

Evaluating the Implementation of an Electronic Medical Record System for a Health
Organization-affiliated Family Practice Clinic

By

Lindsay Forland

B.Com, University of Victoria, 2000

A Thesis submitted in partial fulfillment of the requirements for the degree of

Master of Science

In the Faculty of Human and Social Development

Health Information Science

University of Victoria

© Lindsay Forland, 2007
University of Victoria

All rights reserved. This thesis may not be reproduced in whole or in part, by photocopy
or other means, without the permission of the author.

Evaluating the Implementation of an Electronic Medical Record Implementation for a
Health Organization-affiliated Family Practice Clinic

By

Lindsay Forland
B.Com, University of Victoria, 2000

Supervisory Committee

Dr. Francis Lau, Supervisor
School of Health Information Science

Prof. Denis Protti, Department Member
School of Health Information Science

Dr. Ali Dastmalchian, Outside Member
Faculty of Business

Supervisory Committee

Dr. Francis Lau, Supervisor
School of Health Information Science

Prof. Denis Protti, Department Member
School of Health Information Science

Dr. Ali Dastmalchian, Outside Member
Faculty of Business

Abstract

The use of technology in primary care settings is not a new concept; the benefits of implementing electronic medical records are stated throughout the literature related to gains in productivity, patient safety, and adherence to clinical guidelines. Yet, despite these benefits, the adoption of electronic medical records in primary care settings, in Canada remains low. This thesis research, a descriptive case study, is an in-depth look at the process of electronic medical record implementation for a family practice group in an attempt to understand the process, technology, and the challenges associated with such a transition. This research uses two well-known models as its framework: the Delone and McLean IS Success Model and John Kotter's Eight Stages of Organizational Change. The use of the two models together is unique; their use together provides a broader look at the aspects of implementation including the environment in which it is being conducted.

TABLE OF CONTENTS

Supervisory Committee	ii
Abstract	iii
List of Tables	vi
List of Figures	vi
Acknowledgements	vii
Dedication	viii
1 CHAPTER 1: DEFINITIONS AND CONTEXT	1
1.1 Primary Health Care in Canada	1
1.2 Electronic Medical Record (EMR) Systems in Primary Care	1
1.3 The British Columbia Landscape	4
1.4 Research Aims	7
1.5 Research Rationale	8
1.6 Summary of Study Approach	9
2 CHAPTER 2: EVALUATING INFORMATION SYSTEMS IMPLEMENTATION AND THE PROCESS OF ORGANIZATIONAL CHANGE	10
2.1 Introduction	10
2.2 Objectivist vs. Subjectivist Approaches to Evaluation	10
2.3 Formative vs. Summative Evaluation	11
2.4 Synopsis of Evaluation Models	21
2.5 Organizational Change	22
2.6 Discussion of Organizational Change Models	33
2.7 Conclusion	34
3 CHAPTER 3: RESEARCH APPROACH	35
3.1 Framework	35
3.2 Methodology	37
3.3 Ethics Approval	39
3.4 Timing	39

3.5	Data Collection	40
3.6	Data Analysis	42
4	CHAPTER 4: STUDY FINDINGS	45
4.1	Introduction	45
4.2	Participants	45
4.3	Description of EMR Process	48
4.4	Recommendations	57
5	CHAPTER 5: SYNTHESIS AND CONCLUSION	64
5.1	Critical factors for this EMR implementation	64
5.2	The IS Success Model and Change Theory	65
5.3	Use of the Combined IS Success and Change Model	66
5.4	Use of the Kotter Model	71
5.5	Study Limitations	75
5.6	Conclusion	76
5.7	Future Directions	76
6	REFERENCES	78
7	LIST OF APPENDICES	82
	Appendix A: Ethics Approval	83
	Appendix B: Sample Interview Guide	84
	Appendix C: Survey	85
	Appendix D: Examples of Content Analysis	86
	Appendix E: Survey Results	88
	Appendix F: Summary of Interview Data regarding Ease of Use	92
	Appendix G: Combined IS Success and Change Model	93

List of Tables

Table 2.1. Protti's summary of formative vs. summative evaluations	12
Table 3.1 Timing Summary	40
Table 3.2 Summary of participants and data formats.	42
Table 3.3 Summary of data formats and modes of analysis.	42
Table 4.1 Summary of Participants	47

List of Figures

Figure 2.1. The Updated Delone and McLean IS Success Model. (W. H. Delone & McLean, 2003)	17
Figure 2.2 Orlikowski's Improvisational Model of Change Management	33
Figure 3.1 Study Models	35
Figure 4.2 Summary of Functionality used by Physicians to April 2007	55
Figure 5.1. Combined IS Success and Change Model	66

Acknowledgements

I wish to express my appreciation and gratitude to:

My Committee Members:

Dr. Francis Lau, for his guidance, direction, and support through this process.

Prof. Denis Protti, for his suggestions and interest in this topic.

Dr. Ali Dastmalchian, for his unique perspective, interest, and feedback.

My Outside Reviewer: Dr. Guy Paré, for his insightful comments and positive attitude toward my work.

AND

Dr. Morgan Price, for his assistance in helping me build relationships with the right people to find this research project and additional meaningful work.

My participants and the organization, whom without this research would not be possible.

The Canadian Institutes for Health Research for their financial support of this research and my learning process.

Dedication

For my parents, Wayne and Myrna, who played a large part in my decision to pursue higher education. It has been a long but rewarding journey. Thank you for the unconditional support you've given the entire way.

1 Chapter 1: Definitions and Context

1.1 *Primary Health Care in Canada*

Primary health care is a person's first point of contact with the health care system.

Primary health care encompasses a broad spectrum of care for preventative, diagnostic, and treatment services by clinicians who are generally responsible for coordinating the ongoing care of a patient. (Health Canada) In Canada, the Romanow Report stated, "there is almost universal agreement that primary health care offers tremendous potential benefits to Canadians and to the health care system ... no other initiative holds as much potential for improving health and sustaining our health care system." (Romanow, 2002) In 2000, in an effort to bolster changes in primary care, the government of Canada created the Primary Health Care Transition Fund, to help support projects that promote reform and renewal in primary care settings within provinces across Canada. (PHCTF)

1.2 *Electronic Medical Record (EMR) Systems in Primary Care*

An electronic medical record (EMR) system is a computer application used in primary care settings, such as family practices, that provides the following functions:

- Access to health information and data to help clinicians make sound care decisions in a timely manner. Some examples of the types of data and information included in an EMR are patient diagnoses, medical and surgical history, allergies and alerts.

- Results management: includes data such as electronically distributed lab results, diagnostic imaging reports, or specialist consult letters.
- Order management: supports workflow for placing medication, lab, diagnostic imaging orders and referrals to another clinician or health care service.
- Decision support: includes tools to assist clinicians with identifying information such as drug-drug interactions, drug-allergy interactions, and suggested care guidelines.
- Electronic communication: supports communication between all clinicians and staff within a practice for items such as task requests, messages, reminders, and other notifications.
- Patient care support: includes features such as patient-specific handouts, care planning, and health summaries.
- Practice operation functions: includes patient registration, appointment scheduling, billing, and managing the status of incoming and outgoing referrals.
- Reporting: generating information about the practice and its patients to support activities such as identifying adherence to chronic disease management care for specific patient groups, measuring patient wait times, identifying range of services provided, etc. (BC Ministry of Health, 2007)

Practices who have adopted an EMR to an advanced degree use an EMR as their primary source for charting patient information, rarely referencing a paper chart. The benefits of implementing electronic medical records are stated throughout the literature. Keshavjee

et al identify the following as some of the efficiencies gained by EMR users who participated in the COMPETE study conducted in Ontario, Canada:

- Significant productivity gains for billing data entry and reconciliation
- Reduction in time spent pulling charts
- Increased chart clarity and completeness
- Decrease in time spent reviewing and filing lab results
- Faster prescriptions and repeat scripts
- Decrease in time spent writing referral letters (Keshavjee, Troyan, Holbrook, & Van der Molen, 2001)

Litvin identifies other potential benefits of using EMR as:

- improving adherence to prevention and care guidelines; and
- Reducing risk of adverse events i.e. drug-drug interactions, drug-allergy interactions. (Litvin, Ornstein, Anthony, & Tanner, 2001)

Yet, despite these benefits, uptake of EMRs in primary care varies greatly internationally with North America lagging behind other developed nations. In the United States, only 10-15% of primary care practices are using computers in their practice at all, never mind to support direct patient care. (Protti, 2006) The reasons provided for the lack of adoption of technology in Canadian primary care settings varies, but some of the common barriers include:

- physician concerns about data entry
- direct and indirect cost of EMRs

- security of patient data
- complex work process redesign effort
- ongoing resources required for software configuration, testing, and training
- lack of confirmation on true productivity gains (Loomis, Ries, Saywell, & Thakker, 2002)

1.3 *The British Columbia Landscape*

The population of British Columbia (B.C.) is approximately 4 million people, of which half reside in the Lower Mainland around the major city, Vancouver. According to the Centre for Health Services and Policy Research there were approximately 8,558 physicians in clinical practice in B.C. in 2004-05. Of these physicians, 4,405 provided primary health care services. This equates to roughly 105 primary health care physicians per 100,000 persons. Data from 2000/01 places 58% of primary health care physicians in community-based group practices, 24% were community-based single physician practices. (Watson, 2006) Approximately 97% of all physicians are remunerated on a fee-for-service basis. (Watson, 2006) B.C. is experiencing a physician shortage in addition to other trained health care professionals. Using technology is seen as a way to alleviate some of the burden of this shortage by reducing the time spent on activities not related to direct patient care so that clinicians, including physicians, can focus on providing the best care possible to the growing number of patients they are serving.

The British Columbia Medical Association (BCMA) published a policy paper that describes the environment in British Columbia as well as the benefits and challenges of implementing information technology (IT) in health care. It says “in B.C., there has been

a lack of investment directed towards IT in physician offices. The majority of information systems used in physician offices are limited to electronic MSP billings and do not monitor a patient's health care, transmit medical information among providers, or provide access a range of medical information." (BCMA, 2004) Furthermore, it is estimated that 14% of Canadian physicians are using electronic records in their practices, while 8% are using electronic prescribing. For comparison, 57% of physicians in Britain are using electronic records, 87% are using electronic prescriptions and 52% of physicians in New Zealand are using electronic records and electronic prescriptions. (BCMA, 2004) It is clear that Canada is lagging behind other countries in implementing technology in primary care settings.

1.3.1 Physician Information Technology Office

Recognizing that adoption of clinical information systems in primary care is a key part of improving health care, the provincial government and the B.C. Medical Association formed an organization known as the Physician Information Technology Office (PITO) in the fall of 2005. Three representatives from the government and three practicing physicians make up the PITO steering committee. (BC Ministry of Health, 2006) The purpose of this organization is to co-ordinate and facilitate the adoption of technology (including EMRs) with vendors and physician practices and disburse the funds allocated to PITO according to the agreement whereby the government will contribute up to 70% of the hardware and software costs for technology and the physician practice 30%.

The goals of PITO include:

- Supporting quality of care through increased access to information and clinical decision support
- Supporting physician office efficiency and workflow for both primary health care practitioners and specialists
- Support use of de-identified data to support population health management.
- Enabling physician electronic health record (EHR) adoption (Dalal & Smith, 2006)

1.3.2 Alpha Health Authority¹ and its Primary Care Network

Prior to the establishment of PITO, one of B.C.'s health authorities was funded by the Primary Health Care Transition Fund to achieve its vision of “an integrated primary health care system that provides a comprehensive “bundle” of services, delivered in a timely fashion, in the right place and by the most appropriate provider.” The Primary Care Network has built relationships a number of private practices that have received support for refining and improving the delivery of health care. This has been achieved via new service delivery models such as collaborations between different health care disciplines to address chronic illnesses or use of electronic medical records to support more efficient workflow. (Alpha, 2002)

The newest practice opened its doors in the summer of 2006. Representatives from the health authority recruited physicians for the practice from information sessions, which were held in January 2006. Interested physicians were asked to contact the lead of the

¹ The actual name of the health authority has been changed to Alpha to protect the identity of the organization and individuals involved in this study.

new practice network. The session outlined the major purpose of the network, which is to develop a high functioning family practice group. To assist in accomplishing this goal, Alpha offered to supply a nurse practitioner and/or a nurse and an electronic medical record system. In addition, the practice will act as a teaching clinic for medical students and other health care providers as part of discussions that have begun with the local university's Department of Family Practice. In exchange for some of the funding support provided, practice members are required to participate in evaluation activities as a way to assess the success of the network model.

Physicians who joined the practice met the following criteria:

1. Commitment to continuous care of patients.
2. Willingness to teach medical students and/or residents.
3. Interested or experienced in use of information technology or electronic medical record.
4. Interested in working in a multi-disciplinary team setting.

1.4 Research Aims

The aims of this research were to:

- understand the practice's process of organizational change related to the EMR in the context of Kotter's organizational change model;
- ascertain how the use of the EMR system could be improved over time using the Delone and McLean IS Success Model as a lens for the lessons learned.

The specific research questions developed to achieve this aim were:

1. What are the critical success factors for EMR implementation?
2. How has the practice approached organizational change related to installing an EMR?
3. How can the use of the EMR system be improved over time?

1.5 Research Rationale

As part of Alpha's primary care mandate, the practice has agreed to participate in evaluation activities. As such, the health authority and practice recognized this research as an opportunity to complete some of this evaluation work. While both agreed there was a need to understand the progress the practice has made to date, there was no structured approach chosen for performing such work. While primary care and technology has been given an increased focus in health care, there is still a lack of published literature on assessing electronic medical record systems in primary care using established frameworks. In response, this study will examine the implementation of an EMR in this practice focusing on how the practice has managed the change using the John Kotter's well-known Eight Stages of Change model. (Kotter, 1996) In addition, the Delone and McLean's IS Success model is also used to understand the system specific aspects of the transition to EMR. (W. H. Delone & McLean, 2003) Using the two models will help identify the areas in which the practice can focus to improve its operations. The results of the study will also be informative to other practices and organizations that are embarking on technology implementations in primary care. This is timely given the direction that has been taken and activities that are occurring within B.C.'s health authorities, B.C.'s Ministry of Health, and the B.C. College of Physicians and Surgeons.

1.6 *Summary of Study Approach*

This study uses a single descriptive case study methodology involving interviews with major players involved in the EMR implementation; a validated questionnaire targeted at end-user satisfaction with technology; and direct observations in the practice. All of these methods were conducted after the EMR was deployed.

2 Chapter 2: Evaluating Information Systems Implementation and the Process of Organizational Change

2.1 Introduction

Health care continues to face increased pressure to contain costs while maintaining or increasing service. The Fraser Institute, an independent research and educational institution based in Canada, published a study identifying health care spending trends. The author concludes the current health care system is not financially sustainable. (Skinner, 2007) In an effort to improve patient care and increase efficiencies, Anderson and Aydin report that the adoption of computers in healthcare is accelerating. (Anderson & Aydin, 2005) However, reports of system failures continue to be published. (Wager, Lee, & White, 2005)

In order to solve the imminent health care crisis, evaluation must play a key role in helping identify the specific areas for improvement so efforts can be made to target these areas. The next question becomes how to evaluate the success of information system implementations.

2.2 Objectivist vs. Subjectivist Approaches to Evaluation

Moehr describes the objectivist evaluation approach as one that assumes “truths exist and can be measured as attributes of the components of the model.” (Moehr, 2002) Measures used in this approach are based on procedures present in measurement theory including cardinal or ordinal scales, for example. The primary goal is the achievement of objectivity, therefore eliminating subjectivity. These objectively established truths are then “used deductively to understand the

truth of complex systems made up of these components.” (Moehr, 2002) This approach is common in the laboratory environment, such as testing new pharmaceuticals. The objectivist approach, though it has gained much credibility and support, is difficult to use in evaluating information systems due to the complex and constantly changing environment of which they are a part.

The goal of the subjectivist approach is to use subjectivity to its full capacity, rather than trying to eliminate it. In this way, it is a powerful approach to discovering answers to what people want or need to know. It describes the system in its natural environment and the perceptions of people interacting with each other and with the system in that environment and uses inductive reasoning to understand the world. (Moehr, 2002) Moehr suggests the “subjectivist approach deserves a guiding role in the evaluation of health information systems rather than that of an exceptional complement for the objectivist approach. It can serve to focus objectivist approaches and reduce (evaluation) resource requirements.” (Moehr, 2002)

2.3 Formative vs. Summative Evaluation

It is not clear in the literature what measures are needed to achieve success. (Seddon, Staples, Patnayakuni, & Bowtell, 1999) The summary of information systems evaluation literature completed for Health Canada, describes formative evaluation as occurring “while a program is still developing and can be modified based on the basis of the findings.” (Neville et al., 2003) “Summative evaluations occurs after a program has been established and are used to determine what has been achieved as a result of the program, such as outcomes or impacts, attainment of goals, unintended consequences or comparisons with alternative programs.” (Neville et al., 2003)

Protti also provides a comparison of formative and summative evaluation approaches and summarizes them in the following table: (Protti, 2002)

Formative	Summative
Primarily prospective	Primary retrospective
Analyze strengths and weaknesses towards improving	Document achievement
Develop habits	Document habits
Shape direction of professional development	Show results of such forays
Opportunity to reflect on meaning of past achievements	Evidence of regular formative evaluation
Feedback	Evidence

Table 2.1. Protti's summary of formative vs. summative evaluations

With this in mind, there are a number of evaluation models that have been used both in and outside health care. Health Canada undertook a review of information systems literature in an effort to inform the development of an evaluation framework for large-scale electronic health record projects. (Neville et al., 2003) At the January 2006 HICSS conference, Mohd also reviewed some of the common evaluation models used in health care. Based on these reviews of information systems evaluation, some of the prominent models are discussed: (Mohd, Yusof, & K.S., 2006)

Kaplan's 4C's

The 4C's evaluation model consists of four elements: communication, care, control, and context. (B. Kaplan, 1997) The article in which Kaplan has published the 4C's model has been cited 49 times in the literature, all of which are related to health care and information systems. Within the context of health information systems, questions developed to address these elements are:

- What are the anticipated long-term impacts on the ways departments linked by computer interact with each other?
- What are the anticipated long-term effects on the delivery of medical care?
- Will system implementation have an impact on control in the organization?
- To what extent do medical information systems have impacts that depend on the practice setting in which they are implemented? (B. Kaplan, 1997)

CHEATS

The CHEATS evaluation framework was developed by Shaw and applied to a telemedicine initiative. (Shaw, 2002) It has been cited only 5 times in the literature indicating it is a model not widely used in practice. Of these citations, all articles are related to health and information systems. Shaw maintains the model is generic to any health information system. The model consists of six aspects:

- clinical,
- human and organizational,
- educational,
- administrative,

- technical, and
- social.

Within each aspect, Shaw calls for both quantitative and qualitative data to be collected.

The care aspect focuses on a number of elements including: quality of care, diagnostic reliability, impact and continuity of care, technology acceptance from patients and professionals, work practice changes, differences in acceptance and efficacy for different users, cultural differences, different patient groups, interviewing techniques, effectiveness on rates of referral, and appropriateness of referral. (Shaw, 2002) The human and organizational aspect addresses examining the interfaces between different care providers including those who work in primary care, secondary and tertiary care (hospital settings), and community care. (Shaw, 2002) The educational aspect looks at the effects of the information system on staff recruitment and retention, ability of the organization to adequately train users and their satisfaction with training provided. The administrative aspect addresses changes in how the health care service is delivered as a result of the use of the information system. It focuses on the effect on access to care, changes in the interactions between patients and health care providers, and cost effectiveness of the new means of care delivery. The technical aspect measures the technical efficacy and effectiveness of the technology implemented, which focuses on elements such as ease of use, technical reliability, appropriateness of the technology to the setting. The social aspect looks at the effect of the system on the amount and level of social interaction between people and if the effect is beneficial to the overall care process. (Shaw, 2002)

TEAM

The Total Evaluation and Acceptance Methodology (TEAM) was developed by Grant et al and also published in 2002. TEAM has been cited only 4 times in the literature of and all articles relate to health and information systems. Though it focuses on the use of the model in health care, Grant indicates the model can be applied to any information system evaluation. It consists of three dimensions: role, structure, and time. The role dimension addresses the perspective from which the success of the system is being judged. Thus, there will be different evaluation criteria for each perspective, or role, of the system. Roles can include stakeholder, designer, and user. The structure dimension addresses the impact of the information system within different levels of the organizational structure namely, operational, tactical, or strategic. The time dimension calls for evaluation to occur over a number of phases, with evaluation criteria relevant for each phase. (Grant, Plante, & Leblanc, 2002)

Balanced Scorecard

Kaplan and Norton published the balanced scorecard in 1992. It is used as a way to help companies evaluate their performance from more perspectives than just the bottom line. The model has been cited 264 times in the literature, 25 of which are related to health care and 76 related to information systems. It includes four perspectives each of which address an evaluation question:

- Customer Perspective: How do customers see us?
- Innovation and Learning Perspective: Can we continue to improve and create value?

- Internal Business Perspective: What must we excel at?
- Financial Perspective: How do we look to shareholders? (R. S. Kaplan & Norton, 1992)

Baker and Pink developed a balanced scorecard for Canadian hospitals in 1995. (Baker & Pink, 1995) To date, the balanced scorecard is used widely in Canadian health care, including the Ontario Hospitals Association (Ontario Hospital Association), the Calgary Health Region (Calgary Health Region, 2006), British Columbia's health authorities (Fraser Health Authority, 2005; Vancouver Coastal Health, 2006), among others. Protti also recommended the use of this evaluation framework as a way to monitor progress for England's National Health Service. (Protti, 2002) While the balanced scorecard evaluation model seems to work well for the overall management of organizations, it is not strictly focused on the evaluation of information systems.

Delone and McLean IS Success Model

The Delone and McLean IS Success Model has a long and established history in the information systems world. The model has been cited 509 times in the literature, 23 articles relate to health care, and nearly 300 articles have used or made reference to the IS Success Model since 1992, which speaks to the model's popularity and, consequently, the need for a comprehensive evaluation framework for information systems. (W. H. Delone & McLean, 2003) Based on the premise that information systems success is a dependent variable, the model articulates the inter-related nature of its six dimensions: System Quality, Information Quality, Use, User Satisfaction, Individual Impact and

Organizational Impact. (W. H. Delone, McLean, E.R., 1992) Though published in 1992, the model was based upon research conducted by a number of researchers throughout the 1970's and 1980's. Based on significant feedback from articles published that used or responded to the original model, Delone and McLean published a revised IS Success Model in 2002, which now includes the following dimensions: System Quality, Information Quality, Service Quality, Use/Intention to Use, User Satisfaction, and Net Benefits. (W. H. Delone & McLean, 2003)

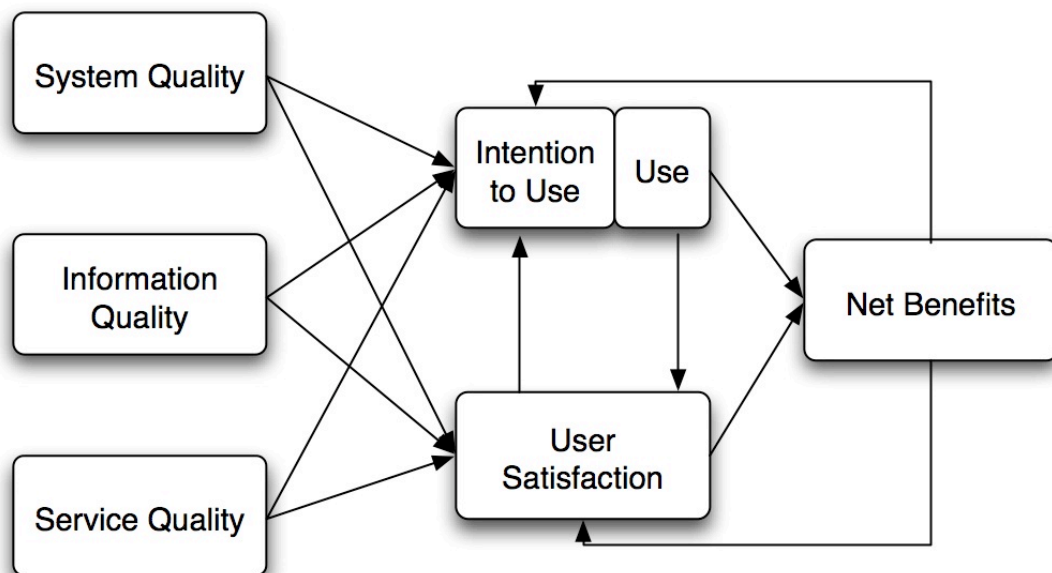


Figure 2.1. The Updated Delone and McLean IS Success Model. (W. H. Delone & McLean, 2003)

The IS Success model is neither a fully process-oriented model, nor a fully causative model and it has been criticized in the literature for this very fact. Delone and McLean's response to this criticism is that researchers must understand that success is the dependent variable, and subsequently each part of the IS Success model is a part of success.

Therefore, researchers must distinguish between independent variables that are controlled by management, such as amount of investment or level user involvement, and the desired results as they are manifested in the dimensions of success.

The adoption of the IS Success Model in health care is very new. Health Canada's review of evaluation models cite the IS Success Model and several others as potential candidates for evaluating electronic health records projects. (Neville et al., 2003) Canada Health Infoway, an arms-length government organization tasked with accelerating e-health in Canada through strategic investments in key projects, has used the IS Success Model as the basis for its Benefits Evaluation Framework, which was recently published by Lau et al. (Lau, Hagens, & Muttitt, 2007) Given the impact Infoway has had on e-health in Canada, it is expected the IS Success Model will play an important role in evaluating e-health. It should also be noted that the original mandate of Infoway did not include activities related to primary care. However, it is anticipated that Infoway will eventually turn its attention and provide funding to primary care e-health projects as well. Thus the use of a now strategic evaluation model in primary care, a different health care environment, is both a contribution to the research community and to the health care community as technological change unfolds in primary care.

The following is a detailed description of the IS Success Model dimensions and variables adapted from the Benefits Evaluation Framework:

System Quality

Definition of dimension:

System quality measures the technical achievement of a system.

Attributes and measures of this dimension:

- Response time: the length of time the system takes to reply to a user action.
- Reliability: the percentage of time the system is available to users when it is required.
- Accessibility: availability of the system in the setting it is needed either locally or remotely.
- Security: the system's technical ability to protect data recorded, stored, and accessed.

Information Quality

Definition of dimension:

Information quality measures the quality of the information that the system produces and if that information expresses the intended meaning.

Attributes and measures of this dimension:

- Accuracy: the amount of data that is error-free.
- Completeness: All parts of information are present
- Relevance: extent to which information presented fits the user's domain and purpose for its use.
- Consistency: data that is entered multiple times is completed in the same format.
- Timeliness: extent to which the information is available at the time it was needed

Service Quality

Definition of dimension:

Service quality measures the overall support provided for the system regardless of the party who is providing support.

Attributes and measures of this dimension:

- Responsiveness: willingness and ability to provide assistance promptly.
- Reliability: ability for staff to perform service accurately and credibly.

- Assurance: Knowledge and capability of staff to inspire trust and confidence in the service provided.

System Use and Intention to Use

Definition of dimension:

System use is the actual or perceived use of a system.

Attributes and measures of this dimension:

- Perceived and actual usage behaviour and patterns
 - Frequency and duration of use: how often and the length of time the system is used.
 - Location, nature, and flexibility of use: the purpose of the session.
- Dependency: the degree to which use of the system is “institutionalized”.
- Intention to use: proportion and factors related to turning non-users of an implemented system into users of the system.

User Satisfaction

Definition of dimension:

User satisfaction is the level to which users perceive their needs have been met through use of the system.

Attributes and measures of this dimension:

- Competency: the level of knowledge, skills and experience of the system users
- User Satisfaction: the opinions of users or their perceived expectations of information/system/service quality and perceived use of the system.
- Ease of use: the user-friendliness of the system and how easy it is to learn to use it.

Net Benefits

Definition of dimension:

Net benefits take into account the overall effects of the system on its stakeholders and environment. This category contains both positive and negative impacts of a system. Net Benefits also relies on the need to define whom the benefits are for. Benefits to organization management or the “bottom line” may be in contrast to the impact of the system on users.

Attributes and measures of this dimension:

- Quality of care: the appropriateness and effectiveness of care, patient safety, and overall health outcomes.
- Access: the availability of care and length of time required to obtain it.
- Productivity: the efficiency at which care is provided. (Lau, Hagens, & Muttitt, 2007)

2.4 Synopsis of Evaluation Models

There are a variety of evaluation models derived from both the formative and summative, objective and subjective evaluation perspectives used inside and outside health care. Evaluation can be applied to organizations as a whole, to individual departments, and individual systems. Choosing a model that is aligned with the purpose of the evaluation and its scope is important and no one model can suit all purposes. Kaplan and Norton’s balanced scorecard, while appropriate for examining the overall performance of a large organization, does not address factors specific to information systems. Conversely, the IS Success model focuses on information systems in depth but does not address organizational aspects or the environment in which the system operates. Bonnie Kaplan’s 4C’s provides a framework geared toward evaluation in health care, but is not as specific to information systems evaluation as the IS Success Model. Shaw’s CHEATS framework and Grant’s TEAM Methodology are specific to both health care and information systems but have not been as widely tested as the IS Success

model in evaluating information systems. Van der Meijden et al published a review of patient care information systems in which they used the IS Success model dimensions to categorize the aspects evaluated of each system. The review did not find any proposed evaluation framework for evaluating patient care information systems and concluded the use of the IS Success model for evaluating such systems should be explored. (Van der Meijden, 2003) Given this finding, an opportunity exists to test the IS Success model for other health care information systems such as primary care EMRs.

2.5 Organizational Change

Understanding the organizational factors influencing information systems is an important part of evaluation. Anderson and Aydin maintain that evaluating the impact of information systems requires an understanding of social and behavioural processes as well as the technology involved. (Anderson & Aydin, 2005)

Armenakis' review of organizational change literature from the 1990's reveals four themes: content issues, contextual issues, process issues, and outcome variables. (Armenakis & Bedeian, 1999) Armenakis summarizes each theme as follows:

- Content: focuses on the targets of change efforts and how these relate to an organization's effectiveness. The change models examined by Armenakis in this review focus on content variables such as strategic orientation and organization structure that ultimately determine an organization's mission and direction for survival and success. Such change models are useful for diagnosing the state of an organization prior to a change.

- Context: focuses on the internal and external environment of the organization. The contextual studies selected by Armenakis seek to understand the impact of internal and external factors on organizations and how the response to such factors determines the organization's level of effectiveness in both its internal and external environments.
- Process: addresses the actions taken to produce the intended organizational change. The process studies reviewed focus on how organizations go about implementing change, of which several models propose a phased approach and ongoing process for change.
- Outcome variables: this theme addresses the measurement of the change. These studies looked at the criteria examined in assessing organizational change efforts specifically related to behaviour changes, but also at more global variables such as organization survival and profitability.

For the purposes of this research, the process theme provides assistance in understanding how organizations have gone about making change and is considered relevant for helping the practice in question through their change process.

Planned Approach to Change

Kurt Lewin, one of the earliest pioneers of the organizational development discipline, which change management is a part, developed a three-step model to explain organizational change known as the Planned Approach to Change. The model is based on the premise that human behaviour is based around a sense of equilibrium held in place by a complex web of driving and restraining forces. (Burnes, 2004)

Step 1: Unfreezing

This step involves disrupting the equilibrium such that old behaviour can be unlearned and set the basis for adopting new behaviour. Step 1 is difficult and requires an approach tailored to the specific situation or group.

Step 2: Moving

This step involves identifying and evaluating the options for change on an iterative trial and error basis, which is similar to an Action Research approach.

Step 3: Refreezing.

This step involves stabilizing the group in a new equilibrium with the desired changes in place.

Lewin's model was published in 1947 and has fallen out of favour in the last 20 years. Despite this, Hendry commented that the process of creating and managing change "necessarily begins with a process of unfreezing" and thus is part of many accounts or models of managing change. (Burnes, 2004) Kanter argued that although Lewin's model was simple, the concept was unrealistic and does not recognize organizations as "fluid entities" whose stages of change overlap in important ways. (Burnes, 2004)

Culture-Excellence Approach

In the early 1980's other organizational change perspectives emerged including the Culture-Excellence approach supported by researchers including Kanter. The Culture-Excellence approach sees change not as a linear process, as Lewin did, but as an entity that organizations will adapt to organically through the initiative of empowered employees contributing to the development of an organizational culture that embraces

flexibility and spirit for innovation, experimentation, and entrepreneurship. (Burnes, 2004) The Culture-Excellence approach argues change will emerge in a bottom-up fashion from day-to-day operations rather than as a top-down approach as Lewin's model is interpreted.

Processual Approach to Change

Pettigrew's processual approach recognizes change is a complex and dynamic process and focuses on the inter-related aspects of different perspectives including individuals, groups, organizations, and society. This perspective on organizational change maintains that change should be studied across different levels of analysis and time periods spanning all functions and levels in the organizational hierarchy. In the "Handbook of Strategy and Management", Pettigrew describes the pace at which modern corporations must move that requires us to view change as a "nested sequence of events that unfold over time in the development of individuals, organizations, and industries." (Pettigrew, Thomas, & Whittington, 2002)

The process-oriented approaches to change provide a basis for understanding how change occurs, but do not provide organizations a framework for how to enact change. Armenakis details some process-oriented change models that build on Lewin's theory, which includes Galpin's change model, and John Kotter's Eight Stages of Change. (Armenakis & Bedeian, 1999)

Galpin's Model

Timothy Galpin published his model in 1996. The model has been cited in 10 articles, 1 related to health care and none related to information technology. Galpin maintains that

change can only be successful if it is addressed at both a strategic level and at the operational level of an organization. Of the nine-step model that Galpin proposes, the early stages of change require greater attention to the strategic side of change while the later stages target the operational level of the organization. The nine-step model is as follows: (Galpin, 1996)

1. *Establish the need to change*

- This stage establishes the rationale for change, which can come from a variety of sources such as competition in the marketplace, customer requests, or a desire for better performance.

2. *Develop and disseminate a vision of the change*

- This stage establishes the picture of what change will look like. It is necessary in helping others feel they are part of the change and that it will be of benefit to them. Once the vision is developed it must be communicated throughout the organization via various channels to gain widespread buy-in.

3. *Diagnose/analyze the current situation*

- This stage involves comparing the current state of the organization with where the vision places the organization. This is achieved through techniques such as performance measures and cost-benefit analyses.

4. *Generate recommendations*

- In this stage, recommendations for how to achieve the vision are gathered from all parts of the organization, particularly employees at the operational level. Employees are involved in designing the new processes, which assists in reducing resistance to the change.

5. *Detail recommendations*

- This stage details the resources and other factors needed for each of stage four's change recommendations. Resources can include overall costs for hardware and software or training requirements while other factors to consider may include time of implementation or availability of resources.

6. *Pilot test recommendations*

- Pilot testing involves testing out the proposed recommendations on a small scale before rolling out to the entire organization. In doing so, the goal is to work out any issues in the new processes. This stage can also involve comparing recommendations against one another before deciding on the final course of action.

7. *Prepare recommendations for rollout*

- Feedback from the pilot stage is incorporated into the change process and adjustments are made based on the scope of the change rollout.

8. *Roll out changes*

- This involves implementing the change to the entire organization often according to a roll-out schedule, which plays out over a period of time.

9. *Measure, reinforce, and refine changes*

- This stage involves examining how the change has affected the organization and identifies areas that may need additional reinforcement or refinement for achieving the desired effect.

Kotter's Eight Steps to Organizational Change

John Kotter has developed an Eight Stage Process to Organizational Change that is based on over 100 case studies of corporate organizational change initiatives. The model was

first published in 1995 in the Harvard Business Review and later in 1996 in his book “Leading Change.” Combined, the model has been cited over 400 times, nearly 70 articles related to health care, 34 related to information technology, of which 1 related to health care information technology – a telemedicine project. Kotter states that organizations must go through each stage in order. Skipping stages or not staying long enough in one stage can compromise the entire change effort. (Kotter, 1996) The eight steps of Kotter’s organizational change model include:

1. *Establishing a Sense of Urgency*

- This step is concerned with finding compelling reasons to make change. It may involve a market analysis, which can uncover crises or opportunities for the organization. A truthful discussion about the findings usually occurs. Kotter explains that about 50% of organizations fail at completing this step successfully usually because they do not spend enough time at it to truly create the urgency needed in order to gain commitment for the change.

2. *Forming a Powerful Guiding Coalition*

- This step involves assembling a group with enough power in the organization to lead the change. This group works as a team to generate momentum for the change. Though a leader close to the top of the organization needs to be involved, not all senior executives need to be part of the coalition and often are not at first.

3. *Creating a Vision*

- The vision is developed by the guiding coalition. It must be sound, simple to communicate, and compelling enough for the rest of the organization to buy into. Kotter’s rule of thumb for visions is “if you can’t communicate the vision to someone

in five minutes or less and get a reaction that signifies understanding and interest, you are not done with this phase.”

4. *Communicating the Vision*

- Communicating the vision involves using as many vehicles as possible in the organization and communicating the vision often. Communicating the vision involves more than just publishing it in newsletters or a one-time speech to staff. The guiding coalition must also exemplify the vision through the behaviours they exhibit; they must “walk the talk”.

5. *Empowering Others to Act on the Vision*

- This step involves removing obstacles so people can start to change behaviours. Examples of obstacles can be compensation or performance-appraisal systems that do not align to the vision or a powerful company officer that is allowed by his peers to continue to behave in a way that undermines the vision.

6. *Planning for and Creating Short-term Wins*

- Recognizing that major change occurs over the course of several years, this step involves creating and measuring incremental performance improvements that support the vision. Errors that occur in this step occur because people lose interest or momentum for change because the results are not clearly demonstrated to them and it becomes easier to fall into routine habits or start resisting the change effort.

7. *Consolidating Improvements and Producing Still More Change*

- This step uses the momentum gained from the process to add credibility and continue to change even larger processes and policies that do not fit the vision. This stage also involves placing employees who can implement the vision into positions where they

can be effective. The biggest mistake made at this stage is what Kotter refers to as “declaring victory too soon”. Once people think the change initiative is “over”, the momentum for change slows and the old ways of doing things start to creep back in, negating any progress that has been made.

8. *Institutionalizing New Approaches*

- This step involves drawing clear connections between the changed behaviours and the organization’s enhanced performance. This step takes longer than most think and is achieved when the changed behaviours become shared values and “the way we do things around here”. In order for the change to “stick”, it is important that successors of the initial change leaders are also committed to the continued support of the change initiative and make choices for the organization accordingly.

The IHI Model for Improvement

Another process-oriented model that has been used prominently in health care is the Institute for Healthcare Improvement’s Model for Improvement. The IHI’s Model for Improvement is based upon the work of W. Edwards Deming, who is best known for applying his PDSA (Plan, Do, Study Act) cycle to improve Japan’s quality control. (Orsini, 2006) Langley’s book “The Improvement Guide: A Practical Approach to Enhancing Organizational Performance”, which was published by one of the authors of the IHI Model for Improvement has been cited in nearly 150 articles, 80 of which are related to the health care field, none related directly to a change in information systems. The IHI’s Model for Improvement uses Deming’s work as a part of its change model. It includes the following steps:

1. *Setting Aims*

- This step addresses the question “what are we trying to accomplish?” The aim needs to address the population targeted for the change, be measurable and time-specific.

2. *Establishing Measures*

- This step addresses the question “how will we know that a change is an improvement?”

3. *Selecting Changes*

- This step involves choosing the changes to focus on, which are those that will most likely lead to the desired improvement.

4. *Testing Changes*

- This step involves the PDSA (Plan, Do, Study, Act) cycle. The cycle is about trying the change on a small scale, observing its effects, and making adjustments based on what is learned.

5. *Implementing Changes*

- This step involves implementing additional changes to the same pilot group or the same change to a larger group, but not yet to the entire organization.

6. *Spreading Changes*

- Once changes have been implemented on a broader scale, the change can be spread to other parts of the organization or to other organizations.

Orlikowski’s Improvisational Model for Change

Orlikowski et al present an alternative to the traditional planned approach to change management. The Improvisational Model for Change has been cited in more than 40 technology-related articles with one related to the health care field. The model reflects

what Orlikowski calls a “discrepancy between how people think about technological change and how they do it” and suggests an approach to managing change that accommodates “ongoing and iterative experimentation, use, and learning.” The model recognizes three types of change:

- Anticipated Change: planned changes that happen as they were intended.
- Emergent Changes: changes that were not originally anticipated and arise spontaneously from local innovation.
- Opportunity-based Changes: changes that are not planned but introduced as part of the change process in a deliberate, purposeful way in order to address an “unexpected opportunity, event, or breakdown.”

The Improvisational Model of change begins with a planned change event but then capitalizes on emergent changes with opportunity-based changes. The model does not take into account environmental factors or organizational context. Orlikowski emphasizes that change relies on the relationship between the organizational context, the technology, and the change model being compatible or at least not conflicting with one another. Further, dedicated resources for ongoing support of the change are essential.



Figure 2.2 Orlikowski's Improvisational Model of Change Management

2.6 Discussion of Organizational Change Models

Organizational change is a vast subject with a number of models addressing differing aspects of the change process. As noted by Armenakis, organizational change literature falls into four categories: content, context, process, and outcome variables. While some models seek to determine all the aspects that change encompasses, others attempt to explain why change occurs and still others focus on how change occurs. Lewin's Planned Approach to Change, while influential in the field of organizational development is too general for organizations to use to guide their change effort. Similarly, the Culture-Excellence Approach and the Processual Approach speak more to the theory of organizational change than specifically how to achieve it. Orlikowski's Improvisational Model is different still, coming from a different philosophy of change than the other models discussed and is formatted as a model rather than as a "checklist". Regardless, the process-oriented models have provided a strong foundation for the development of "checklist" models such as Kotter's, Galpin's, and the IHI Model for Improvement, which

provide more direction for organizations to focus their change efforts. All three of these models are strikingly similar; they involve phases in which the change must progress to be achieved and address aspects of forming a vision, disseminating the vision, and once implemented, measuring the effects of the changes. Kotter's model pays close attention to generating both leadership and momentum for change, both of which are crucial for any change effort. (Luo, Hilty, Worley, & Yager, 2006) The disadvantage to these checklist-like models is, while practical, they do not fully address the environment in which organizations operate, which can profoundly affect the change process. Nevertheless, the checklist-like model is deemed appropriate for a study such as this because of its practicality. Environmental factors will be addressed in addition to the change model chosen.

2.7 Conclusion

According to Keshavjee, "there is little doubt that the implementation of electronic record systems requires considerable change engineering." (Keshavjee, Troyan, Holbrook, & Van der Molen, 2001) In addition, Orlikowski states "understanding how individuals and organizations make systems workable in practice requires focusing on the micro-level practices of those developing, using, and repairing such systems over time and the ways in which power, social networks, human interpretations, and materiality come into play. Consideration of such issues will, we believe, add significantly to our understanding of how ICTs influence organizations over time." (Orlikowski & Yates, 2006)

This study is a demonstration of what the literature calls for, a real-life look at what is happening in practice, contributing to an understanding of how primary care practices are actually handling the transition to EMR from the systems and change perspectives.

3 Chapter 3: Research Approach

3.1 Framework

The frameworks chosen for this study include the Delone and McLean IS Success model and John Kotter’s Eight Stage Process of Change. The combination of frameworks will allow the author to look specifically at the two aspects of this study, the information system itself and the change process the practice has experienced surrounding the electronic medical record in their practice.

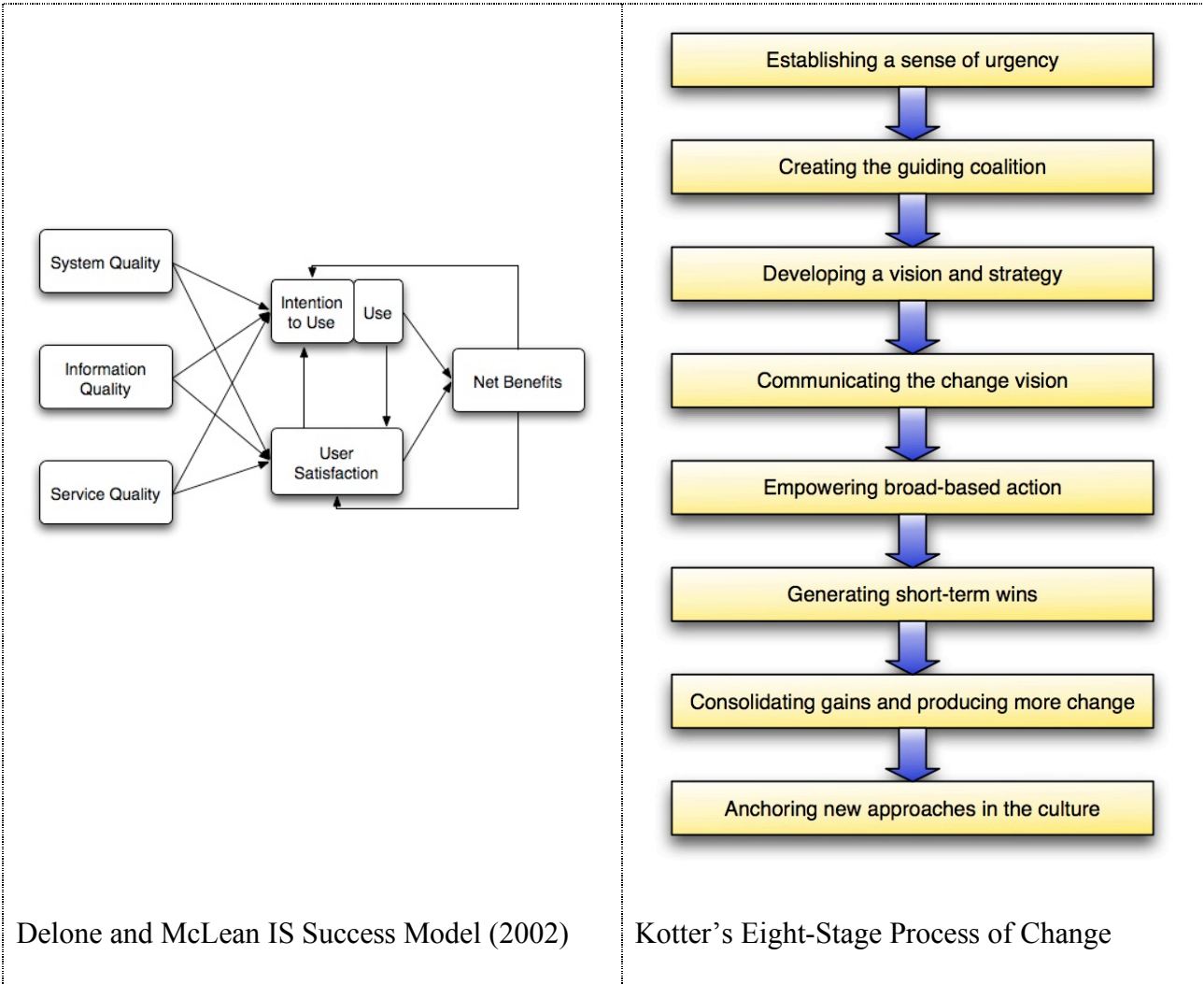


Figure 3.1 Study Models

3.1.1 The IS Success Model

Given the wide use of the IS Success model in its own field and its potential in the Canadian health care environment, it has been chosen as the evaluation model for this study. Since no one model can address all aspects of evaluation, the IS Success model has been paired with a model examining organizational change to obtain a broader understanding of the overall effects of the information system as recommended in the literature. (Mohd, Yusof, & K.S., 2006) (Lau, Hagens, & Muttitt, 2007)

3.1.2 Kotter's Change Model

This model was chosen not only because it is widely cited, but also because of the author's philosophy. John Kotter explains in an interview conducted in 2003 that he is more interested in practical application than theory; he wants to influence the actions of other people. (Crainer, 2003) This philosophy is consistent with the researcher's aim. In addition, as the model has not been used in small organizations or to evaluate the change process related to information systems, it is an exploration of how this model accommodates both of these aspects. The pairing of the two models will allow the study to examine the two relevant parts of this study: the electronic medical record system itself, and the change process the practice has experienced to date with transitioning to this system. One goal is to provide practical and specific feedback to the practice on how to improve their process for adopting the EMR.

3.2 Methodology

3.2.1 The Case Study

Case study, as a research strategy, is one way to approach social science research. Other strategies used include histories, experiments, and surveys. Case studies are used as a way to understand complex social phenomena. (R. K. Yin, 2002) A case study approach is useful for situations where the researcher is attempting to answer “how” or “why” research questions, is focusing on contemporary events, rather than historical, and does not have behavioural control over events. Case studies provide a systematic way of examining an instance or event (known as the case) in-depth and sometimes longitudinally. As a result, the researcher is able to gain an understanding of why the event unfolded as it did and provide insight into what additional phenomena could be examined in future research. Case studies involve multiple forms of data, both quantitative and qualitative in any combination and “rely on multiple sources of evidence, with data needing to converge in a triangulating fashion”. (R. K. Yin, 2002) Based on the analysis of the case study, the generalizability of the results is made to theory, not to populations. (R. K. Yin, 2002)

3.2.2 Types of Case Studies

There are different forms of case studies each suited to particular research questions and study circumstances:

- **Descriptive Case Study:** a descriptive case study “presents a complete description of a phenomenon in its context.” (R. K. Yin, 2003) The descriptive study begins with a descriptive theory, which identifies the scope and depth of the case and determines what will be examined and what will be excluded.

- **Exploratory Case Study:** the goal of an exploratory case study is to “define questions and hypotheses of a subsequent study and determining the feasibility of research procedures.” Fieldwork and data collection can be undertaken prior to defining the research questions. (R. K. Yin, 2003)
- **Explanatory Case Study:** an explanatory case study provides an analysis of cause-effect relationships among elements in the study. (R. K. Yin, 2003)

3.2.3 *Single vs. Multiple Cases*

Any type of case study can be a single or multiple case design. A single case study design is used when the case represents: a critical case, one that will be used to test an already formulated theory; a unique case, one that shows up rarely in practice and is used to learn more about it; a typical case, one that is used to illustrate lessons and be informative to others in similar circumstances; a revelatory case, one that has previously been inaccessible to scientists or researchers; or a longitudinal case, one where the case is examined at two or more points in time aimed at identifying when certain changes appear over time. (R. K. Yin, 2002) A multiple case study design is used when the study wants to examine the replication of a theory in two or more cases. The logic behind selecting multiple cases is to either predict similar results or contrasting results for predictable reasons. (R. K. Yin, 2002)

3.2.4 *Use of Case Study Design for Information Systems Research*

Benbasat advocates for the use of case study research strategy when examining information systems because it allows the researcher to “study information systems in their natural setting, learn about the state of the art, and generate theories from practice.” (Benbasat, p. 370) Further

case study research strategy helps the researcher to understand the nature and complexity of the processes taking place.” (Benbasat, 1987).

3.2.5 *Single Descriptive Case Study*

A descriptive single case study research methodology is used in this study. The practice under investigation is considered a typical case and it is anticipated the results will contribute to lessons for both the practice and will be informative to others undertaking an EMR implementation. As previously described, the use of the case study research strategy is appropriate given the “how” research questions posed, the need to examine an information system in its natural setting, its categorization as a contemporary event, and the lack of control the researcher has over behaviours.

3.3 *Ethics Approval*

An application for ethical review was submitted to the University of Victoria’s Human Research Ethics Board on December 14, 2006. A signed letter from all five physicians in the practice stating their intention to freely participate in the research was provided as part of this application. The notice of ethical approval was obtained in January 2007 just prior to the start of data collection activities. Participants were required to sign a paper consent form at the time the interview was conducted.

3.4 *Timing*

Date	Research stage
Sept/Oct 2006	Reading literature. Negotiate access to field.
Nov 2006	Finalize proposal.

Dec 2006	Preparation
Jan 2007	Ethics approval obtained Data Collection: <ul style="list-style-type: none"> - Interviews begin. - Questionnaires administered.
February 2007	Data Collection: <ul style="list-style-type: none"> - First round interviews completed (13) - Interview transcribing.
Mar 2007	Data Collection: <ul style="list-style-type: none"> - Follow-up interview with head physician - Direct observation – MOAs in practice. - System log statistics Analysis begins
Apr 2007	Analysis and Conclusions

Table 3.1 Timing Summary

3.5 *Data Collection*

3.5.1 *Interviews*

Semi-structured interviews based on an interview script prepared by the researcher were conducted over the course of a one-month timeline. The interview scripts were structured to identify aspects of Kotter’s eight stages of change as well as addressed information quality, system use, and user satisfaction dimensions from the IS Success Model. Input from the researcher’s committee members were obtained prior to executing the first set of interviews. Each interview was a minimum of 30 minutes in length. Interviews were held with all members of the practice including five physicians, five medical office assistants and the chronic disease management nurse over a month time period between January and February 2007. The interviews with the physicians took place on the same day; the interviews with the medical office assistants were also conducted on the same day of the week two weeks after the physician interviews. The interview with the chronic disease management nurse took place two weeks

after the interviews with the medical office assistants. Additional interviews of one hour in length were conducted with two representatives from the EMR vendor organization and also with the health authority representative. All interviews were recorded and transcribed. A copy of each individual's interview transcript was provided in order for each participant to validate the correctness of the transcription and an opportunity for clarification of context or wording with the researcher. The participants were given a minimum of one week to provide comments and approval. A copy of sample questions is available in Appendix B.

3.5.2 Questionnaire

A questionnaire developed and validated by Doll and Torkzadeh titled "End-user computing satisfaction" was used in an effort to assess user satisfaction with information quality and perceived usefulness of the EMR. A copy of the questionnaire is available in Appendix C. The questionnaire was completed by the five physicians, five MOAs, and the chronic disease management nurse.

3.5.3 Field Observations

The researcher spent five hours during one day directly observing operations of the practice's front desk in March 2007. The intent of this type of data collection was to observe how the medical office assistants (MOAs) were using the EMR in practice and note the context in which they encountered issues using the application. Further, the researcher was able to gain a better perspective on the daily workflow and level of activity in the office and some interactions between the medical office assistants, the physicians, and the nurse. Preparation for the field observations included reviewing both the MOA and physician interview transcripts and noting usability problems or suspected workflow problems. During the observation session, four of the

five MOAs were in attendance. The observations were conducted in a passive manner although, when needed, the researcher would ask participants for further clarification on their actions with the system or a workflow process.

	<i>Participants</i>			
	Clinicians	MOAs	Vendor	Health Authority
Interview	Y	Y	Y	Y
Observations		Y		
Survey data	Y	Y		
Project documentation				Y

Table 3.2 Summary of participants and data formats.

3.6 Data Analysis

The primary form of data analysis in this study was content analysis. The purpose of content analysis is to classify text into content categories and, in the process, allow the researcher to be able to make valid inferences about, in this study, the sender of the message and the message itself. (Weber, 1990) Descriptive statistics were used to describe some of the interview data collected, and the combined survey data. A summary of the data formats and the participants is supplied in Table 3.2. A summary of the data formats and the type of analysis performed on each is supplied in Table 3.3.

	<i>Mode of Analysis</i>	
	Content Analysis	Descriptive Statistics
Interview	Y	Y
Observations	Y	
Survey data	Y	Y
Project documentation	Y	

Table 3.3 Summary of data formats and modes of analysis.

The observation notes and 13 interviews were transcribed and imported into NVivo for content analysis. The researcher started reviewing aspects of each of the two models described in the methodology, the IS Success Model and Kotter's Eight Stages of Change. With this in mind, the researcher reviewed physician interviews first and "tagged" phrases in the interview scripts that were of interest and labeled them with a short description of what the concept entailed. Once through the physician interviews, the same process was applied to the MOA interviews, the nurse interview, the vendor interview, and the health authority interview, in that order. After the first pass through the transcripts was completed, the researcher examined the concepts across all interviews for consistency. For example, the first and second physician interviews did not have as many "tags" as subsequent interviews. As a result, the researcher decided to go through the transcripts a second time to ensure concepts had been "tagged" appropriately and consistently.

Once all transcripts were analyzed, the process of combining concepts into larger concepts and themes occurred. This was done by grouping similar concepts together, which constituted a theme. At this point, the themes were compared against the dimensions and stages dictated by the two models discussed in the methodology section, the IS Success Model and Kotter's Eight Stages of Organizational Change. Themes that could be grouped within each model were tagged with the appropriate model and dimension. Themes that did not fit into either model were also examined and included as environmental and process factors. Examples of the content analysis are provided in Appendix D.

Data from the survey was aggregated by type of user (either clinician or MOA) and compared against the concepts generated from the content analysis. This was then used to confirm the findings.

4 Chapter 4: Study Findings

4.1 Introduction

Based on the multiple forms of data collected and analysis described, this section discusses an overview of the participants and the EMR process. This is followed by an analysis of the issues experienced, categorized according to Kotter's Eight Stages of Change and the IS Success Model, and recommendations.

4.2 Participants

4.2.1 Clinicians

The family practice consists of five physicians, five support staff, and one chronic disease management nurse. Each clinician has been practicing medicine for twenty years or more and serves a range of patients and conditions. Each physician's practice consists of a majority of female patients and children, whose ages range from newborn to elderly. As a result of each practice group's patient demographics, some of the common types of conditions seen are related to obstetrical care, minor surgical care including some hospital visits, geriatric care including chronic diseases such as hypertension, diabetes, heart conditions, and depression. The size of each practice group ranges in size: two clinicians are in the process of starting up their practices, two serve an estimated 3,000-4,000 patients each, and another two serve between 1,000 and 1,500 patients each. All physicians operate on a fee-for-service basis and the nurse is receives a salary from the health authority.

When asked to generally rate their computer experience according to the scale: beginner, novice, intermediate, expert, two of the six clinicians assessed their level of experience as intermediate, two assessed themselves as novice, and two assessed themselves as beginners. Of the six, one physician has previously used a full EMR, three have previous experience in a limited capacity using a computer for clinical functions in their practice, and two have never used an EMR nor used a computer for clinical functions.

4.2.2 Support staff

The practice consists of five medical office assistants, four of whom have worked with the physicians in their previous practice locations. In this practice setting they perform tasks for any of the clinicians, however, sometimes they tend to “take care of” the physicians they previously worked for due to previous knowledge of practice style. When asked to generally rate their computer experience according to the scale beginner, novice, intermediate, expert, three assessed themselves as intermediates, one as expert, and one as novice. Of the five, three MOAs have worked with a full EMR previously, and two had limited exposure to using computers for managing practice operations such as billing and scheduling.

4.2.3 Alpha Health Authority Representative

Alpha’s practice manager has been in the position since November 2005 and led the recruitment of and negotiation with the physicians who ultimately became part of this practice group.

Though he did not have previous direct experience implementing EMRs, he had knowledge of the primary care renewal objectives, resources, and outcomes of the health authority’s primary care network, which was initiated from funding from the federal government’s primary care

renewal fund to support changes in general practice including practice redesign and use of technology.

4.2.4 EMR Vendor

The vendor for the practice’s EMR system is an international vendor and recently relocated its head office to Vancouver. It still maintains its support desk and research and development abroad. The company has been in operation since 1997, and has installations outside Canada in a number of sites, which include large institutions and health authority-affiliated facilities as well as traditional medical practices. The vendor has EMR installations in other parts of B.C. and has also been chosen to provide an EMR for a number of community health centres operated by Alpha.

Participant Group	# of Participants	Range of Experience in role/ position	Range of Self-Assessed Computer Ability
Clinicians	6	20-30 years	Beginner to Intermediate
Medical Office Assistants	5	3-15 years	Novice to Expert
Health Authority Rep	1	1 year	N/A
Vendor	2	10 years	N/A

Table 4.1 Summary of Participants

4.2.5 Computer Equipment and Network

The office is equipped with new computers in all exams rooms and one computer per physician in a shared office. There is one printer located in a hallway between exam rooms and the physicians’ shared office and another located in the filing room, which is in close proximity to the MOA front desk. Hardware support is provided by a company external to the health

authority. Due to the location of the practice being based in a facility affiliated with the health authority, there is also involvement from the health authority's information technology department for computer networking. This practice is treated as an "island" from the greater health authority network and the practice data cannot be accessed from other parts of the Alpha network.

4.3 Description of EMR Process

4.3.1 Practice Formation

Recognizing a need to bolster the attraction and ties to family medicine, an agreement was struck between the health authority and their affiliated university's department of family medicine to secure space in a new health facility being built through a public-private partnership. Initially, it was the health authority's intention to facilitate the leasing of the space for interested family physicians. Through the process, Alpha realized the proposed cost of leasing the space was too prohibitive for most family physicians to entertain due to the overall large amount of space and the quality of the building. As a result, recruitment for the space was revamped in the form of a service agreement with Alpha. As part of the agreement, the family practice leases space in the new health facility within close proximity to hospital labs and diagnostic imaging and a number of specialty practices. It is also provided with additional supports including a chronic disease management nurse, the initial costs of the EMR paid for, and a portion of the office space rented by the health authority in order to reduce the overall costs of practicing in such an upscale facility. In exchange, the practice is required to evaluate the success of the arrangement, which

includes working toward improving the management of chronic diseases in its patient population, and improving patient access to care.

4.3.2 Timeline

	Jan-06	Feb-06	Mar-06	Apr-06	May-06	Jun-06	Jul-06	Aug-06	Sep-06	Oct-06	Nov-06	Dec-06
Recruitment for physicians	█	█										
Negotiations with interested physicians			█	█	█	█	█					
Demonstration of health organization endorsed EMR system						█						
EMR Training								█				
Go Live for Physicians 1 and 2 and staff								█	█			
Go Live for Physicians 3 and 4 and staff										█		
Go Live for Physician 5											█	
Chronic Disease Management Nurse												█

Figure 4.1 Implementation Timeline

The key activities related to organizing and implementing this practice occurred over relatively short timelines. From initial engagement to the go live of the first two physician practice groups the process was completed in 8 months. Negotiations with the physicians to determine and agree on the terms of the service agreement took the longest amount of time at 5 months. This directly affected the ability of the vendor to begin working with the practice to prepare them for the transition to EMR. As a result, planning and preparation for the EMR was severely limited. In addition, because leases on the physicians’ previous practice spaces expired at different times, their arrival into the new practice space was staggered.

4.3.3 Goals

One of the overarching goals of the arrangement between the practice and the health authority is to improve patient care for those with chronic conditions. The service agreement does not specify any specific measures or targets, just a commitment to work toward improving patient care. The details of the measures will be agreed upon at a later date. In addition, because the practice setting and circumstances are unique, another commitment in the service agreement is to evaluate the success of the arrangement over the course of the three-year pilot. No specific measures for evaluating the arrangement have been defined at this point.

4.3.4 Selection of EMR

While negotiations with the practice physicians were in progress, the health authority arranged a demonstration of their preferred EMR vendor product. The health authority had a previous relationship with the vendor as their EMR software had been chosen for an in-house EMR implementation. The physicians were free to research and test other EMR products, but did not take the opportunity to do so due to the limited amount of time available for implementation.

4.3.5 Preparing for Implementation

While negotiations between the health authority and practice occurred to determine the terms of the service agreement, four of the five physicians and their staff were still involved in responsibilities of the daily operations of their busy family practices in their original practice locations. The service agreement appointed a lead physician, whose role was to liaise with the health authority for any discussion required and obtain consensus from the larger physician group when appropriate. The same lead physician also had previous experience using an EMR so was also the point of contact with the EMR vendor. Once the service agreement was signed, the

vendor was contacted to begin the implementation process, which first occurred approximately four weeks prior to the go live date of the first two physicians, the last week of August 2006. Given the very tight timelines, only mandatory activities were completed for the implementation. As a result, activities such as workflow analysis, which involves identifying and deciding how paper processes and the people performing them are impacted by EMR use; basic computer skills competency assessments; and privacy requirements, preventing viewing or editing access to certain parts of patient records for specific users, were not completed. There was a limited amount of data able to be transferred to the new system from the lead physician's old EMR.

4.3.6 Implementation and Maintenance

Training

The physicians and staff were trained in their old office space at the end of the week prior to the practice moving to the new office space, while the practice was still in operation. The training sessions were designed to cover basic functionality of the EMR system such that the staff and physicians could be functional during the first week on the new system. Follow-up training would be provided on-site at a later date to cover additional functions. During the time made available for the vendor, the training sessions covered approximately 60% of the full set of EMR functionality.

Hardware and Networking

Hardware and network configuration were managed by the health authority representative who liaised with the vendor, an external networking company, and Alpha's information technology department to ensure computers were installed in the practice and access to the software and Internet were available prior to the go live date. Due to the nature of the public-private

partnership arrangement of both the practice and the building in which they were moving into, networking proved to be a challenge although was operational for the go live date. Backup procedures are also in place and are overseen by the health authority. Remote access to the EMR software was not available until eight months after the first go live.

Transferring patient data

Each physician had a different level and state of information that needed to be transferred to the EMR. Summarized are the situations and the approaches each physician took.

Physician A: Previous EMR User

Close to all of his patient information was in his previous EMR system. A data transfer of demographics and some patient appointments were able to be completed prior to go live, however some additional data was transferred after the go live. This physician began using all EMR functionality immediately, backfilling patient historical information to the new EMR system as he saw patients.

Physician B: Paper Charts

Physician B had patient information stored in paper charts and shared an electronic appointment and billing system with Physician A through the previous EMR system. Physician B's approach to transferring a patient's historical data into the EMR was to put necessary information into the EMR as patients presented in the practice. From the first day of using the new EMR, Physician B performed all functions in the EMR until he found it too frustrating to do so. This most often equated to Physician B using the EMR for patients seen in the morning where he would summarize the patient's history, process encounter notes, prescriptions, and referral letters at the point of care with the patient in the room. Physician B would end up severely behind in his schedule and would switch to using the paper charts for patients seen in the afternoon.

Gradually, Physician B was able to see more and more patients using the EMR at the point of care. Despite this, Physician B still spends a lot of extra hours in the office at night completing tasks for patient visits that occurred during the day.

Physician C: New practice, no charts

Physician C started a new practice upon moving into the new practice space. Therefore she did not have any patient charts to convert data from. However, new patients taken on by Physician C have information sent from other physicians or clinics via fax. Physician C's strategy for capturing a patient's historical data based on the data received from other providers was to summarize this information in the EMR's comprehensive patient summary. Any information to be scanned is tagged and sent to the MOAs to perform.

Physician D: Paper Charts

Physician D also had information stored in paper charts. Her strategy for transferring data from the paper chart to the EMR was to take a portion of her patients' charts each morning and review the pertinent information in the chart for summary into the EMR. Any information in the paper chart to be scanned is tagged and the chart is given to an MOA to perform the task. Physician D also does not perform all her work at the point of care with the patient. Encounter notes and referral letters are often completed at the end of the day or next morning or between patients.

Physician E: Paper charts

Physician E has paper charts but has not adopted the full set of EMR functionality as quickly as the other physicians. Being a new computer user, she is taking a gradual, step-wise approach to performing new functions in the EMR, as she feels comfortable. Her strategy for transferring data from the paper chart to the EMR is similar to Physician D's in which she examines the patient's record and pulls any pertinent information for the MOAs to scan. At the time of

interview, Physician E was doing encounter notes and referral details through the EMR, but would still handwrite her referral letter. She is also not processing diagnostic test orders or prescriptions through the EMR. As a result, Physician E still relies heavily on her paper charts, which are pulled for each patient visit.

4.3.7 EMR Optimization

As of April 2007, the majority of the physicians in the practice are using nearly all the functionality available in the EMR at a basic level. Figure 4.2 shows the functions each physician is using based on broad categories and the approximate level to which they are utilizing the function. None of the physicians are using the care plans or reporting functionality in the EMR, although this is considered advanced level functionality. Some examples of where physicians are not using the EMR at 100% of capacity include:

- All physicians are using the billing function, however, an MOA is required to complete the billings and submit them.
- Physician B uses the EMR to order diagnostic tests, but on occasion prints the requisition from the EMR and indicates the tests to be ordered by handwriting on the form. This was interpreted as approximately 60% of test orders are completed fully on the EMR, while some are still completed by hand.
- Physician E who is logging referrals in the EMR, but still completes a handwritten letter. This was assessed as 50% of usage.
- Physician E, as an EMR beginner, is not yet using the prescription or test ordering functionality in the EMR yet. This is reflected in the absence of those functional bars on the graph.

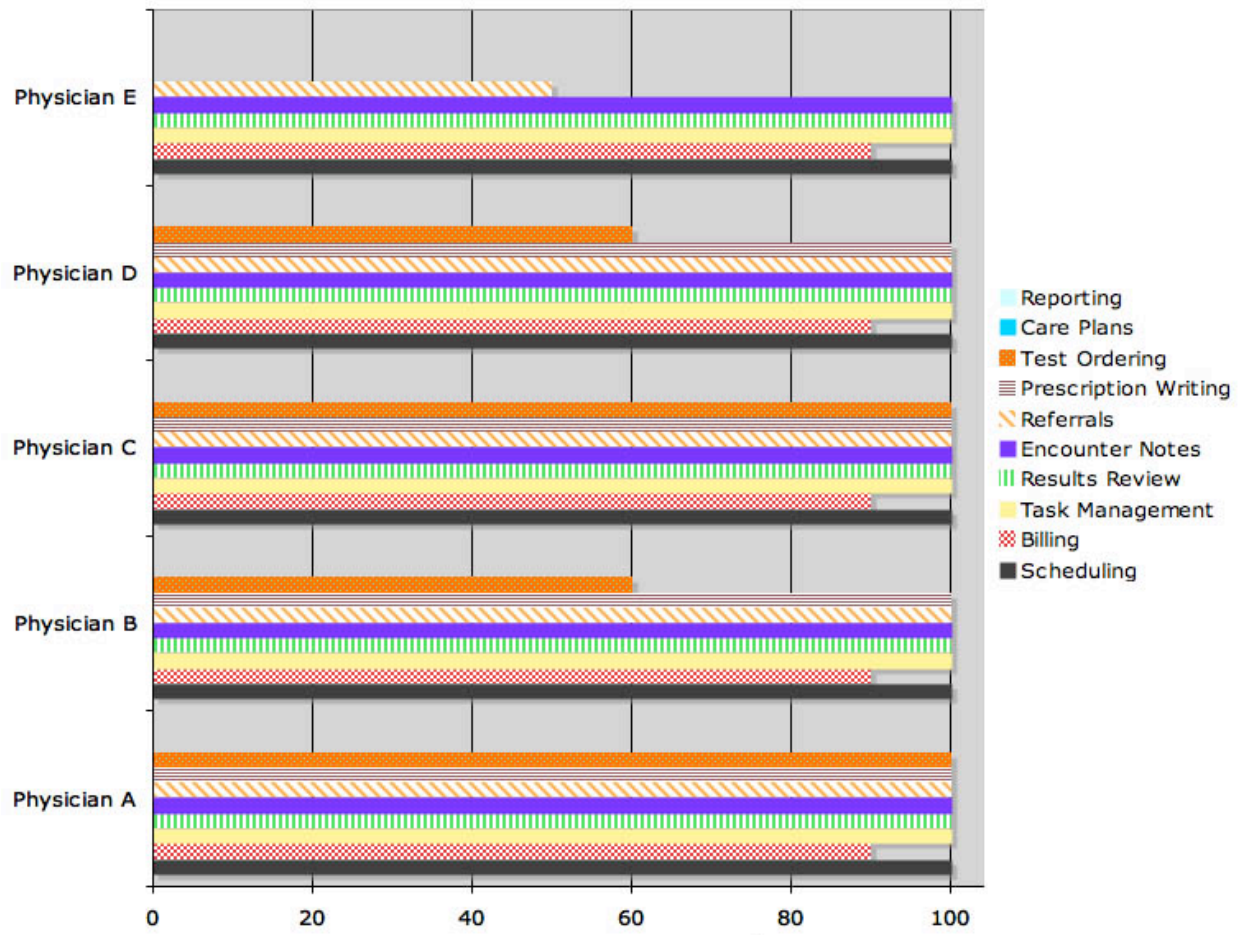


Figure 4.2 Summary of Functionality used by Physicians to April 2007

MOA Workflow

From go live, the MOAs are performing all practice operation tasks such as registering and scheduling patients, processing referrals, scanning incoming documents, and inputting results to the EMR that arrive on paper. Of the five MOAs, one works primarily in the filing room and is responsible for scanning and data entry while another has been designated to be the billing expert for the group and process claims on behalf of all the physicians. The MOA workflow is also dictated by the differences in physician workflow, for example, in the different ways each physician processes referrals and prescription refills.

Practice Changes

Due to the little amount of planning completed, the optimization of the EMR in the practice has occurred on an as needed basis. Changes to workflow processes were decided upon as physicians and staff learned to use the system in their natural environment. When the practice first opened, MOAs were taking care of tasks only for the physicians whom they previously worked for in the individual practices. However, this process was changed so that all MOAs would take care of tasks for any of the physicians. This was accomplished through the use of a common task list available through the EMR. This change resulted in a perceived increase in efficiency for task completion.

In addition, other practice and process changes have occurred with the introduction of the chronic disease management nurse whose role has evolved gradually since her arrival in December 2006. The patient visit model has developed organically through discussions with the nurse on the types of patients she would like to see and when patients should be introduced to her. The process is, typically, the physician identifies a patient as appropriate for the nurse to see during the patient's encounter. After the visit with the physician is complete, the physician then brings a patient to talk with the nurse, provided she has an available time slot. Alternatively, the physician will ask the patient to schedule an appointment with the nurse. The importance of this visit model is to ensure the patient knows the physician endorses the care provided by the nurse. It also strengthens the relationship and communication surrounding patient care between the nurse and the physicians. Another practice change that is in progress is the MOAs learning to take blood pressure of patients prior to seeing their physician. This requires MOAs to be trained to use the equipment properly and also to record the information collected in the EMR. The

nurse is taking on responsibility for managing this practice change by training the MOAs to use the equipment.

Optimizing the EMR is still very much a work in progress for this practice. The recommendations section identifies the successes and challenges the practice has faced and some they will continue to face based on the models selected for this study.

4.4 Recommendations

Form a representative team with a leader, a well-defined and achievable vision, and secure resources to support it.

Leadership and Team

Leadership and a committed team are essential to the transition to EMR. (Studer, 2005)

Along with this, a focus on building trust among all members involved in the change including the health authority, each physician and MOA, the nurse, and the vendor is important. A previously established relationship with a vendor has been noted as a facilitator of a smooth transition to EMR. (O'Neill & Klepack, 2007) Developing trust is an important step given the number of stakeholders and organizations involved. At this point, the practice may want to focus on continuing to build its relationship with both the vendor and the health authority.

Achievable Vision

Kotter explains that the vision should provide direction to those making decisions in the organization. A vision that is not communicated or shared among team members can cause problems later in the implementation process. (Crosson, Stroebel, Scott, Stello, & Crabtree, 2005) The “paperless practice” vision does not specifically define what paperless really

means. The practice is currently scanning a lot of incoming documents, while some are being entered into the EMR and the paper copies filed. Scanned documents are not as powerful as extracted data in the use of an EMR as the documents can only be read with the human eye, not by the computer. Therefore, information on scanned documents is limited. In addition, scanned documents are stored as images and take up more disk space than the pure data. It is important for the practice to identify a vision that is achievable and delve into the information they want available in the EMR for analysis so as to get the most out of the EMR's analytic capabilities and perhaps reduce the amount of work required to scan documents.

Resources

High direct and indirect costs of EMR are one of the major barriers to implementation and adoption. (Studer, 2005) This is consistent with what this practice has experienced; they are part of the way through the change process and the external funding has been exhausted. By spending time understanding the true costs of an EMR upfront by researching and planning, a practice can reduce the risk that they will start a process to EMR that is under-resourced. Practices should also be prepared for the financial burden a reduction in productivity will cause, as was experienced by this practice. (Studer, 2005) At this point, this practice may want to research the availability of funding from research bodies or pursue additional funding from provincial government initiatives in exchange for furthering research on this topic.

Ensure EMR System and Service Quality

System Quality

Several important aspects of system quality were revealed in this study. It is essential that practices ensure the EMR software they choose is reliable as the practice will become

dependent on it for daily operations and frequent downtimes will result in lost productivity and unnecessary stress for both staff and clinicians. Pagliari noted system reliability and incompatibility as a barrier to implementation in a case study. (Pagliari et al., 2005) The EMR system must be customizable so as to support individual clinician workflow practices such as adding new forms for tracking chronic disease care or encounter templates so that clinicians may choose how they would like to document their notes i.e. SOAP note or free-form. Physicians said to pay special attention to features available that are specific to general practice, which performs a lot of care related to immunizations, obstetrics, and referrals. Ease of use is an important aspect to consider when deciding on EMR software. (Blair & Schutte, 2003) Physicians and MOAs at this practice recommended researching other systems and even observing or testing out different kinds of software prior to making a selection. Usability has implications for productivity and potentially patient safety. (Wager, Lee, & White, 2005). While it may be too late for this practice to switch EMR vendors, it is advisable for them to identify the ways they would like the software to work and approach the vendor regarding these requests. This practice could also establish relationships with other practices who use the same software to better understand how they have integrated the use of the system into their workflow, which may reveal some additional functionality or customization available that would work better for this practice.

Service Quality

When selecting an EMR vendor, support must be readily available whether this is in the form of a help line, e-mail, forum, on-site or a combination of all of these. This practice has struggled with getting local issues solved through the vendor's help desk, which is based outside Canada. Other implementations have found that local and in-house support are key facilitators for a smooth transition to EMR. (Studer, 2005) It is essential that service

agreements with EMR vendors outline specifically how much support will be provided pre- and post- implementation and on an ongoing basis.

Engage in detailed planning, preparation, and training

Planning and Preparation

Once goals and vision are established, constructing a detailed plan for transitioning to EMR is recommended. (Blair & Schutte, 2003) This includes agreement on the process by which the transition will occur, for example gradually vs. “jumping in with both feet” as this practice has experienced. Planning should strive to answer “how will I do this in the EMR?” and “what will my job look like when we have an EMR?” especially for MOAs who spend a lot of energy on keeping a practice running smoothly. Planning can also help reduce the level of stress of EMR implementation by using a stepwise transition to the EMR in which groups of functions are adopted in a coordinated fashion rather than all EMR functionality at once as seen in other implementations.(Blair & Schutte, 2003; O'Neill & Klepack, 2007) Finally, planning and a workflow analysis will help uncover some of the obstacles, such as increasing basic computer literacy, and allow for solutions to be developed prior to go live. (Studer, 2005) While the practice has implemented a large portion of the EMR functionality, there is still room for improvement related to tracking chronic disease management. The practice group may choose to establish some goals, such as a certain number of their total patient population to have their chronic disease data captured, and then monitor their progress at regular communication intervals such as weekly meetings.

Training Pre- and Post- Implementation

A computer competency assessment should be completed by all members of the practice to identify those who may need to obtain a mastery of basic computer skills prior to EMR

training. This will ensure the EMR training sessions are as productive as possible and be able to focus the majority of learning on the EMR software itself. The location of training can occur inside or outside the practice, some individuals may prefer to be trained outside the office environment as it can provide a break from distractions and responsibilities in the practice. If a demonstration system is available, staff and clinicians could dedicate time to exploring the EMR system as it will also make instructed training sessions more productive. Regardless of the training format, an adequate amount of time for training needs to be allotted. (Studer, 2005) It should be recognized that not all EMR functionality can be taught at one session, therefore, additional training sessions or “top-up” training should be scheduled at key intervals in the transition process to build on the basics and provide time for the learning to “sink in”. Timeliness and amount of training is reflected in the literature as being a critical success factor. (Studer, 2005) If additional resources are available, each individual should identify some areas of the software that they would like extra training on and bring in a trainer for short one-on-one sessions on a regular basis such as once per month.

Continually work to optimize and evaluate EMR

Optimization

The transition to EMR is an “evolution not a revolution” as one physician in this study termed it. While workflow analysis is normally completed prior to the EMR implementation, it is still a beneficial activity if conducted after go live. In addition, customizations to the application will likely be necessary after go live has occurred as users will have become more comfortable navigating the system and will be able to determine what additional functionality or features they may need. (Blair & Schutte, 2003)

Evaluation

Practices should establish ways to collectively track progress to ensure they are making steps toward achieving goals. It is recommended that time be spent developing some evaluation measures and commit to incorporating the tracking of these measures into regular communication because communication is a key part of a smooth transition. (Crosson, Stroebel, Scott, Stello, & Crabtree, 2005) This will form the basis for developing what Kotter terms “short-term wins”, which are the basis for long-term benefits. It is important that evaluation can answer both “how am I doing in my own practice?” and “how are we doing as a group?” EMR can also be optimized through actioning results discovered in the workflow analysis and through studying the usability of different aspects of the EMR in practice to improve how efficiently and effectively it is used. This practice can still establish shared practice goals, which may or may not be directly related to the EMR, and monitor progress toward those goals over time.

Align rewards and incentives as closely as possible with strategy and performance.

As observed in this study, the overall incentive of generalized funding for implementing a “high-functioning” practice has only taken the group part of the way. In order to increase effectiveness of the EMR, incentives need to be directly tied to better performance as clinicians deal with juggling quality of care against productivity on a daily basis. This misalignment of incentives is also noted by Hutchison who notes “primary care physicians in Canada have received payment for the provision of patient care (usually in the form of fees-for-service) with no funding specifically designated for staffing, clinical information systems, or quality improvement activities. As a result, investments in infrastructure represent income forgone from the physician’s perspective.” (Hutchison, 2007). For this practice there may be

an opportunity to be remunerated alternatively such as through blended billing, a combination of sessional payments and fee-for-service, for the comprehensive care they provide. The EMR can assist in helping the practice bill to its maximum potential.

5 Chapter 5: Synthesis and Conclusion

5.1 *Critical factors for this EMR implementation*

Based on this practice's experience, the following are the critical factors that affected the implementation:

Misalignment of goals with implementation reality

The goal of improving care for chronic disease patients and achieving a high functioning practice was agreed to in principle by both the health authority and the practice group.

However, in practice, physicians and MOAs were constantly pulled in opposing directions when the level of effort required to become "high-functioning" with the EMR conflicted with their need for stable remuneration and reasonable work hours.

Lack of detailed planning and user readiness

The lack of a formalized plan coupled with tight timelines and lack of time to adequately prepare users likely contributed to the less than ideal implementation this practice experienced.

Mediocre level of ownership

There was initial buy-in from the physician group to install and practice with an EMR. However, due to constrained timelines, the lack of first-hand research of other EMR products and little time to establish a good working relationship with the vendor likely affected the level of commitment the physician group had toward their current EMR product when things went awry.

Availability of local champion

Because of his previous experience with an EMR, the head physician took the lead for the practice for decisions related to EMR. However, the amount of work required to get the practice “up to speed” was more than one person could undertake, especially when operating a full-time practice simultaneously.

Poor system quality

The lack of system reliability contributed to an increase in workload to an already stressed staff. The prolonged unavailability of remote access to the EMR rendered the system less flexible than the paper chart system because physicians were forced to stay at the office to complete their work rather than taking work home to complete later in the evening, when their schedule could accommodate it more easily.

5.2 The IS Success Model and Change Theory

Neither the IS Success model nor Kotter’s Eight stages of change can alone account for the process of transitioning to a new information system. Therefore, the combined model proposed offers some insight into how the models relate to one another given the experience of the practice studied. The combined model shows how the change process encompasses the evaluation of system and user aspects and is an iterative cycle. Based on the practice studied, the researcher proposes that the first five stages of Kotter’s model must be adequately addressed prior to examining any system characteristics. The later stages can parallel the system implementation indicating that the planning of short-term wins is normally required prior to system benefits being realized. Conversely, if planning for short-term wins is not done, the likelihood of seeing measurable system benefits decreases. Once benefits of the system have been seen, stages seven and eight can be pursued by consolidating the improvements that have generated the greatest

benefit and incorporating those into the organization’s culture in stage eight. Even when pairing these two models, there are still environmental factors to consider that are unique to the health care environment. These environmental factors are, for the most part, out of the direct control or influence of the practice. Therefore it is important to identify these factors as they will influence the practice’s ability to even succeed in the change process. The environmental factors must be considered right from the beginning of the change process to ensure the practice’s change strategy incorporates these factors ensuring maximum possible success.

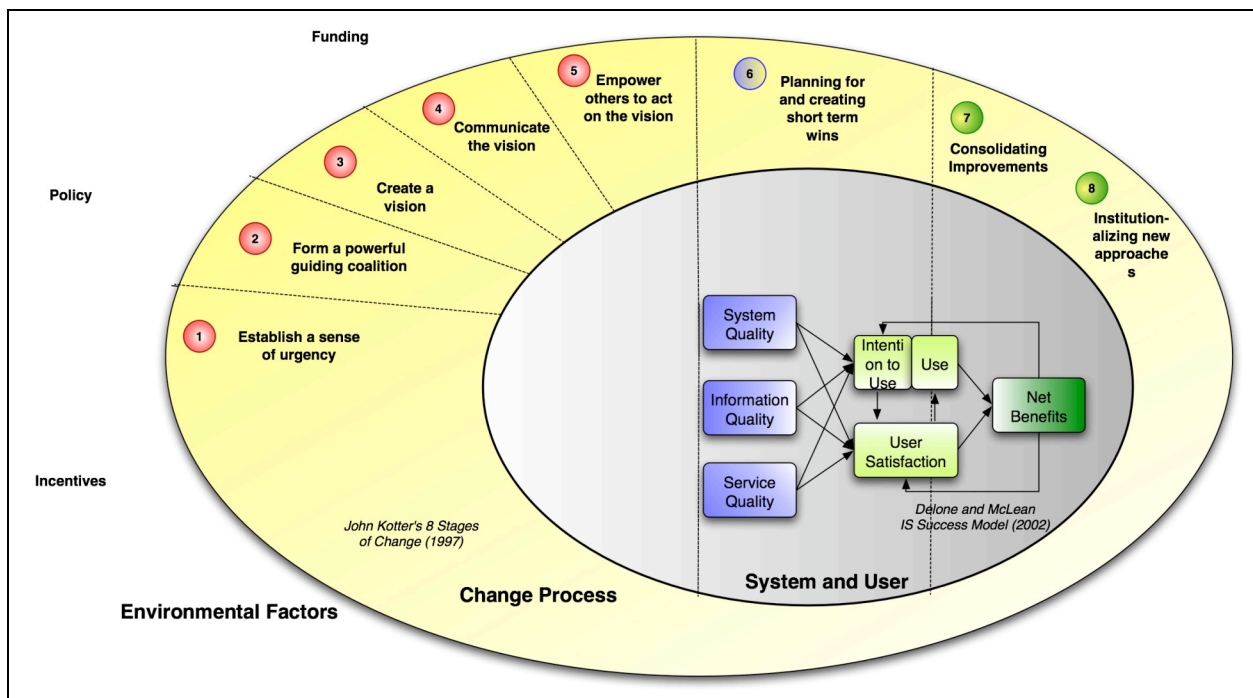


Figure 5.1. Combined IS Success and Change Model

5.3 Use of the Combined IS Success and Change Model

Using the Kotter model checklist-like format, dimensions of the IS Success model that apply to each stage in the change process are discussed. The EMR Adoption stages are adapted from the EMR Toolkit and are provided to indicate where the change stages relate to typical EMR

adoption phases. (Greymartin Consulting Inc., 2006) Examples of evaluation measures or areas to monitor are provided based on this practice's experience.

Establishing a sense of urgency

Relevant IS Success Dimensions: System Quality, Information Quality, Service Quality, User Satisfaction, Use, Net Benefits.

Stage in EMR Adoption Process: Getting Started

In this stage, if a previous system is in use, measures of current system quality, information quality, service quality, use, user satisfaction, and impact can be discussed. This may assist in increasing commitment for the adoption of a new system and start the process of identifying areas where the new system should outperform the previous one.

Forming the Guiding Coalition

Relevant IS Success Dimensions: None.

Stage in EMR Adoption Process: Getting Started.

This stage should focus on the aspects of forming the team, establishing trust, and working toward the common goal. This provides the foundation for the system implementation.

Creating the vision and strategy

Relevant IS Success Dimensions: System Quality, Information Quality, Service Quality, User satisfaction, Net Benefits

Stage in EMR Adoption Process: Getting Started, Selecting an EMR

In this stage, the vision for the practice is determined, which may be influenced by previous experience with other systems. The benefits that the practice wishes to see should also be articulated as part of the strategy, which will assist in evaluating potential EMR software and vendors. Once the vision is decided upon, a detailed list of requirements can be developed and potential EMR software can be evaluated on this basis. The software can also be evaluated on the following IS Success model dimensions: system quality, such as reliability and flexibility of the software; information quality, such as the accuracy and completeness of standard system data (i.e. specialist contact information, diagnostic test order names); service quality, including the vendor's previous record serving other clients in terms of reliability and availability and proposed targets for a potential contract; and user satisfaction, how other clients perceive their service and the usability of the software.

Communicating the Vision

Relevant IS Success Dimensions: Information Quality, User Satisfaction (Perceived System Quality, Perceived Information Quality, Perceived Benefits)

Stage in EMR Adoption Process: Selecting EMR, Preparing for Implementation.

At this stage, Kotter describes the necessity of communicating the vision to the rest of the organization. For small practices, ideally all players that will be affected by the EMR have

already been involved in the process of developing a vision for the EMR. A detailed analysis of the practice's current operations may occur in this stage to help determine EMR requirements and used to assess vendor software. Additionally, once EMR software has been selected, this stage also serves to answer questions about the transition, thus uncovering and dealing with changes to workflow and agreeing on strategies for how to use EMR, for example, the standard information needed to complete for patient registration, the disease coding structure, and perhaps other customizations such as encounter templates like SOAP notes or free-form encounter notes. In this way, the EMR can be evaluating in terms of perceived system quality (flexibility and ease of use), and information quality (accuracy, completeness). Additions to the EMR should be taken on when perceived benefits such as time savings are high enough to justify the change. If use of the system is voluntary, this stage could also involve measuring participants intention to use the system, which can then be compared post-implementation.

Empowering Others to Act on the Vision

Relevant IS Success Dimensions: User Satisfaction, Use, Net Benefits

Stage in EMR Adoption Process: Preparing for Implementation, Implementation and Maintenance, Optimizing EMR.

This stage focuses on removing obstacles so that the system can be used to its fullest capacity. In this stage user satisfaction of training sessions and user competency can be assessed, which will likely partially affect information quality, and productivity benefits. Restructuring workflows and measuring effects on productivity such as the number of incoming documents processed per day or the length of time patients wait either on the phone or in the waiting room can also be used to assess the effects of changes made. Alterations to the EMR via custom forms or usability

improvements can also be measured in terms of efficiency gains such as length of time spent documenting encounters or an audit of the functions used before and after the development of a custom form could also be performed. An audit of information quality could also help determine what areas of the system need to be improved from a usability perspective, which would be targeted at improving productivity and quality of care through better accuracy and completeness of information.

Generating Short-term wins

Relevant IS Success Dimensions: User Satisfaction, Use, Net Benefits

Stage in EMR Adoption Process: Optimizing EMR.

In this stage, the benefits achieved to date should be communicated. While overall benefits may not be realized yet, it is important for users to see how their efforts are making progress toward the long-term benefits such as improving patient care. Short-term benefits could include identifying potential chronic disease patients or generating a practice profile, which are steps toward the long-term benefit of improving care for chronic disease patients. Areas of the system where users are not satisfied or looking at usage statistics can provide clues as to where customizations need to be made, which can also be the source of short-term wins in productivity.

Consolidating Improvements and Anchoring new approaches in the culture

Relevant IS Success Dimensions: User Satisfaction, Use, Net Benefits

Stage in EMR Adoption Process: Optimizing EMR.

Similar to the short-term wins, these can be used to build momentum for further changes to be

made. Changes can be measured by looking at user satisfaction with the system and its ability to support new workflows or productivity (net benefits) levels.

5.4 Use of the Kotter Model

5.4.1 Kotter's Model for Canadian Health Care

Kotter's model was developed primarily from case studies on private corporations. The basis for the model drives at the need for organizations to compete in the marketplace in order to survive. In Canada, health care organizations are public entities and are not subject to the same market conditions as private corporations. In addition, while there are government policies and restrictions under which private corporations also operate, health care organizations receive their funding directly from these governments, therefore have even less control over their strategic direction. While the family practice environment does recognize a need for survival- they must make a living- they are not operating in a competitive environment. They are changing practice, because they are appealing to their own conscience to provide better care and hopefully reduce their own workload. Improving the overall operation of the health system in which they work is not a top priority as the majority of it is out of their control.

The Kotter model is also based on the premise that organizations work within one hierarchical structure i.e. an employee reports to a manager who reports to a director who reports to a senior Vice-President who reports to the Chief Executive Officer who reports to the organization's Board of Directors. Health care has many permutations to this hierarchical structure. In this study, the partnership is collaboration between the health authority and essentially five

independent businesses that work in co-operation with each other. The latitude to fire, replace, and reorganize people in order to make change is limited due to the nature of the practice group's insulation from the larger health authority organization and the need to answer to more than one master (i.e. the provincial government, the college of physicians and surgeons, their own colleagues, and the health authority), all of whom have their own goals, some of which are in opposition to one another.

5.4.2 Kotter's Model for the Medical Practice setting

Kotter's model has traditionally been used to guide major change at large corporations. The interesting part of the model is that the same principles are present in small organizations, as was seen in this practice, but some aspects are different. They are addressed in Table 5.1.

Stage	Large Organization	Small Medical Practice
<i>Establish Sense of Urgency</i>	<ul style="list-style-type: none"> Examine market and competitive realities for the industry as a whole and identify potential crises or major opportunities such as where additional market share could be gained. 	<ul style="list-style-type: none"> A sense of urgency is needed and must exist for each physician who wants to change his or her practice. In a small medical practice, there is little control over "market forces" as they are mostly paid through government agencies. However, there are still opportunities that can be realized even in this type of environment.
<i>Create the guiding coalition</i>	<ul style="list-style-type: none"> Core, representative group is needed to drive change. As a percentage of the overall size 	<ul style="list-style-type: none"> Core group is needed to drive change. In a small organization, the author believes that nearly all

	<p>of the organization, this group is relatively small.</p>	<p>those involved must be part of the “guiding coalition” for the change to be successful. Those who do not support the change will have a much bigger influence on the group as a whole and vice versa.</p>
<p><i>Develop vision and strategy</i></p>	<ul style="list-style-type: none"> • A vision is developed that helps direct the change effort. Strategies are developed to support the vision. Detailed planning is left to middle managers to do based on the vision’s framework. 	<ul style="list-style-type: none"> • A vision and strategy are still required, however, these is a need for a focus on the development and management of a detailed plan for achieving the vision. As was seen in this practice, the lack of a detailed plan for transition has hindered the practice’s performance.
<p><i>Communicating the Vision</i></p>	<ul style="list-style-type: none"> • Using multiple communication vehicles to get the vision and strategy messages out. This is particularly important for large organizations where there is a large number of staff that need to be communicated with. Communication vehicles might include presentations, newsletters, face-to-face interactions, and management behaviour supporting the vision. 	<ul style="list-style-type: none"> • For a small practice, communicating the vision does not involve a communication strategy, rather, it needs to be given attention during face-to-face interactions such as group meetings rather than newsletters or presentations which likely are not needed. The author believes that physician behaviour supporting the vision is particularly important in this step, as it is likely to primary form of communicating commitment to the vision.

<i>Empowering broad-based action</i>	<ul style="list-style-type: none"> • For large organizations this means removing obstacles including changing organizational structures, firing or hiring people that support the vision, or changing systems to support the vision. 	<ul style="list-style-type: none"> • For a small medical practice, removing obstacles is key to a successful transition to EMR. However this practice is not in control of the structures outside itself, which would need to be changed to solve in part the privacy concerns that currently exist as the result of the differing ownership of data.
<i>Generating short-term wins</i>	<ul style="list-style-type: none"> • For large organizations, this means planning for visible improvements, creating improvements, and then recognizing those who have contributed to making wins possible. 	<ul style="list-style-type: none"> • The same is true for the medical practice. Planning needs to occur to create short-term wins as well as celebrating as a group when wins occur.
<i>Consolidating Gains and Producing More Change</i>	<ul style="list-style-type: none"> • For large organizations, this means using increased credibility to roll changes out to the entire organization while promoting appropriate people to continue the change effort then developing new change themes. 	<ul style="list-style-type: none"> • For a medical practice, testing changes will likely occur for the entire group rather than a “pilot” that is then rolled out to other parts of the organization. If the changes do not work, they will be dropped. Due to the flat organizational structure of a medical practice, there will not likely be any movement or promotions. However, if turnover occurs, practices can pay attention to hiring a replacement who fits

		the vision. The development of new change themes applies to the practice setting the same as it does for a large organization.
<i>Anchoring new approaches in the culture</i>	<ul style="list-style-type: none"> • For a large organization, this means articulating the link between the change effort and the benefits realized to ensure changes “stick”. 	<ul style="list-style-type: none"> • For a small medical practice, the author believes new approaches will naturally be adopted into the culture and does not require a formal approach to “anchoring”.

5.5 Study Limitations

Organizational change is an ongoing process. This study was able to look at a practice implementing an EMR for a limited time during this process. Due to time limitations the study could not follow the practice for a longer period of time. Though it was not possible for the researcher to do a pre- and post-implementation study design, this is the design that the researcher would use if asked to perform this type of research again. Participants had to recall past events during interviews, which can introduce bias into their responses as far as the experiences they do and do not remember. In addition, opinions and level of comfort with the system change over time therefore the researcher was only able to capture this at one point in the EMR transition. The interview guide itself could have been improved had it been pre-tested with one or two relevant individuals (i.e. physician and MOA) prior to administering it. The interview itself should have addressed more in-depth the workflow of both physicians and MOAs and focus on the differences between the paper processes and those with the EMR. The questionnaire chosen, although a validated one, was dated (published in 1988). Some responses

from the questionnaire indicated participants did not understand some of the questions particularly when term “output” was used. A recommendation would be to administer a more in-depth questionnaire on end-user computing satisfaction.

5.5.1 Generalizability

The results of this study are based on the experience of one practice with somewhat unique circumstances. While the results can be taken at face value and are consistent with results seen in other similar studies, they are not generalizable to other practices. However, the approach taken and author believes the combined model presented could be applied to evaluate other information systems implementations including hospital and primary care settings.

5.6 Conclusion

EMR implementation is complex. The success of an EMR implementation is dependent on the basics including system quality, information quality, service quality, but can still be accomplished with mediocre performance on these. Other factors that drive user satisfaction and improved use of the system are the presence of trust and team, achievable vision, preparation and planning including training, and adequate resources. These aspects are addressed by change theory. By using two complementary models to evaluate the implementation of an electronic medical record system, a more complete picture of the factors affecting the implementation were obtained and the linkages between the information system variables and organizational change variables are illuminated, which can be used to inform this and future implementations.

5.7 Future Directions

Organizational change plays out over time. Based on the snapshot of this practice, further research should attempt to follow the change process further. Areas that could be explored

further with this practice are: linking net benefits to information quality by examining how data is currently inputted and if the current processes are facilitating or hindering the ability of useful information to be generated by the EMR such as reporting; and usability testing could also play a role to more accurately identify how users are interacting with this particular EMR system and identify areas of improvement.

6 References

- Alpha. (2002). Alpha Health Authority Receives Funding to Strengthen PHC. Retrieved Feb 28, 2007, from [For details contact the author.](#)
- Anderson, J. G., & Aydin, C. E. (2005). *Evaluating the Organizational Impact of Healthcare Information Systems* (2nd ed.). New York: Springer.
- Armenakis, A. A., & Bedeian, A. G. (1999). Organizational Change: A Review of Theory and Research in the 1990s. *Journal of Management*, 25(3), 293-315.
- Baker, G., & Pink, G. (1995). A balanced scorecard for Canadian hospitals. *Healthcare Management FORUM*, 8(4), 7-13.
- BC Ministry of Health. (2006). MSP - Negotiated Agreements with the BCMA - FAQs - PITO.
- BC Ministry of Health. (2007). *Request for Proposals Electronic Medical Records Project*. Retrieved from <http://www.bcbid.gov.bc.ca/open.dll/welcome>.
- BCMA. (2004). *Getting IT Right: Patient Centred Information Technology*. Retrieved March 6, 2007. from http://www.bcma.org/public/news_publications/publications/policy_papers/ITPaper/GettingITRight.htm.
- Benbasat, I. (1987). The Case Research Strategy in Studies of Information Systems. *MIS Quarterly*, 11(3), 369-386.
- Blair, D., & Schutte, P. C. (2003). The Electronic Medical Record in Multi-Site Family Practice Part 2: The Implementation Phase. *Journal of Medical Practice Management*, 19(3), 131-136.
- Burnes, B. (2004). Kurt Lewin and the Planned Approach to Change: A Re-appraisal. *Journal of Management Studies*, 41(6), 977-1001.
- Calgary Health Region. (2006). Enterprise Balanced Scorecard: 2nd Quarter Status Report - Fiscal 2006/2007. Retrieved Jan 17, 2007, from http://www.calgaryhealthregion.ca/communications/publications/2006-2007_EBSC_Q2Final.pdf
- Crainer, S. (2003). The Management Interview: John Kotter - Has plans to change himself and the world. *New Zealand Management*, 48-50.
- Crosson, J. C., Stroebel, C., Scott, J. G., Stello, B., & Crabtree, B. F. (2005). Implementing an Electronic Medical Record in a Family Medicine Practice: Communication, Decision Making, and Conflict. *Ann Fam Med*, 3(4), 307-311.
- Dalal, B., & Smith, J. (2006). PITO/EMR Overview. In B. F. Session (Ed.). Vancouver.
- Delone, W. H., & McLean, E. R. (2003). The DeLone and McLean Model of Information Systems Success: A Ten-Year Update. *Journal of Management Information Systems*, 19(4), 9-30.

- Delone, W. H., McLean, E.R. (1992). Information Systems Success: The Quest for the Dependent Variable. *Information Systems Research*, 3(1), 60-95.
- Fraser Health Authority. (2005). The Fraser Health Strategic Plan. Retrieved Jan 17, 2007, from <http://www.fraserhealth.ca/NR/rdonlyres/eme3vbx2ipj24m5fnfyog7y2sghpfv247plz6p4gug7opztt2dcccdbbyssodzcg6rp6nr2f2s7qygnenr5q2j7jd6f/Plan.pdf>
- Galpin, T. J. (1996). *The Human Side of Change: A Practical Guide to Organization Redesign*. San Francisco, CA: Jossey Bass.
- Grant, A., Plante, I., & Leblanc, F. (2002). The TEAM methodology for the evaluation of information systems in biomedicine. *Computers in Biology and Medicine*, 32(3), 195-207.
- Greymartin Consulting Inc. (2006). *The EMR Toolkit*. Retrieved Dec. 1, 2006. from http://emrtoolkit.ca/files/EMR_Toolkit_en.pdf.
- Health Canada. (June 21, 2006). About Primary Care. Retrieved Dec 1, 2006, from http://www.hc-sc.gc.ca/hcs-sss/prim/about-apropos/index_e.html
- Hutchison, B. (2007). Cracks in the Foundation: The Precarious State of Canada's Primary Care Infrastructure. *Electronic Healthcare*, 10(2), 1-3.
- Kaplan, B. (1997). Addressing organizational issues into the evaluation of medical systems. *J Am Med Inform Assoc*, 4(2), 94-101.
- Kaplan, R. S., & Norton, D. P. (1992). The Balanced Scorecard - Measures That Drive Performance. *Harvard Business Review*, 70(1), 71-79.
- Keshavjee, K., Troyan, S., Holbrook, A., & Van der Molen, D. (2001). *Measuring the Success of Electronic Medical Record Implementation Using Electronic and Survey Data*. Paper presented at the American Medical Informatics Association Symposium.
- Kotter, J. (1996). *Leading Change*. Cambridge: Harvard Business School Press.
- Lau, F., Hagens, S., & Muttitt, S. (2007). A Proposed Benefits Evaluation Framework for Health Information Systems in Canada. *Electronic Healthcare*, 10(1), 112-118.
- Litvin, C. B., Ornstein, S. M., Anthony, W. E., Jr., & Tanner, D. (2001). Quality improvement using electronic medical records: a case study of a high-performing practice. *Top Health Inf Manage*, 22(2), 59-64.
- Loomis, G. A., Ries, J. S., Saywell, R. M. J., & Thakker, N. R. (2002). If electronic medical records are so great, why aren't family physicians using them? *J Fam Pract*, 51(7), 636-641.
- Luo, J. S., Hilty, D. M., Worley, L. L., & Yager, J. (2006). Considerations in Change Management Related to Technology. *Academic Psychiatry*, 30(6), 465-469.
- Moehr, J. R. (2002). Evaluation: salvation or nemesis of medical informatics? *Computers in Biology and Medicine*, 32(3), 113-125.
- Mohd, M., Yusof, R. J., & K.S., L. (2006). *Towards a Framework for Health Information Systems Evaluation*. Paper presented at the Proceedings of the 39th Hawaii Conference on System Sciences, Hawaii.

- Neville, D., Gates, K., MacDonald, D., Barron, M., Tucker, S., Cotton, S., et al. (2003). *Toward an Evaluation Framework for Electronic Health Record Initiatives: A Proposal For an Evaluation Framework*. Retrieved Jan 17, 2007. from http://www.hc-sc.gc.ca/hcs-sss/pubs/kdec/nf_eval/nf_eval1_e.html#4.
- O'Neill, L., & Klepack, W. (2007). Electronic Medical Records for a Rural Family Practice: A Case Study in Systems Development. *Journal of Medical Systems*, 31, 25-33.
- Ontario Hospital Association. Hospital Report: A Balanced Scorecard for Ontario Hospitals. Retrieved Jan 17, 2007, from http://www.oha.com/client/OHA/OHA_LP4W_LND_WebStation.nsf/page/Hospital+Report
- Orlikowski, W. J., & Yates, J. (2006). ICT and Organizational Change: A Commentary. *The Journal of Applied Behavioral Science*, 42(1), 127-142.
- Orsini, J. N. (2006). W. Edwards Deming - the first management engineer. *Engineering Management*, 16(3), 46-47.
- Pagliari, C., Donnan, P., Morrison, J., Ricketts, I., Gregor, P., & Sullivan, F. (2005). Adoption and perception of electronic clinical communications in Scotland. *Inform Prim Care*, 13(2), 97-104.
- Pettigrew, A., Thomas, H., & Whittington, R. (Eds.). (2002). *Handbook of Strategy and Management*: Sage.
- PHCTF. Primary Health Care and Health Care System Renewal. Retrieved December 11, 2005, from http://www.hc-sc.gc.ca/hcs-sss/prim/renew-renouv/index_e.html
- Protti, D. (2002). A proposal to use a balanced scorecard to evaluate *Information for Health*: an information strategy for the modern NHS (1998-2005). *Computers in Biology and Medicine*, 32(3), 221-236.
- Protti, D. (2006, Sept 18-20). An overview of global paths to ExR journeys. *Informing Health Care in Wales*:
- Romanow, R. (2002). *Building on Values: The Future of Health Care In Canada*. Retrieved from http://www.hc-sc.gc.ca/english/pdf/romanow/pdfs/HCC_Chapter_5.pdf.
- Seddon, P. B., Staples, S., Patnayakuni, R., & Bowtell, M. (1999). Dimensions of Information Systems Success. *Communications of AIS*, 2(20), 61.
- Shaw, N. T. (2002). 'CHEATS': a generic information communication technology (ICT) evaluation framework. *Comput Biol Med*, 32(3), 209-220.
- Skinner, B. J. (2007). Long-term or Short-term, Public Health Insurance is Not Sustainable: A Reply to CUPE About Health Spending Trends in Canada. *Fraser Alerts* Retrieved Jan. 17, 2007, from <http://www.fraserinstitute.ca/admin/books/files/Health%20insurance4.pdf>
- Studer, M. (2005). The Effect of Organizational Factors on the Effectiveness of EMR System Implementation - What Have We Learned? *Electronic Healthcare*, 4(2), 92-97.
- Van der Meijden, M. J., Tange, H.J., Troost, J., Hasman, A. (2003). Determinants of Success of Inpatient Clinical Information Systems: A Literature Review. *Journal of the American Medical Informatics Association*, 10(3), 235-243.

- Vancouver Coastal Health. (2006). Vancouver Coastal Health Balanced Scorecard. Retrieved Jan 17, 2007, from <http://www.vch.ca/accountability/scorecard.htm>
- Wager, K. A., Lee, F. W., & White, D. M. (2005). Life After a Disastrous Electronic Medical Record Implementation: One Clinic's Experience. *Idea Group Publishing*.
- Watson, D. B., C; Peterson, S; Mooney, D; Reid, R.J. (2006). *Primary Health Care in BC: Physician Supply, Distribution and Practice Collocation (1996/97 to 2004/05)*: University of British Columbia.
- Weber, R. P. (1990). *Basic Content Analysis* (2nd. ed. Vol. 49). Newbury Park: Sage.
- Yin, R. K. (2002). *Case Study Research, Design and Methods* (3rd ed.). Newbury Park: Sage Publications.
- Yin, R. K. (2003). *Applications of Case Study Research* (Vol. 34). Thousand Oaks: Sage.

7 List of Appendices

Appendix A: Ethics Approval

Appendix B: Interview Guide

Appendix C: Survey

Appendix D: Sample Content Analysis

Appendix E: Survey Results

Appendix F: Ease of Use Summary

Appendix G: Combined IS Success and Change Model

Appendix A: Ethics Approval



University of Victoria


Human Research Ethics Board
 Office of Research Services
 University of Victoria
 Technology Enterprise Facility, Room 218
 Tel (250) 472-4545 Fax (250) 721-7836
 Email ethics@uvic.ca Web www.research.uvic.ca

**Human Research Ethics Board
 Certificate of Approval**

<u>Principal Investigator</u> Lindsay Forland Master's Student	<u>Department/School</u> HEIS	<u>Supervisor</u> Dr. Francis Lau	
<u>Co-Investigator(s):</u>			
Project Title: Evaluating the Implementation of an Electronic Medical Record System for a Health Organization-Affiliated Family Practice Clinic			
<u>Protocol No.</u> 06-408	<u>Approval Date</u> 16-Jan-07	<u>Start Date</u> 16-Jan-07	<u>End Date</u> 15-Jan-10

Certification

This certifies that the UVic Human Research Ethics Board has examined this research protocol and concludes that, in all respects, the proposed research meets appropriate standards of ethics as outlined by the University of Victoria Research Regulations Involving Human Subjects.



 Dr. Richard Keeler
 Associate Vice-President, Research

This Certificate of Approval is valid for the above term provided there is no change in the procedures. Extensions or minor amendments may be granted upon receipt of a "Research Status" form.

06-408 Forland, Lindsay

Appendix B: Sample Interview Guide

Background

1. How long have you been practicing family medicine?
2. Approximately how many patients are in your practice?
3. Describe some of the common types of care you provide or conditions you treat.
4. Describe what this practice is all about. What makes it different from a regular private family practice? Why did you join this practice?
5. Would you consider yourself a beginner, novice, intermediate, or expert user of computers? Besides EMR, what types of things do you use your computer for a) at home b) at work?
6. Describe your past experience with EMR.

EMR Transition

1. What are the EMR-related goals for the practice? For yourself? How were goals decided upon and communicated to everyone?
2. Describe the approach you and/or the practice as a whole took, from planning and preparation, through go live, support to transition to EMR?
3. What has worked and what didn't? If you had to give advice to a practice going through the same experience, what advice would you give them?
4. Have you identified any processes happening in the practice that seem to be hindering transition to EMR or new processes that are assisting the transition? What is the practice's strategy for communicating and changing these processes?
5. What progress have you made toward the goals you set out for yourself and the practice? Have you revised any of your goals or set new ones?

System Use

1. What system functionalities have been the most useful and least useful for a) the provision of patient care and b) for practice operation management? Why?
2. Describe the ease of use of the system. What features do you find particularly easy to use? What features are difficult?
3. Does the EMR meet your information needs at the point of care? If so, why? If not, why not?
4. What do practices need in the EMR that is currently not there to provide effective patient care?

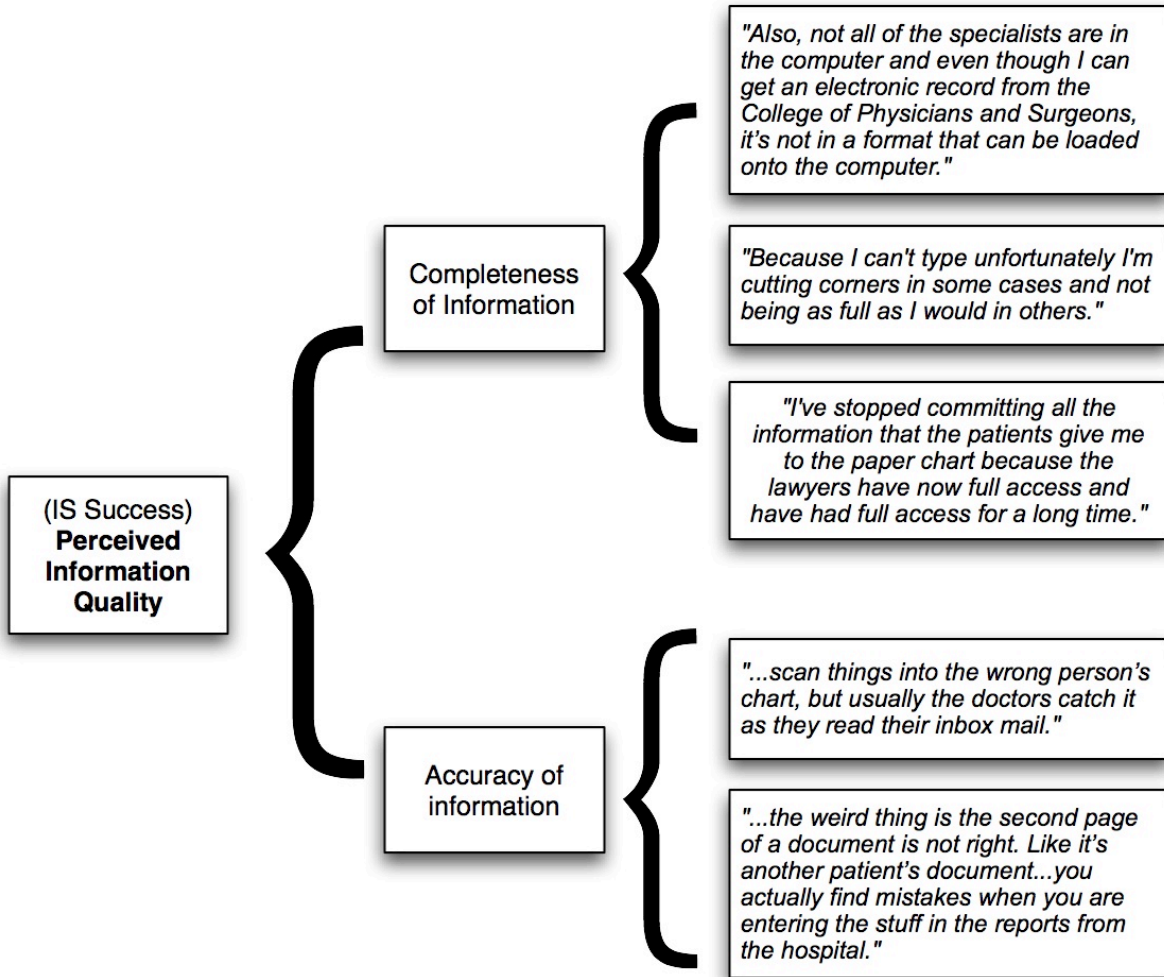
Appendix C: Survey

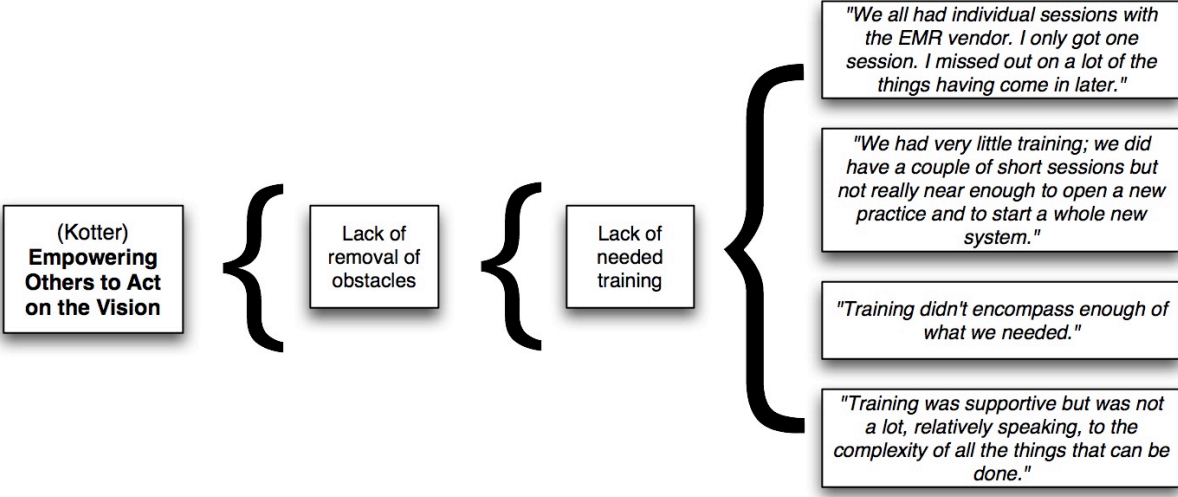
About this survey: This survey was developed by William Doll and Gholamreza Torkzadeh in 1988 and published in MIS Quarterly. It was designed and validated to measure end-user computing satisfaction of information systems.

Instructions: Please rate your EMR system for each of the following questions according to the scale provided. The survey should take you less than 5 minutes to complete. Once completed, please place your survey in the envelope provided at the front desk labeled EMR Survey. Thank you for your participation.

		Non existent	Poor	Fair	Good	Excellent
C1	Does the EMR provide the precise information you need?	1	2	3	4	5
C2	Does the EMR information content meet your needs?	1	2	3	4	5
C3	Does the EMR provide reports that seem to be just about exactly what you need?	1	2	3	4	5
C4	Does the EMR provide sufficient information?	1	2	3	4	5
C5	Do you find the output relevant?	1	2	3	4	5
A1	Is the EMR accurate?	1	2	3	4	5
A2	Are you satisfied with the accuracy of the EMR?	1	2	3	4	5
A3	Do you feel the EMR output is reliable?	1	2	3	4	5
A4	Do you find the EMR dependable?	1	2	3	4	5
F1	Do you think the output is presented in a useful format?	1	2	3	4	5
F2	Is the information in the EMR clear?	1	2	3	4	5
F3	Are you happy with the layout of the EMR output?	1	2	3	4	5
F4	Is the EMR output easy to understand?	1	2	3	4	5
E1	Is the EMR user friendly?	1	2	3	4	5
E2	Is the EMR easy to use?	1	2	3	4	5
E3	Is the EMR efficient?	1	2	3	4	5
T1	Do you get the information from the EMR you need in time?	1	2	3	4	5
T2	Does the EMR provide up-to-date information?	1	2	3	4	5

Appendix D: Examples of Content Analysis



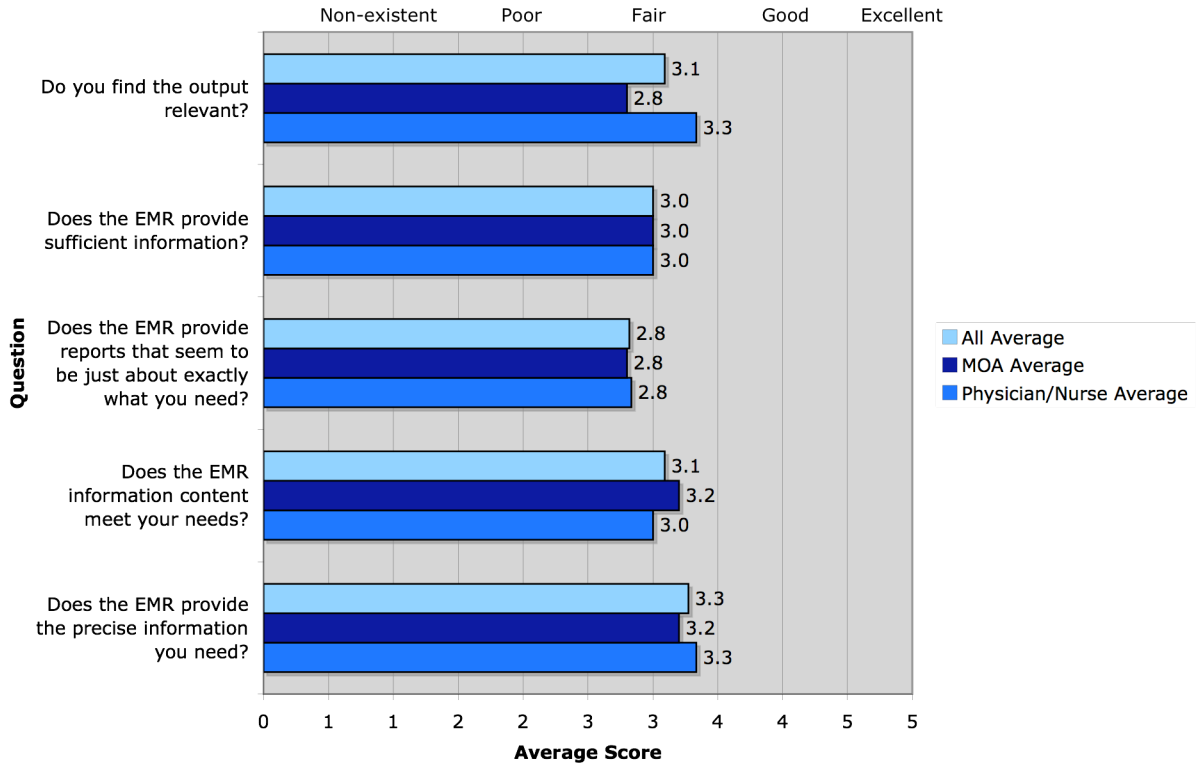


Appendix E: Survey Results

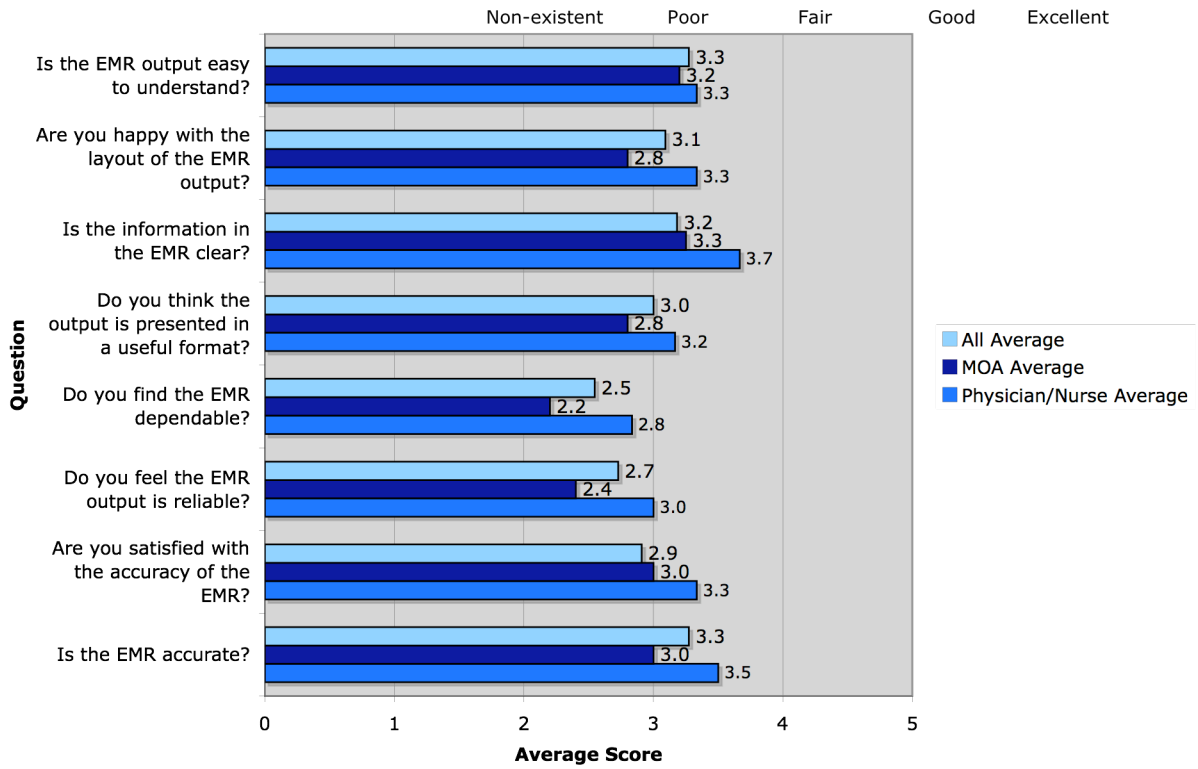
The following is the average scores for each survey question. Graphs are provided following this table. Questions coded with “C” indicate they are “Content” related questions, “A” relates to “Accuracy”, “F” relates to “Format”, “E” relates to “Effectiveness”, and “T” relates to “Timeliness”.

		Physician/Nurse Average	MOA Average	All Average
C1	Does the EMR provide the precise information you need?	3.33	3.20	3.27
C2	Does the EMR information content meet your needs?	3.00	3.20	3.09
C3	Does the EMR provide reports that seem to be just about exactly what you need?	2.83	2.80	2.82
C4	Does the EMR provide sufficient information?	3.00	3.00	3.00
C5	Do you find the output relevant?	3.33	2.80	3.09
A1	Is the EMR accurate?	3.50	3.00	3.27
A2	Are you satisfied with the accuracy of the EMR?	3.33	3.00	2.91
A3	Do you feel the EMR output is reliable?	3.00	2.40	2.73
A4	Do you find the EMR dependable?	2.83	2.20	2.55
F1	Do you think the output is presented in a useful format?	3.17	2.80	3.00
F2	Is the information in the EMR clear?	3.67	3.25	3.18
F3	Are you happy with the layout of the EMR output?	3.33	2.80	3.09
F4	Is the EMR output easy to understand?	3.33	3.20	3.27
E1	Is the EMR user friendly?	3.00	3.00	3.00
E2	Is the EMR easy to use?	3.17	3.60	3.36
E3	Is the EMR efficient?	2.83	2.60	2.73
T1	Do you get the information from the EMR you need in time?	3.33	3.00	3.18
T2	Does the EMR provide up-to-date information?	3.17	2.80	3.00

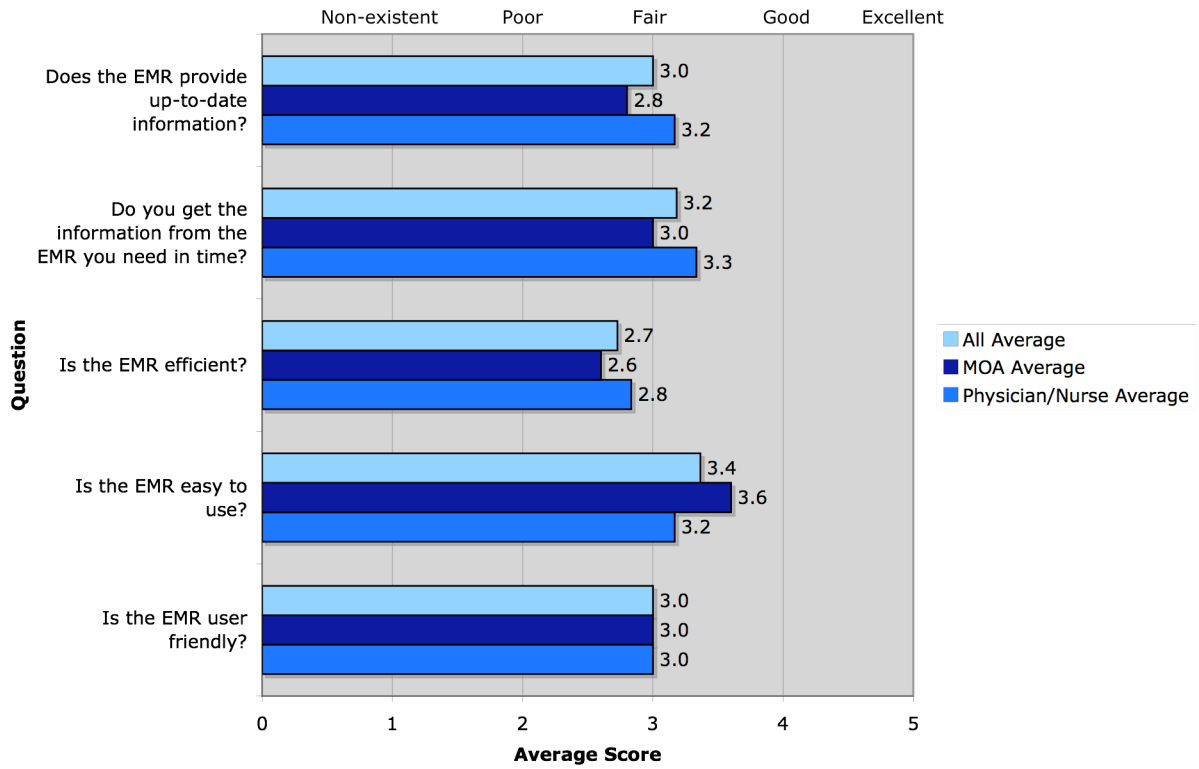
End-user satisfaction Survey results: Content



End-user satisfaction Survey results: Accuracy and Format



End-user satisfaction Survey results: Ease of Use and Timeliness



Appendix F: Summary of Interview Data regarding Ease of Use

Functions that Practice Group finds easy to use

- Billing works well
- Summary page in patient's chart helpful.
- Management of referrals through tasks working well
- Instant messenger
- Prescription module is user-friendly
- Problem list
- SOAP record
- Results management
 - signing transactions
- Time management (time scale for patient waiting)

Functions that Practice Group finds difficult to use

- Immunization module
 - hard to use for patients who are “out of sync” with standard immunization schedule.
- Chronic disease management templates usability
 - Cannot add more than one measurement of previous chronic disease measures from chart.
- Graphing values
 - Does not have normal range to reference.
- Collating lab results or other results into a table to see values at different times.
- Referral letters
 - Letter templates can be cumbersome to create
 - Cannot locate dates to associate with historical patient conditions.
 - Some specialist information is out of date.
- Symbols on scheduling module
 - Difficult to know what they mean as a legend is not readily available.

Appendix G: Combined IS Success and Change Model

