Scale

Studies were assessed using the Melnyk Rating System for the Hierarchy of Evidence.

The table below (Table I) summarized the level of evidence.

Table I:

Melnyk Rating System for the Hierarchy of Evidence	
Level I	Evidence from a systematic review or meta-analysis of all relevant randomized control trials (RCTs), or evidence – based clinical practice guidelines based on systematic reviews of RCTs
Level II	Evidence obtained from at least one well- designed RCT
Level III	Evidence obtained from well- designed control trials without randomization
Level IV	Evidence from well designed case – control and cohort studies
Level V	Evidence from systematic reviews of descriptive and qualitative studies
Level VI	Evidence from a single descriptive or qualitative study
Level VII	Evidence from the opinion of authorities and/or reports of expert committees

The GRADE system classifies the quality of evidence in three areas of strength.

Table II:

Strength	DEFINITION
A	Recommended based on consistent and good quality of evidence
B	Recommended based on inconsistent and limited quality of evidence
C	Recommended based on other evidence

All articles were reviewed and levels were confirmed by a second reader.

Sample Size

Sample size was established by the available full text articles, reports and studies published from 1999 to 2010. Of the 98 articles found 13 met the inclusion criteria.

Chapter 3: Data Collection and Analysis

The literature review generated a total of 98 articles of which 13 meet the inclusion criteria. The methods used for the 13 articles varied and are as follows, four paper-based surveys, two cross-sectional surveys, two random controlled trial surveys, two qualitative case studies, one expert opinion, one study, and one systematic review. Articles that meet the inclusion criteria were graded and assigned a level according to the Melnyk Rating System of Hierarchy of Evidence (See Table I). This system gave a rating of Levels I-VII and a recommended grade of A through C based on evidence (See Table II). Articles that included information on primary care and office-based settings that implemented and used partial or full electronic medical record systems and reported outcomes on quality of care, patient satisfaction, and physicians and staff perceptions were broken out and summarized in results (Table III).

When looking at implementation and use, three articles reported similar data. From 2006 to 2009 the use by primary care and office-based settings varied and increased over time. In 2006 29.2% used partial or full EMR systems; this was a 22% increase from 2005 and a 60% increase from 2001. In 2008 a second article reported that 41.5% used full or partial systems and increased to 43.9% in 2009. Trends in adoption were as follows, 57.9% rate not varying by location, however 43.5% when it is a solo practice. The projected use in the next four years is that use will be as high as 68%.

Although there are increasing numbers in use of electronic medical records systems, there were some interesting findings in the results of some primary care/office-based settings who had trouble during the implementation process. One article in particular discussed how a family medicine office's culture was affected after the initial implementation of an EMR. This study

found that there were dysfunctional communication patterns, informal decision-making power and internal conflicts that limited the effectiveness in implementation and use of the EMR system. Additionally, on this same topic, barriers were found in one article that included cost and buy in from the physicians and staff.

When determining if EMR use was associated with higher quality of care and medical records, the results were similar. One study looked at whether or not electronic laboratory results were associated with higher ambulatory quality of care, the results determined that there was an associated higher quality of care overall, however EMR use was independent of lab viewing results. Another study looked at determining if users of electronic medical records perceived their medical records to be higher quality and the results found that there was a more positive perception of medical records. Additionally, one study reported that electronic health record improved overall quality of care 63% to 86%, reduced medication errors 72% to 81%, improved follow-up test results 62% to 87% and improved communication 72% to 93% during the first year of use.

Outcomes on physicians and staff perceptions also varied. One article reported that physicians and staff attitudes toward EMR use were overall positive, especially around refills and referrals. However, there was hesitancy surrounding patient communication as none of the patients in this study opted to use general messaging. When looking at the affect on working conditions one study found that the use of an electronic medical/health records system did not impact working conditions or quality of work. While another study that measured the impact of a new EMR on various aspects of practice function found that there was high concordance

between priorities, decreased hazardous in nurse physician chart interaction but hazard increased in already high hazard domains.

Finally, on the topic of patient satisfaction a systematic review aimed to examine the impact on patient satisfaction of physician computer use during the ambulatory encounter. One method was used in this study but the findings varied. Attitudes about physicians use during the visit varied based on the level of experience. The study found that patients seeing trainees were more likely to report potentially negative effects of the computers on their interaction than the patients seeing faculty. Additionally, patients seeing residents were less likely to strongly agree that they were satisfied with their overall relationship with the physician than were patients seeing faculty. Results from this article also reported that 62% of physicians did not think that the EMR had an effect on patient satisfaction whereas 31% felt that the new system had increased satisfaction and 7% felt that it had decreased satisfaction. The article also looked at pre and post implementation and found that no effect on patient satisfaction.

Chapter 4: Conclusion and Recommendations

As the shift to centralize health care medical records is on the rise, more primary care and office-based providers are moving towards implementation. There are many benefits to implementing an electronic medical records system. However, there are many aspects to the implementation process that can have an overall positive or negative effect on these practices. Quality of care, quality of medical records, physician and staff perceptions, working conditions, patient satisfaction and safety, cost and barriers are all important factors to be looked at to succeed in implementation. Some studies showed that there were positive outcomes and perceptions around quality of care, quality of medical records and patient satisfaction. However, on the flip side some studies reported no difference before or after implementation around working conditions and quality of work. So although there was a positive impact on some factors others had either a neutral effect or no effect at all.

The majority of the articles pulled for the research did not meet the inclusion criteria because they were either a study performed outside of the United States or within a hospital setting. The research surrounding penetration and implementation of electronic medical record systems in primary care and office-based settings showed that use is on the rise. Based on that fact, greater knowledge can be generated around what is effective and what is not. With high costs surrounding implementation it is not cost effective for an organization to move forward without effective guidance. Barriers to implementation found that cost and buy in from the organization to be a problem. Lack of communication is one of the most commonly found mistakes when implementing and using a new form of technology.

Without gathering information on outcomes around quality of care, medical records, perceptions, working conditions and satisfaction it can be assumed that implementation was neither a success nor failure.

Best Practices for Implementation of Electronic Medical/Health Records

With the data available there was not sufficient evidence surrounding overall outcomes of quality of care, quality of medical records, perceptions, working life, working conditions and patient satisfaction to recommend a best practice. Primarily due to less than half of primary care and office-based settings using this form of technology and the lack of literature available further research is needed to conclude if a best practice can be generated.

Recommendations for Future Research

More data surrounding the implementation of electronic medical records would prove to be beneficial. Information around the pre-implementation phase, the people (physicians, staff, stakeholders, patients, other users), software, integration, implementation, training, support, feedback, monitoring and evaluation, and incentives would all assist in getting a better understanding of what best practice method can be recommended.

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Table III: Results

Article Title/Author	Method	Description	Participants	Outcome	Level of Research	Strength	Recommendation
Electronic Results Viewing and Quality of Care in Small Group Practices, Kern, L., et al.	Cross Sectional	To determine if electronic laboratory results are associated with higher ambulatory quality of care.	168 Primary Care Physicians	32% used portal over 6 months, associated with higher quality overall, but independent of lab viewing results.	Level VI	Strength A	Consistent and good quality of evidence
Primary care physician attitudes towards using a secure web-based portal designed to facilitate electronic communication with patients, Kittler, L., et al.	Paper-based Survey	To assess physician attitudes towards electronic communication with patients 6 month after implementation of Patient Gateway.	43 Primary Care Physicians	Overall, physicians felt Patient Gateway impact was positive. Refill & referral especially. Hesitant on patient communication, none used general messaging option.	Level VI	Strength A	Consistent and good quality of evidence
Trends in Primary Care Clinician Perceptions of a New Electronic Health Record, El-Kareh, R., et al.	Survey	To measure changes in primary care clinician attitudes toward an electronic health record during 1st year. Impact on quality, safety, communication, and efficiency at 1, 3, 6, and 12 months.	86 Primary Care Clinicians	Electronic health record improved overall quality of care 63% to 86%, reduced medication errors 72% to 81%, improved follow-up test results 62% to 87% and improved communication 72% to 93%.	Level VI	Strength A	Consistent and good quality of evidence
Implementating an Electronic Medical Record in a Family Medicine Practice: Communication, Decision Making, and Conflict, Crosson, J., et al.	Qualitative Case Study	To explore how unique aspects of a family medicine office culture affect the initial implementation of an EMR.	Large Family Medicine Practice	Dysfunctional communication patterns, the distribution of formal and informal decision-making power and internal conflicts limited effective implementation and use of EMR.	Level VI	Strength B	Limited quality of evidence
Are electronic medical records associated with improved perceptions of the quality of medical records, working conditions, or quality of working life? Karsh, B., et al.	Cross Sectional Survey	To determine if users of electronic medical records perceived their medical records to be higher quality & examine perceptions of working conditions, quality of work and quality of care.	1482 Family Physicians	More positive perception of their medical records. Working conditions, quality of work and quality of care were not impacted.	Level VI	Strength A	Consistent and good quality of evidence
Estimating impacts on safety caused by the introduction of medical records in primary care, Servoss, T., et al.	Survey	To estimate impact of a new EMR on various aspects of practice function.	32 Academic Rural Practice Care with 32 staff	High concordance between priorities. Decreased hazardous in nurse physician chart interaction but hazard increased in already high hazard domains.	Level VI	Strength A	Consistent and good quality of evidence

Table III: Results

Adoption of Electronic Health Records in Primary Care Pediatric Practices, Kemper, A., Uren, R. & Clark, S.	RTC Survey	To measure the penetration and functionality of EHRs into primary care pediatric practice, to plan for the adoption, to understand common barriers and evaluate attitudes.	1,000 Primary Care Pediatricians	Adoption of EHR increased with size, cost was a barrier, half questioned ability for EHR to improve quality of care and many could not find one that meet their needs.	Level II	Strength A	Consistent and good quality of evidence
The Use of Electronic Health Records in the Exam Room and Patient Satisfaction: A Systematic Review, Irani, J., et al.	Systematic Review	To examine the impact on patient satisfaction of physician computer use during the ambulatory encounter.	Initial 2103, 72 selected and of them 7 were included	Studies were quite disparate in design, participants, and findings.	Level VI	Strength A	Consistent and good quality of evidence
Electronic Medical Records Use by Office-Based Physicians and Their Practices: United States, 2006, Hing, E., et al.	Interviews - RTC Survey	Report presents information on use of EMR in physician offices in 2006.	3,350 Office Bases Physicians	29.2% of office-based physicians used full or partial EMR, 22% increase from 2005 & 60% increase since 2001.	Level II	Strength A	Consistent and good quality of evidence
Electronic Medical Record/ Electronic Health Record Use by Office-based Physicians: United States, 2008 and Preliminary 2009, Hsiao, C., et al.	Expert Opinion	Pace of electronic medical record/electronic health record adoption by office-based physicians.	0	From 2008 data 41.5% reported using all or partial EMR/EHR. In 2009 43.9% used all or partial.	Level VII	Strength C	Other evidence
Trends in adoption of electronic health records by family physicians in Washington State, Stream, G.	Survey	Measured current rate of EHR adoption by family physicians in Washington State, as well as barriers and identification of means to overcome barriers.	464 Family Physicians, Totaling 1961 Individual Physicians	Response rate 43.8%, adoption rate was 57.9% and did not vary by location. Solo practices at 43.5%. Barriers include financial means. 68% use projected in next 4 years.	Level VI	Strength B	Limited quality of evidence - specific to Washington State
Challenges to EHR Implementation in Electronic - Versus Paper-based Office Practices, Zandieh, S., et al.	Qualitative Study	To determine how ambulatory leaders differentiate implementation approaches between practices that are currently paper-based and those with a legacy EHR system.	11 Practice Managers and 12 Medical Directors	Paper-based leaders prioritize sufficient workstations and printers, EHR leaders prioritize technical training.	Level VI	Strength A	Consistent and good quality of evidence

Table III: Results

<p>Successful Computerization in Smally Primary Care Practices: A Report on Three Years of Implementation Experience, Keshavjee, K., et al.</p>	<p>Study</p>	<p>Report experiences and results of implementation after three years.</p>	<p>33 Family Physicians and 75 Staff</p>	<p>Implementation largely dependent on managing stress. Extensive training, management consultation and case management needed.</p>	<p>Level VII</p>	<p>Strength A</p>	<p>Consistent and good quality of evidence</p>
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