THE FINANCIAL VIABILITY OF ELECTRONIC MEDICAL RECORDS FOR PRIVATE PRACTICE PHYSIOTHERAPY IN BRITISH COLUMBIA

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EXECUTIVE SUMMARY

BACKGROUND

Electronic medical records (EMRs) are fast-becoming a normal part of practice in medical offices throughout British Columbia and Canada. However, private practice physiotherapy clinics (PPPCs) have had little knowledge of this trend or the potential cost / benefit implications EMR adoption might have to their practices. Recent advances in technology and legislative requirements have now begun to drive interest in EMRs from PPC owners and associates. Although the potential benefits for improved quality and efficiency of care are compelling, uncertainty around the financial viability of a transition remains a significant barrier to the adoption of EMRs in this context.

OBJECTIVE

This study sought to determine the financial viability of a PPC EMR conversion for a case study clinic. After a thorough background section placing EMRs in the context of private practice physiotherapy, the research component of this project is divided into three main parts. Firstly, the study used the literature to identify cost and benefit categories PPCs could expect to realize from an EMR adoption and organized these costs and benefits on a theoretical framework. Secondly, the values for these cost and benefit categories were determined for a case clinic over a projected five-year time horizon. Finally, the present values of total costs and total benefits were compared to assess the financial viability of EMR conversion for the case clinic over the five-year period.
RESULTS

This project constructed a framework of costs and benefits using the basic business practices categories of Alter's Work System Method. Under the assumptions and estimations made, the present value of five-year costs was $156,579 while the present value of five-year benefits was $160,850. Overall, a small net benefit of $4,712 was observed. While this value represented a scenario under which EMR adoption was financially viable for the case clinic, the findings were highly sensitive to work practice benefits and whether or the clinic would choose to digitize its historical charts. This finding was consistent with the physician EMR literature.

CONCLUSION

The background review found that healthcare systems both nationally and provincially have made their decision to transition from paper to electronic records and that PPPCs would do themselves and their patients well to participate in this transformation. The findings of the case clinic analysis indicate that while this case showed a net benefit, significant financial uncertainty of an EMR transition still exists for PPPCs. There is potential for failure if PPPCs do not complete a thorough examination of all aspects of the transition and thus PPPCs should proceed with caution and informed planning.

This research serves as a starting point for PPPCs and the physiotherapy associations in British Columbia and Canada to increase their knowledge of the potential of EMRs in their context and to assess their financial ability to make the electronic transition. It is
recommended that physiotherapy associations increase awareness of EMR benefits and
develop resources to help members in the adoption process. Lessons should be learned
from the experience of the recent transformation of physician clinics. Associations
should also consider working towards PPPC EMR transition with local Ministries of
Health as their physician counterparts have done. Future research may help to solidify
this analysis through actual measurements of work practice changes and other values
through a pilot or partial implementation analysis.
INTRODUCTION

The Institute for Healthcare Improvement states that the best healthcare system improvements have accomplished the “triple aim”. That is, they have (1) improved the experience of the patient (including quality and satisfaction), (2) reduced the cost of the system, and (3) improved the health of populations. It is the potential of electronic medical records (EMR) - the digital version of the medical chart capable of so much more that it’s historical paper counterpart - to fulfill this trifecta of purpose that has resulted in their growing adoption in medicine. Subsequently, across the globe, medicine is increasingly putting patient data in electronic format for a myriad of purposes.

Accordingly, Canadian healthcare systems are making gradual and accelerating progress towards the implementation of EMRs in many settings with the ultimate goal of interoperability between healthcare practices and facilities. While large information technology departments have existed for some time in hospitals, community practice facilities such as physicians’ offices are only now seeing more widespread EMR implementation. In British Columbia, the acceleration in physician adoption has been spurred on by the BC Ministry of Health subsidization of their systems through the Physician Information Technology Office (PITO) of the Doctors of BC. Similar programs are in place in other provinces. PITO now reports 93% of British Columbia’s family physicians in group practices of six or more have adopted electronic medical records.
However, little awareness of the general EMR trend exists in the private practice physiotherapy community in British Columbia. Private practice physiotherapy clinics (PPPCs) have had little exposure to the potential benefits of EMR in their context and EMR adoption lags behind the rest of the medical community in this important component of British Columbia’s health system. Physiotherapists are graduate-trained healthcare professionals with great potential to contribute to efficient and equitable healthcare delivery. However, with slow EMR adoption rates, physiotherapists risk becoming increasingly out of touch with the rest of the medical community to the detriment of their quality of patient care and their professional relevancy. Although a few larger rehabilitation organizations foray into the digital world, most confine the computerization of their practices to booking and billing tasks.

In many respects, a PPC is functionally analogous to the community practice physician office, and it is reasonable to assume that many of the quality and efficiency benefits of EMRs should apply to both, albeit in some aspects more than others. However, due to the nature of PPC as private enterprises, any move to EMR will have to be shown to be economically beneficial to the bottom-line of the clinic business in order to incentivize action from owners.
The paper seeks to examine the potential financial viability of EMR in the PPPC context. After a thorough background section placing EMRs in the context of private practice physiotherapy, the research component of this project is divided into three main parts. Firstly, the study uses the literature to identify cost and benefit categories PPPCs could expect to realize from an EMR adoption and organizes these costs and benefits on a theoretical framework. Secondly, the values for these cost and benefit categories for a case clinic are determined and projected over a five-year time horizon. Finally, the present values of total costs and total benefits are compared to assess the financial viability of EMR conversion for the case clinic over the five-year period. Figure 1 shows a graphical overview of this project.

**Figure 1: Graphical Approach to this Study:**

Position PPPC EMR in global, national, and local healthcare system contexts through a thorough background analysis

Organize expected cost and benefit categories identified in the literature on a conceptual framework

Determine the value of identified costs and benefits for case clinic over a five-year time horizon

Compare five-year total cost and benefit present values to determine PPC EMR financial viability

Analyze and discuss results and make recommendations for PPC EMR adoption
BACKGROUND

THE COMPUTER, INTERNET AND MEDICINE

Since the invention of the computer in the 1940’s\textsuperscript{3}, all of civilization in nearly all reaches of the globe have been transformed by its capabilities. The computer’s computational power and ability to access vast amounts of information have resulted in its rapid adoption into all aspects of human life. Industries have been quick to adopt the computer to increase competitive advantage by leveraging its ability to improve efficiency through all aspects of business operations. Public organizations, although often large and difficult to change, increasingly incorporate technology into their functioning. With the invention of the Internet, the computer’s abilities were magnified. Computer systems in distant locations “interoperate”. That is, a computer in one location can work with or use the capabilities and information of another computer in a completely separate location through the Internet.

Medicine is no exception to the technological transformation, and it finds itself in the middle of a remarkable metamorphosis. Historically, the concept of medical practice has been a fairly simple one; the patient goes to see a doctor or other health practitioner who uses their learned knowledge to provide treatment for an ailment. But technology has changed this interaction. Physicians now have access to a quality and quantity of information for decision-making they never had before. Advances in technology improve diagnostic equipment, processes and transfer of information. Investigators can
access a more broad set of data with efficiency unimaginable in times past and the computerized integration of the medical record with research shows great promise. National computerized health surveillance systems vastly improve the world’s ability to monitor disease. Administrative and billing practices are greatly improved through the efficiencies realized by the use of electronic records. The changes are so wide and deep that the study of computers in medicine – or ‘health informatics’ - has become a discipline unto itself³.

**Electronic Medical Records**

**Evolution, Definition and Terminology**

The backbone of health informatics and the focus of this research is electronic medical records. For at least 2,000 years, those who care for the health needs of individuals have kept records about those encounters. History credits Hippocrates (460 -370 BC) with having developed the first medical record, which he noted should have two main goals – it should state a probable cause for a disease and it should accurately reflect the course of the disease⁴. Although various forms of the record have existed throughout the centuries since, pen and paper have been the mode of maintaining the patient chart. However, the technological evolution of medicine finds pen and paper medical records an increasingly inadequate tool. Masses of data from modern medical equipment, bureaucratic administrative requirements, and communication and coordination among multiple providers are just a few of the demands that the paper chart is poorly designed
to handle\textsuperscript{3}. Therefore, medical systems across the globe are converting from paper to electronic medical record keeping for the many benefits it can provide.

While they are many things, EMRs are essentially computerized medical information systems that collect, store, and display health care data about a patient\textsuperscript{5}. They allow health care professionals to record information about their patients in a legible and organized fashion. They also allow health care professionals to access health records quickly and efficiently in order to facilitate treatment. The terms Electronic Medical Records (EMRs) and Electronic Health Records (EHRs) are synonymous in much of the health informatics literature\textsuperscript{5}. However, in Canada they are distinguished from each other. This paper undertakes research in the Canadian context and therefore the terms will be distinguished here. Canada Health Infoway (CHI), the federally funded not-for-profit organization responsible for accelerating the development and adoption of electronic records in Canada, defines an EMR as “the computer-based patient record system used in the ambulatory or community clinic setting\textsuperscript{6} (such as a doctor’s or physiotherapist’s office). The EHR has a broader definition and is the “secure and private lifetime record of each Canadian citizen’s key health history and care within the health system”\textsuperscript{6}. The counterpart of the EMR in larger health organizations such as hospitals is the Clinical Information Systems (CIS). This paper primarily concerns itself with community practice EMR within the context of the national plans for a Canadian EHR.
THE BENEFITS OF EMRS IN COMMUNITY MEDICAL PRACTICE

Benefits

The benefits of EMR in community physician practices have been studied extensively in the literature. Here, the benefits are summarized from three sources. Firstly, in 2010, the Ministry of Health in British Columbia published the Health Sector Information Management / Information Technology (IM/IT) Strategy for the BC eHealth Strategy Council. In this document, the benefits of EMRs for community practice were summarized. Secondly, in 2013, Canada Health Infoway (CHI) conducted a literature review of over 250 research articles, Infoway funded research evaluations, physician surveys and 20 key informants from across Canada in order to quantitatively describe the benefits of EMR to community practice. Finally, the Physician Information Technology Office (PITO) outlines the benefits of EMR on the website maintained for physicians converting to electronic records. The benefits identified in above three sources are summarized below. In keeping with the theme of the ‘triple aim’, these benefits are categorized here under the headings of quality, cost, and population health.

Quality Benefits:

1. Potential for integrated information between care settings

2. Improved physician access to complete and organized clinical information

3. Potential for automated decision support and reminders

4. Reduced duplicate clinical tests and assessments
5. Faster access for care providers to lab results and medications

**Cost / Efficiency Benefits:**

1. Faster prescription writing, referrals, and recalls

2. Less time spent searching for information as a result of simple searches and filters

3. Improved access to the latest reference material, guidelines, templates, and tools to help manage patients and especially those with chronic diseases

4. Reduced paperwork

5. Reduced chart pulling and filing

6. Better inter-office communications

**Population Health Benefits:**

1. Improved national and local surveillance of population health

2. Improved research opportunities with quickly accessible and sortable aggregated data

**Progressive Value**

Equally important to recognizing EMR benefits is the realization EMRs tend to have progressively increasing value through the stages of implementation. PITO presents these stages as a “Clinical Value Model” pyramid\(^\text{10}\). As a healthcare practice climbs higher in this model, more value is achieved for the practice, the patient, and the health
of the population. The final stage of the model is the highest level clinical effectiveness and practice efficiency. This level represents “interoperability”, or the ability to share patient information, testing, and encounters with the medical system across various providers and facilities. Figure 2 depict this process graphically.

![Primary Care Clinical Value Model](image)

**FIGURE 2: CLINICAL VALUE MODEL** (PITO - USED WITH PERMISSION)

Most medical practices, be they physician’s or physiotherapist’s offices, now use at least level one EMR as paper billing and booking is prohibitively cumbersome, and the efficiencies afforded by electronic methods are undisputed. PITO’s principal goal has been to help primary care physicians achieve clinical value level three. PITO describes this as the foundational level use for clinical effectiveness. At level three, physicians’
offices are at “full EMR”, which means they are using electronic records as their principle method of record keeping and are entering fully structured data using generally accepted coding standards. Level three sets the stage for progressions to level four (data driven practice) and level five (interoperability).

Benefit Potential and the Direction of Healthcare Systems

The potential for these quality, cost and population health improvements in a perpetually cash-short health care systems is too much to ignore. It is for this reason that healthcare systems have directed much energy towards conversion from paper to electronic records across the globe. The momentum is now so significant even in laggard nations such as the United States that Blumenthal reports “widespread use of electronic health records in the United States is inevitable” 11. The literature in Canada expresses a similar sentiment. Leitch et al. capture much the tone of much the literature when they state:

“let us be clear at the outset. There is no choice but to move forward to adopt the technologies that power and connect our society with our health system - no matter how challenging this transformational change may be. The factors driving change are undeniable and mounting: cost pressures from changing demographics; shortages in health human resources; growing costs of managing chronic diseases; demand for new medical technologies; and new infectious diseases that spread around the globe in hours. To sustain our health care system
in the face of these challenges, we must embrace the technologies that other sectors of the economy and public service have successfully used to enhance efficiency and improve service.”

EMR TRENDS

EMR Trends - Global
In response to this, most developed nations across the globe have recognized the potential benefits of using electronic records in community practice and are gradually progressing their adoption. Canada and the US have tended to lag behind much of the rest of the globe. A cross-national survey of more than 10,000 primary care doctors in 2009 found that percentage adoptions rates were nearly universal in the Netherlands (99%), New Zealand (97%), the United Kingdom (96%), Australia (95%), and Sweden (94%). Significant adoption was noted in Germany (72%) and France (68%). The United States (48%) and Canada (37%) were the last on the list. The adoption of EMR by physicians is especially important, as this tends to drive adoption by the rest of the medical community.

However, both Canada and the United States are experiencing accelerated adoption in the past several years. With the passing of the Health Information Technology for Economic and Clinical Health (HITECH) Act in 2009 by the US Congress, nearly $30 billion dollars were offered to physicians and hospitals as an incentive to transition to “meaningful use” electronic health record systems. Progress has indeed been made.
The most recent information from the US Centre for Disease Control reports as of February 2014 reports that the percentage of physicians using any EHR system increased from 29.2% in 2006 to 78.4% in 2013. This statistic also represents significant growth since the 48% noted in 2009.  

**EMR Trends - Canada**

In Canada, the move towards electronic records was propelled largely by the Romanow Report of 2002 as part of a multipronged approach to improve Canada’s health care system. The Canada Health Infoway was formed shortly after and a model was created for a pan-Canadian electronic health record in the form of the Electronic Health Record Solution (EHRS) Blueprint. This blueprint laid the foundation for an interoperable electronic health record across Canada and is shown in Figure 3.

![Figure 3: Electronic Health Record Blueprint (Canada Health Infoway. Used with permission)](image-url)
The EHRS model includes point of service inputs for ambulatory and community-based health provider EMRs. Although mention of their involvement in this blueprint seems non-existent in the CHI literature, a complete system would see patient encounters with PPPC at the “physician / provider” point of service. Creating an interoperable health information system is extremely complex and requires that there be subcomponents to interoperate, namely primary care physician offices, hospitals, and other points of service. Overall, progress on the vision of an interoperable framework has been quite sluggish. While most hospitals now use some form of CIS, primary care physicians have been slow to adopt EMRs in their community practices. The reasons for this are multiple, but the literature indicates that it is in large part due to the high implementation costs in their ambulatory offices, the uncertainty surrounding the actual realization of proposed benefits, and the fact that many benefits accrue to the system and not the independent practitioner.\(^\text{12}\)

However, the last several years have seen significant progress in Canada. Canada Health Infoway reports that as of November 2012, 56% of family physicians in Canada are using EMRs, up from 37% in 2009.\(^\text{17}\) In British Columbia, PITO reports that 80% of targeted physicians have adopted EMRs while 93% of physicians in group practices of six or more have done so.\(^\text{2}\) This progress has been made possible through coordinated efforts supported from Doctors of BC and the Ministry of Health in British Columbia. Similar programs are aiding EMR adoption in other parts of the country.
BARRIERS TO ELECTRONIC MEDICAL RECORDS

In many industries, efforts at IT improvements fail. Despite the benefits noted above, this is also true in healthcare. According to AC group, 70% of EHR adoptions in the US fail \(^{18}\). The process is complex and must be managed on a number of different levels - administratively, technologically, culturally, legislatively, logistically and financially \(^5\).

Boonstra’s systematic review in 2011 thoroughly examined the barriers in the literature and identified eight main categories of barriers including 31 subcategories. The eight main categories were: 1) Financial, 2) Technical, 3) Time, 4) Psychological, 5) Social, 6) Legal, 7) Organizational, 8) Change Process. Boonstra also noted the relationship among these barriers is important. Figure 4 presents Boonstra’s barrier relationship diagram.

![Figure 2 Relationship among the barriers.](image)

**Figure 4: Boonstra’s Taxonomy and Interaction of Barriers Diagram\(^5\)**

Here it can be seen that the degree of influence of barriers A through F on the adoption rate of EMR is itself influenced by the organizational factors present and the change process employed. The diagram highlights the theme of the literature that EMR
transition fail without adequate consideration of all potential barriers. Some have attempted to transition to EMR believing the process simply involved buying computers and using keyboard and monitor instead of pen and paper. This type of limited consideration of the impact of EMR on community practice seems likely to result in failure of the implementation. This becomes important as this paper attempts to put financial values to any barrier that would be relevant and should be addressed by a pragmatic PPC owner in an EMR transition process.

PRIVATE PRACTICE PHYSIOTHERAPY AND EMR

The Private Practice Physiotherapy Industry

Having described the definition, benefits, trends and barriers of electronic medical records in the global and local context, attention is now shifted to how private practice physiotherapy clinics in British Columbia can participate in the technological medical records changes at hand.

Physiotherapists are graduate-level trained health care professionals. In Canada, there are two main fields of employment – (i) publically funded positions in facilities such as hospitals and (ii) privately funded positions in private practice clinics. There are approximately 500 PPCs across British Columbia. These clinics are primarily orthopedic in nature, although some clinics employ subspecialties. Clinics see a wide variety of
patients, but typical patients include post-surgical patients (examples include total joint
replacements, tendon repairs, knee reconstruction, lumbar disectomies), patients with
various degrees of strains and sprains, workplace injuries, etc. A PPPC typically consists
of 2 to 20 physiotherapists practicing together. One or more physiotherapists are
entrepreneurs who own and manage the clinic, and the other physiotherapists are
associates or employees of the clinic. The most common business practice is to see 2-4
patients per hour for primarily musculoskeletal injuries in 15 to 30 minutes slots. Visits
to a physiotherapist typically include an assessment followed by appropriate treatment.
Treatments administered include manual therapy, exercise prescription, education, and
various treatment modalities (e.g. ultrasound, laser, electrical current, thermal agents).
Patient treatments are funded through many different sources including private
payment, extended health coverage, Worksafe BC, RCMP, Department of Veteran’s
affairs, and the Medical Services Plan of BC.

Growing Interest in Private Practice Physiotherapy EMR
As health care providers, physiotherapists are required to keep accurate, legible records
by the Health Professions Act of British Columbia\textsuperscript{19,20}. Currently, very few community
practice physiotherapists’ offices in Canada use electronic medical records and most
continue to use paper charts. Although specific numbers are not known, both the
Physiotherapy Association of British Columbia and the Canadian Physiotherapy
Association have reported to this author that the number of PPPCs using EMR in BC and
Canada is very low. To date, the factors that drive PPPCs from paper records have not
been strong. The nature of the industry (disconnected from the rest of the medical
community) has resulted in physiotherapists possessing little knowledge of the medical community’s move towards EMR. However, the recent confluence of multiple factors has resulted in surging interest in physiotherapy EMRs and more PPPC owners are investigating their potential use in their clinics. The factors include:

- Recognition of EMR based referrals and notes from physicians
- Substantial improvements in PPPC EMR software
- An increased focus on recording outcome measures and utilizing such to evaluate treatment effectiveness in the crowded rehabilitation industry
- Increased technical knowledge of new graduates
- The expectation of new graduates to function in technologically up-to-date environments
- Increased reporting requirements by third party payers requiring increased redundant documentation in a paper system
- The expectation that EMR could improve the quality of treatment by providing access to clinical decision support systems specific to physiotherapy

Additionally, the past year has seen changes to the Health Professions Act, which more than double chart retention requirements to 16 years for health care professionals including physiotherapists\textsuperscript{19-21}. For minors, this means their records are kept until the age of 35. Storage of these records provides additional expense to PPPC owners.
This growing interest in EMR has been recognized at the Physiotherapy Association of British Columbia as a number of clinics contact the organization asking about what is required to “go paperless”. This is certainly a simplistic view of the overall potential of EMR, but it provides evidence that the drivers of EMR in physician offices are now being considered in physiotherapy offices.

The Potential Benefits of EMR to Private Practice Physiotherapists

Although there is very little study on EMR in physiotherapy specific contexts, many of the benefits realized by physician offices in their conversion to EMR would be expected to translate to a PPPC. The basic process of a patient visit is largely analogous between the two offices as is the process of using evidence-based medical practice to provide the most appropriate treatment for patients. It seems reasonable to expect the following EMR benefits in private practice physiotherapy:

**Quality Improvements:**

1. Potential for integrated information between clinics with multiple locations

2. Improved legibility of clinical notes

3. Potential for improved communication between care providers and the rest of the medical community
4. Improved physiotherapy access to complete and organized clinical information

5. Potential for automated decision support linked to evidence based medicine

6. Faster access for care providers to imaging (x-ray, MRI, CT, etc.)

Cost Reductions / Efficiencies:

1. Faster report writing, prescription writing, and referrals

2. Less time spent searching for information as a result of simple searches and filters

3. Improved access to the latest reference material, guidelines, templates, and tools to help manage patients and especially those with chronic diseases

4. Web-based EMR can allow physiotherapists to chart from any location

5. Reduced paperwork

6. Reduced chart pulling and filing

7. Better intra-office communications

Population Health Improvements:

1. Improved research opportunities with quickly accessible and sortable aggregated data and outcome measures
BACKGROUND CONCLUSION AND THE PURPOSE OF THIS RESEARCH

Considering the trends in the rest of the medical community and the potential benefits of EMR adoption, the case seems clear that the transition to EMR is inevitable for PPPCs. The sooner this transition is made, the sooner physiotherapists can begin to learn how to function in an EMR world and learn how to interoperate with the rest of the Canadian Electronic Health Care Record as it develops. In addition, they can potentially achieve the “triple aim” in their context – simultaneously increasing quality of care, decreasing costs and improving population health.

However, many of the same barriers that resisted EMR physician conversion now stand in the way of PPPCs. As private healthcare organizations are small businesses unto themselves, any strategic direction for PPPCs must first pass the test of financial viability and potential profitability. Although many clinic owners can see the potential quality improvements from EMR transition, the uncertainty of their return on investment and fear of costly failure must be overcome for the PPC to move to EMR. Having reviewed the background and context for EMR adoption by PPPCs in BC, this paper now turns to examining the financial viability of EMR transition for a case clinic.
METHODOLOGY

The methodology for this research occurs in three parts:

(1) Identification of cost and benefit categories PPPCs could expect to realize from an EMR adoption and organization of these costs and benefits on a theoretical framework.

(2) Determination of the part one cost and benefit dollar values expected over a five-year time period for a case clinic.

(3) Comparison of the present values of total costs and total benefits over the five-year period to assess the financial viability of EMR conversion for the case clinic.

PART ONE: FINANCIAL COST AND BENEFIT IDENTIFICATION

General Approach

Part one of this research focuses on identifying the costs and benefits that could be expected to accrue to PPPCs with EMR conversion. This research focuses on the achievement of level three EMR for private PPPCs where the PPPC would collect all patient clinical data and encounter history in electronic form. Achievement of this level of EMR would set the stage for further optimization and interoperability afforded by level four and five. It would be expected that further benefits would accrue to both the clinic and the patient as clinics climb higher on the Clinical Value Model. Therefore, this research would describe the minimum benefit levels (financial and otherwise) expected with EMR transition and further improvements would be expected with optimization and experience with the system.
I have approached this research from the perspective of a PPPC owner. In planning the study, several considerations were recognized. Firstly, the community of physicians in primary care practice office settings has already accomplished much work in this field. Considering their smaller size and limited resources, the physiotherapist community is unlikely to be able to perform this research in their own context. Nor does it seem necessary. The physiotherapist office is in large part functionally analogous to a family physician office. The level of detail of patient care is indeed simpler, but the broad categories of implication to costs and benefits are likely to be comparable. Therefore, the information relating to EMR conversion from physicians was leaned on heavily but considered in light of the PPPC context.

Secondly, it was recognized that the financial implications of EMR conversion are not only found under the categories of “cost” and “savings” and that EMR conversion will affect all many aspects of clinic operations. It was felt that financial values should be assigned, where possible, to all potential barriers and benefits (i.e. the “culture change” barrier will likely involve some investment in a project leader or consultant to facilitate this change). Therefore, literature examination used the broader terms of “barrier” and “benefit” to identify potential financial implications of conversion.

Thirdly, it was recognized that it is impossible to account for every financial implication of EMR conversion to a practice and that delving into the minutia may be detrimental to
the research objectives. Even if this was achievable for a case clinic, there is a good likelihood that very specific costs may not be generalizable to other practices. Therefore, this study sought to avoid spurious accuracy by focusing on financial costs and benefits that were likely to be substantial to the EMR conversion decision in PPPCs.

As a result of these considerations, financial costs and benefits were included if they met following criteria:

- The cost / benefit was prevalent in the literature, advised to be included by an external source, or is justified by conceptualization through the Work System framework (see below)
- The cost / benefit was likely to translate to physiotherapy practice
- The cost / benefit was likely to be substantial to the EMR decision
- The cost / benefit was concrete enough to be calculated and applied to a summary budget for a financial viability decision

**Literature Sources Used for Cost and Benefit Identification**

Potential financial barriers to EMR conversion were identified through the use of multiple sources. It was felt that the best answer to the research question would be provided if mixed sources were used in order to ensure the benefit and barriers established were relevant, timely, academically supported, local, and as much as possible translatable to the PPPC context.
Search Strategy

In order to identify cost considerations from the academic literature, systematic reviews of barriers and benefits of EMR were sought. A search of UBC Library Summons and the “Cochrane Library of Systematic Reviews” was performed using the terms “electronic medical record”, “electronic health record”, and “systematic review”. Due to the rapid change of technology, this search was constrained to the last five years (2009 to 2014).

On UBC Summons, the following strategies were used:

**Search Strategy 1:** Keywords (in the field of “Title”, constrained to 2009 to 2014):
“electronic medical record*” + “systematic review”.

**Search Strategy 2:** Keywords (in the field of “Title”, constrained to 2009 to 2014):
“electronic health record*” + “systematic review”

On the “Cochrane Library”, the following strategies were used:

**Search Strategy 3:** Keywords (in the field of “Title, Abstract, and Keywords”, constrained to 2009 to 2014): “electronic medical record*” + “systematic review”.

**Search Strategy 4:** Keywords (in the field of “Title, Abstract, and Keywords”, constrained to 2009 to 2014): “electronic health record*” + “systematic review”.

Five systematic reviews that were relevant to community practice and the research topic of this study were found (from the years 2010, 2011, and 2012). The systematic reviews are leaned on heavily in the “Identification of Financial Costs and Benefits”
section of this report. To supplement these systematic reviews with peer-reviewed journal articles in the time since their publication, further searches of Medline, CINAHL, and the Canadian Physiotherapy Association’s Research Reference Centre were searched.

On the database EBSCO Medline and CINAHL, the search was carried out according to the following strategies:

*Search strategy one: Key words (in the field of “T1 Title”, constrained to 2009 to 2014): electronic medical record* + barrier*

*Search strategy two: Key words (in the field of “T1 Title”, constrained to 2009 to 2014): electronic health record* + barrier*

The journal information was then reviewed alongside non-journal sources that had academic foundations to provide information relevant to the Canadian context. The Canadian Health Infoway site was searched for reference to current and nationally relevant barriers and costs. To provide information relevant to the provincial context, the Physician Information Technology Office (PITO) of British Columbia website was reviewed for similar information. Finally, to examine how the barriers might translate to physiotherapy practice, the Canadian Physiotherapy Rehabilitation Reference Centre was searched separately as this resource is not available through UBC. The following strategies were used for the RRC:
Search strategy one: Key words (in the field of “T1 Title”, constrained to 2009 to 2014): electronic medical record* + barrier*

Search strategy two: Key words (in the field of “T1 Title”, constrained to 2009 to 2014): electronic health record* + barrier*

Applying Costs and Benefits Categories to a Conceptual Model:
The Work System Method (Alter)

The literature makes it clear that EMR conversion needs to be conceptualized as a holistic organizational change rather than simply purchasing new computers and software. McCarthy and Eastman state it well: “it is important to stress that focusing on just one factor of implementation readiness in not sufficient . . . all factors work in concert to influence desired change associated with an EMR implementation”

Recognizing this fact, a framework was sought to conceptualize the financial implications of EMR throughout the organization. While some studies do use a Clinical Adoption (CA) Framework by CHI this was felt to be somewhat complex for the purposes of this project. A simpler framework, Alter’s “The Work System Method” was instead chosen. Recognizing the frequent failure of information technology transformation efforts in business, Alter created the Work System Method in an attempt to improve the success of IT adoption efforts. Alter suggests that projects are more likely to be successful if they ensure all aspects of the effort are aligned within the business system no matter in what industry they exist. This theme is also prevalent in the EMR literature. The framework helps the medical practice to recognize that EMR
conversion is not just exchanging paper and pen for keyboard and computer, but that the effect of conversion on all elements of the work system must be considered. The Work System Model is presented in figure 3.

![Work System Model](image)

**Figure 3: The Work System Method (Alter)**

Alter states his method can be used at various levels of depth in order to plan IT projects. In this research, Alter’s work system method was used fairly simplistically to categorize the costs that the literature suggests can be expected in an EMR transition. In addition, the framework was used to guide the conceptualization of additional costs that might be associated within the specific instance of physiotherapy and the Clinic in particular. For the purposes of this research, any part of the system in which EMR conversion is expected to produce financial cost of benefit is recognized in order to give
a complete view of the potential costs of conversion. The tangible and measurable costs and savings can be attributed to the bottom half of the Work System triangle (Technology, Information, Participants, and Work Practices). Alter describes these as the “basic components” that actually perform the work. As PPC business owners are practical in their focus (and mostly without formal business training), these “concrete” areas are likely to be the most relevant to them.

**PART TWO: APPLICATION OF COSTS AND BENEFITS TO THE CASE CLINIC**

**General Approach**

The categorized costs and benefits established in part one were applied to a case study clinic to determine the financial viability of EMR conversion. The case study clinic is described and the external resources used to identify the expected financial value of costs and benefits for the clinic are described below.

**The Case Study Clinic**

The case study clinic (hereafter called “the Clinic”) began its operations in 1994 in British Columbia. It is owned by two physiotherapists. As of 2014, the clinic employs the services of 16 physiotherapists, six massage therapists, six kinesiologists, one occupational therapist, one clinical counselor, one consulting orthopedic surgeon, one office manager, one financial controller, and seven secretarial staff. The business has two clinic locations, one each in the southern and northern parts of the city it is in (about 10 kilometers apart). The Clinic’s primary revenue streams are private practice
physiotherapy services, insurer sponsored rehabilitation programs, and massage therapy services. To a lesser degree, the Clinic generates revenue from orthotics and bracing services, chiropractic visits, functional capacity evaluations, worksite consulting visits, private kinesiologist sessions, and nutritional consulting. The Clinic owners have noted interest in EMR over the past two years and have agreed to work cooperatively with this author in this research.

External Resources
Multiple external agencies were used to inform this research and determine costs and savings likely to occur in the EMR transition at hand. These resources are referenced where the information gleaned was substantial to the purposes of the project. These external resources included:

*AddaTech Systems (Clinicmaster Software)*
This is the clinic’s practice management software provider. AddaTech was consulted on multiple occasions on subjects including hardware requirements, EMR module capabilities, training costs, etc. Contact points with AddaTech are noted in the results sections.

*Kensington Medical Clinic*
A relationship was established with the office manager at Kensington Medical Clinic in Burnaby British Columbia. This is a clinic of 30 physicians that has completed an EMR transition within the past year. The manager was consulted on various occasions in regard to their experience and recommendations for EMR transition.
The Physician Information Technology Office (PITO) of BC

PITO is a collaborative effort of the British Columbia provincial government and the BC Medical Association (now ‘Doctors of BC’) to support BC physicians and clinic staff in preparing for, adopting, and optimizing EMRs. PITO provides many useful EMR resources on its website, and these were consulted and used within this project as needed. Permission was sought and granted to use PITO’s tools in the project cost-benefit analysis.

Myriad Group of Companies

Myriad is the Clinic’s IT installation and maintenance provider. Consultations with Myriad in regards to the cost implications of EMR were performed as needed.

PART THREE: FIVE-YEAR COST AND BENEFIT COMPARISON

General Approach

Financial costs and benefits identified in part two were compared to determine the whether EMR conversion resulted in a net benefit or net cost over a five-year period. A net benefit was over five-years was assumed to be a financially viable result. Initial and ongoing costs were discounted (at 4%) in order to provide a single number comparison between a five-year EMR implementation and the status quo.
RESULTS

PART ONE: WORK SYSTEM METHOD ORGANIZATION OF FINANCIAL COST AND BENEFITS

A review of the literature identified the following relevant financial costs and benefits. Each category is described and supporting literature for justification of inclusion of the cost or benefit is provided as necessary. The costs and benefit categories are then summarized in Table 1 according to the categories of the basic business practices portion of the Work System Method Framework.

Financial Costs

Costs: Technological

Computer Hardware

New computer hardware is the most self-evident of the financial costs of EMR conversion. Boonstra and Broekhuis report that 12 of the 22 studies they reviewed emphasized the high startup costs that hardware and its installation entail is a primary and major barrier to EMR adoption. Most clinics do have some of the needed computer hardware in place for computerized office management (billing and booking) but significant additional investments are required in order to chart electronically. Typical costs include desktops or laptop computers, power supplies, servers, and accessories.
Scanning Hardware
Skolnick states that it is impossible to truly go paperless. Patients will still bring in paper referrals, faxes will still be received from third parties, and imaging diagnostics will be obtained. Much of this will need to be scanned into the patient record. High-quality scanning and their accessories devices will be needed for an EMR conversion.

Network Hardware
Network systems may exist in most clinics that have multiple machines even without EMR, but further investments will need to be made to connect the new computer and scanning hardware. Increasingly, clinicians are moving towards mobile device use, and secure, fast wireless networking devices are likely be needed in many clinics.

EMR Software
In the literature, vendor software is reported as a significant cost to clinics converting to electronic medical records with costs up to $10,000 per physician. However, physiotherapy EMR software is considerably less expensive and often packaged along with billing and scheduling software. For the Case clinic software, EMR modules are opened at no additional cost to the clinic. Nonetheless, any costs involved in opening modules or additional usage costs must be accounted for in cost identification.

Additional Software
EMR installations will often require additional software components to be installed in order to provide optimization of the system, security, and scanning. PITO recommends including these costs in budgeting for EMR transition.
The Financial Viability of Electronic Medical Records for Private Practice Physiotherapy Clinics in British Columbia

**Initial Installation**
The level of IT expertise involved to properly install, connect, and secure the new technology investments will beyond the capacity of most clinicians. There will be cost implications of having to employ a clinic’s IT support company to do this job.\(^5\)

**Ongoing Maintenance and Support**
High ongoing maintenance and support is detailed as a major barrier to EMR adoptions in the literature.\(^5, 30\) While most clinics will have some degree of IT maintenance and support, additional expenditures can be expected with the additional hardware and complexity of setup.

**Renovations of Office Space**
Several resources do point to the need for potential renovations of office space. With the increased use of laptops, tablets, laptop/tablet hybrids in clinical charting and cloud software systems, the need for potential renovations lessens. Existing office space can be used with these smaller devices or clinicians can log in from home and use their own workspace for reporting, reducing costs to the clinic. However, PITO recommends these costs at least be considered in budgeting for an EMR conversion.\(^24\)

**Costs: Information**

**Paper Chart Conversion**
Several resources recommend against converting paper charts and suggest EMR should be begun on a “going forward” basis as the cost of conversion is prohibitively expensive.\(^5, 18\). However, this information is from physician sources where the complexity of information can be much greater than PPPCs. AddaTech indicates that approximately
50% of minimal PPCs who have migrated to Clinicmaster EMR are converting old files. Costs associated with this process are therefore calculated in this report.

**Privacy and Security Protocols**
Privacy and security concerns are a clear concern with any digital venture, especially as it concerns personal health information. Concerns over EMR privacy and security are a theme in the literature and a budget should be devoted to ensuring clinic processes are adequate in an EMR transition plan.

**Costs: Participants**

**Clinician training**
The literature indicates initial and ongoing training is critical to EMR implementation success. User’s report a lack of knowledge and training about their EMR systems as a barrier to successful use. Training costs should be included in the costs expected with transition.

**Secretarial training**
Administrative staff are already familiar with the booking and billing aspects of vendor software. However, opening EMR modules can be expected to require at least some degree of knowledge on their behalf, and a training budget should be included for them outlining the general workings of the system.

**Change Management**
Multiple authors indicate that the difficulty in EMR transition lies more in the change required of the organization’s culture and work practices than the change required of the organization’s technology. In fact, the lack of a structured approach is
implicated as the most likely reason for failure of IT investments in any industry\textsuperscript{34}. PPPCs work on a limited budget and often do not devote resources to anything but the immediate practical needs that are readily observable. However, the volume of references to the importance of change management in the EMR literature would suggest that the costs of not using effective change management strategies are likely to be greater than the costs of doing so. Change management will include meetings and activities to create shared vision amongst the clinician team. Investing in a change management leader (typically a ‘champion’ clinician) is recommended. As such, a budget for change management costs will be included in the case analysis.

\textit{Costs: Work Practices}

\textbf{Lost Productivity during implementation}

Whether lost productivity will temporarily occur as a result of EMR conversion is not clear from the literature and seems to depend on the time frame considered. Skolnik reports that it is almost impossible to have an implementation without a slow down in schedule and suggests physicians plan on a six-week return to normal levels\textsuperscript{18}. However, CHI states that Jaakimainen et al. report that from the date of implementation over the 18 month follow-up period, physician billings remain stable with no net loss of productivity\textsuperscript{8}. Whether lost productivity occurs in EMR transitions seems to depend on the ease of use of the system\textsuperscript{30}. It should be recognized that physicians EMR systems are considerably more complicated than a PPPC chart with requirements for pharmaceuticals, referral to specialists, chronic disease management, etc. A level 3 PPPC EMR will typically only involve SOAP note charting and limited functionality. As such,
costs due to lost productivity are likely to be far less than physician practices and primarily dependent on the user computer skills and typing ability. It seems reasonable, however, to build in a buffer for the potential loss of productivity as the logistics of applying EMR to the setting is relatively unstudied. As such, the cost for lost productivity will be estimated.

Pre-Implementation Workflow Analysis
Appropriate workflow analysis and re-engineering of work practices is a persistent theme in the EMR literature. In describing IT transformations in general, Alter states “too often, the recommendation focuses on the software that will be built or acquired, but not on how the work system will operate after the software is available”\(^{23}\). Skolnick states that “there is very little intrinsic to an EMR that improves your efficiencies and outcomes” and “most gains in efficiency have nothing to do with the EMR but with the process of re-engineering”\(^{18}\). In their systematic review of the impact of electronic medical records on physician office practices, Lau et al. recommend “redesigning EMR supported work practices for optimal fit” as one of their four main conclusions from the literature\(^{35}\). To be sure, physiotherapy clinics that have converted to EMR have done this re-design as matter of necessity and likely ‘on the fly’. However, the experience of physicians with failed EMR systems as noted above should suggest caution with such an approach and a budget designed to re-engineer workflow practices in the pre-implementation stage would be prudent. As such, this cost will be included in the case study under a consulting category.

Financial Benefits
Financial Benefits: Technological

Reduced Material Costs
The change from old to new technology would result in a reduction in the use of paper and other materials. This is not frequently cited in the literature, perhaps due to the larger budget considerations of physician offices. In fact, clinics are often cautioned that going completely “paperless” is impossible, at least immediately. However, smaller budget PPPCs compared to physician clinics may find the reduction in costs for purchasing materials significant. As such, the benefit is included in case analysis.

Financial Benefits: Information

Reduced Need for Paper Chart Storage
Reduced paper chart storage is a self-evident benefit of electronic files. PPPCs store paper charts around their offices (frequently taking up space that could be used for other purposes) and/or rent separate storage facilities. Moreover, recent changes to the Health Professions Act in BC will increase paper chart storage costs to providers as retention requirements have more than doubled from seven to sixteen years. Storage costs of these additional charts can therefore be expected to increase stepwise over the next nine years, as previous charts that would have been destroyed are not purged from the system. At the very least PPPCs can expect to realize the cost savings of charts not created even if they only convert on a going forward basis. There is also the possibility that further savings may be created by converting historical charts (see costs: paper chart conversion section). This reduced cost for paper chart storage will be included in the case analysis. Additionally, office space used for chart storage is being paid for and...
has a value. Square footage can be reclaimed for new treatment rooms or other purposes.

**Financial Benefits: Participants**

The literature identified several potential benefits that could be classified under the Participants section of the framework. For example, a significant financial benefit would be realized in the likely event that a new physiotherapist was attracted to a clinic as a result of its modern technological strategies. However, these participant benefits are difficult to predict and thus difficult to calculate and are therefore left out of this analysis.

**Financial Benefits: Work Practices**

**Reduced Chart Handling by Support Staff**

Reduced chart pulls can be expected to result in significant potential financial benefits. CHI estimates the financial benefit of reduced chart pulls and efficiencies in laboratory and diagnostic test management for community practice physicians at $84 million for 2012\(^8\). PPPCs also require the pulling and filing of the charts for patients each day and savings can be expected to accrue as a result of this activity being eliminated or at least greatly reduced. This benefit is included in the case analysis. Significant time is spent by support staff pulling and filing hundreds of daily charts, searching for charts that have been misplaced, and driving to storage facilities to retrieve charts of patients returning who have not attended the clinic for three years.
### TABLE 1: WORK SYSTEM METHOD SUMMARY OF IDENTIFIED FINANCIAL COSTS AND BENEFITS

<table>
<thead>
<tr>
<th>Work Practices</th>
<th>Financial Costs</th>
<th>Financial Benefits</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>• Increased Scanning by secretarial staff</td>
<td>• Reduced Chart Pulls and Filing</td>
</tr>
<tr>
<td></td>
<td>• Lost Productivity at Implementation</td>
<td>• Reduced Chart Search</td>
</tr>
<tr>
<td></td>
<td>• Pre-Implementation Workflow Analysis</td>
<td>• Reduced Retrieval of Charts from Storage facility</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Participants</th>
<th>Financial Costs</th>
<th>Information</th>
<th>Financial Costs</th>
<th>Technology</th>
<th>Financial Costs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Financial Costs</td>
<td>• Clinician Training</td>
<td>Financial Costs</td>
<td>• Paper Chart Conversion</td>
<td>Financial Costs</td>
<td>• Computer Hardware</td>
</tr>
<tr>
<td></td>
<td>• Secretarial Training</td>
<td>• Privacy and Security</td>
<td>• Scanning Hardware</td>
<td>• Networking Hardware</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Change Management Costs</td>
<td>Policy Updates</td>
<td>• Additional Software</td>
<td>• Initial Installation</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• Initial Installation</td>
<td>• Ongoing Maintenance</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• Ongoing Maintenance</td>
<td>• Renovations</td>
<td></td>
</tr>
<tr>
<td>Financial Benefits</td>
<td>• Reduced need for paper chart storage</td>
<td>Financial Benefits</td>
<td>• Reduced Material Usage</td>
<td>Financial Benefits</td>
<td>• Reduced Material Usage</td>
</tr>
</tbody>
</table>

The Financial Viability of Electronic Medical Records for Private Practice Physiotherapy Clinics in British Columbia
PART TWO: APPLICATION OF FINANCIAL COSTS AND BENEFITS TO THE CASE CLINIC OVER A FIVE-YEAR PERIOD

The financial costs and benefits identified in part one are applied to the case clinic in part two. Various sources were used to determine how these identified categories might manifest themselves practically in a clinic situation. The details of how costs were obtained and calculated for each of the categories identified from the literature in Part 1 can be found in Appendices 1 and 2. The summaries of costs projected are displayed in Tables 2 to 5. The summaries of financial benefits are displayed in Table 6 to 9.

EMR Adoption Costs for the Case Clinic

The costs of EMR adoption for the case PPC are summarized below. The costs are categorized according to the Work System Method framework. Costs were inflated by 2% per year where appropriate. The totals shown are non-discounted dollar costs. Discounted values are shown in the five-year comparison section. Total Technology costs were found to be $55,135, total Information costs $68,400, total Participant costs $7,957, and total Work Practices costs $31,230. The total non-discounted dollar costs for EMR transition over a five-year period for the case clinic was $162,722.
## Technology costs

**Table 1: Technology Costs**

<table>
<thead>
<tr>
<th>TECHNOLOGY COSTS</th>
<th>Qty</th>
<th>Unit Cost</th>
<th>Initial Cost</th>
<th>Year 1</th>
<th>Year 2</th>
<th>Year 3</th>
<th>Year 4</th>
<th>Year 5</th>
<th>5-Yr Total</th>
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</thead>
<tbody>
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<td><strong>Computer Hardware</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
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<td>Tablet</td>
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<td>$800</td>
<td>$6,400</td>
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<td>$0</td>
<td>$0</td>
<td>$6,400</td>
<td>$0</td>
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<td>Keyboard Accessory</td>
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<td>$0</td>
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<td>$1,082</td>
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<td>$5,308</td>
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<td></td>
<td></td>
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<td>$1,040</td>
<td>$1,061</td>
<td>$12,162</td>
<td>$1,104</td>
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<td></td>
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<td>$0</td>
<td>$0</td>
<td>$3,000</td>
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<td>$0</td>
<td>$0</td>
<td>$1,000</td>
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<td><strong>Total Scanning Hardware</strong></td>
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<td></td>
<td></td>
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<tr>
<td>Router/Accessories</td>
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<td>$1,020</td>
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<td>EMR Software</td>
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<td>$1,863</td>
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</tr>
<tr>
<td><strong>Total Technology Costs</strong></td>
<td></td>
<td></td>
<td></td>
<td>$21,632</td>
<td>$2,883</td>
<td>$2,999</td>
<td>$21,559</td>
<td>$3,121</td>
<td>$55,135</td>
</tr>
</tbody>
</table>
The Financial Viability of Electronic Medical Records for Private Practice Physiotherapy Clinics in British Columbia

**Information Costs**

Table 2: Information Costs

<table>
<thead>
<tr>
<th>INFORMATION COSTS</th>
<th>Qty</th>
<th>Unit Cost</th>
<th>Initial Cost</th>
<th>Year 1</th>
<th>Year 2</th>
<th>Year 3</th>
<th>Year 4</th>
<th>Year 5</th>
<th>5-yr Total</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Paper Record Conversion</strong></td>
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<td>Iron Mountain Fee</td>
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<tr>
<td><strong>Total Record Conversion</strong></td>
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<td></td>
<td></td>
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<td></td>
<td></td>
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<td></td>
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<tr>
<td>Project Lead - Consult Fee</td>
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<td>$60</td>
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<td>$0</td>
<td>$0</td>
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<td>$0</td>
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<tr>
<td><strong>Total Privacy and Security</strong></td>
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<td>$2,400</td>
<td>$0</td>
<td>$0</td>
<td>$0</td>
<td>$0</td>
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<td><strong>Total Information Costs</strong></td>
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<td>$0</td>
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</table>

**Participant Costs**

Table 3: Participant Costs

<table>
<thead>
<tr>
<th>Staff Training Costs</th>
<th>Initial Cost</th>
<th>Year 1</th>
<th>Year 2</th>
<th>Year 3</th>
<th>Year 4</th>
<th>Year 5</th>
<th>5-yr Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physiotherapist Training</td>
<td>$100</td>
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<td>$0</td>
<td>$0</td>
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<td>Secretarial Training</td>
<td>$17</td>
<td>$117</td>
<td>$0</td>
<td>$0</td>
<td>$0</td>
<td>$0</td>
<td>$117</td>
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<tr>
<td>Employee Training Time</td>
<td>$40</td>
<td>$640</td>
<td>$0</td>
<td>$0</td>
<td>$0</td>
<td>$0</td>
<td>$640</td>
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<td><strong>Total Staff Training</strong></td>
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<td>$0</td>
<td>$0</td>
<td>$0</td>
<td>$0</td>
<td>$2,357</td>
</tr>
<tr>
<td><strong>Project Team / Consulting Compensation</strong></td>
<td>Initial Cost</td>
<td>Year 1</td>
<td>Year 2</td>
<td>Year 3</td>
<td>Year 4</td>
<td>Year 5</td>
<td>5-yr Total</td>
</tr>
<tr>
<td>Consulting Costs</td>
<td>$400</td>
<td>$5,600</td>
<td>$0</td>
<td>$0</td>
<td>$0</td>
<td>$0</td>
<td>$5,600</td>
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<tr>
<td><strong>Total Project Team Compensation</strong></td>
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<td>$0</td>
<td>$5,600</td>
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<tr>
<td><strong>Total Participant Costs</strong></td>
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<td>$0</td>
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<td>$0</td>
<td>$7,957</td>
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</table>
Work Practices Costs

Table 4: Work Practices Costs

<table>
<thead>
<tr>
<th>Lost Revenue</th>
<th>Qty</th>
<th>Unit Cost</th>
<th>Initial Cost</th>
<th>Year 1</th>
<th>Year 2</th>
<th>Year 3</th>
<th>Year 4</th>
<th>Year 5</th>
<th>5-yr Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>$6,000</td>
<td>2</td>
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<td>$0</td>
<td>$0</td>
<td>$12,000</td>
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<tr>
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<td>$3,094</td>
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<td>$0</td>
<td>$0</td>
<td>$0</td>
<td>$0</td>
<td>$3,094</td>
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<table>
<thead>
<tr>
<th>Total Lost Productivity</th>
<th>Qty</th>
<th>Unit Cost</th>
<th>Initial Cost</th>
<th>Year 1</th>
<th>Year 2</th>
<th>Year 3</th>
<th>Year 4</th>
<th>Year 5</th>
<th>5-yr Total</th>
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<tr>
<td>$15,094</td>
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<td>$0</td>
<td>$0</td>
<td>$0</td>
<td>$0</td>
<td>$15,094</td>
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</tbody>
</table>

Secretarial Scanning Time

<table>
<thead>
<tr>
<th>Daily Scanning</th>
<th>Qty</th>
<th>Unit Cost</th>
<th>Initial Cost</th>
<th>Year 1</th>
<th>Year 2</th>
<th>Year 3</th>
<th>Year 4</th>
<th>Year 5</th>
<th>5-yr Total</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Total Scanning Costs</th>
<th>Initial Cost</th>
<th>Year 1</th>
<th>Year 2</th>
<th>Year 3</th>
<th>Year 4</th>
<th>Year 5</th>
<th>5-yr Total</th>
</tr>
</thead>
</table>

Total Work Practices Costs


Total Costs

Table 5: Total EMR Costs

<table>
<thead>
<tr>
<th>Initial Cost</th>
<th>Year 1</th>
<th>Year 2</th>
<th>Year 3</th>
<th>Year 4</th>
<th>Year 5</th>
<th>5-yr Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>TOTAL EMR COSTS</td>
<td>$113,083</td>
<td>$5,984</td>
<td>$6,103</td>
<td>$6,225</td>
<td>$24,850</td>
<td>$6,477</td>
</tr>
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</table>
EMR Adoption Financial Benefits

The financial benefits of EMR adoption for the case PPPC are summarized below. The benefits are categorized according to the Work System Method framework. Benefits were inflated by 2% per year where appropriate. The totals shown are non-discounted dollar benefits. Discounted values are shown in the five-year comparison section. Total technology financial benefits were found to be $14,545, information benefits $38,535, and work practices benefits $128,248. No applicable participant benefits were identified in the literature. Total five-year non-discounted benefits were found to be $181,328.

Technology Financial Benefits

Table 6: Technology Financial Benefits

<table>
<thead>
<tr>
<th>Reduced Material Costs</th>
<th>Qty</th>
<th>Unit Cost</th>
<th>Year 1</th>
<th>Year 2</th>
<th>Year 3</th>
<th>Year 4</th>
<th>Year 5</th>
<th>5-yr Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Paper and Other Materials</td>
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<td>$2,795</td>
<td>$2,851</td>
<td>$2,908</td>
<td>$2,966</td>
<td>$3,025</td>
<td>$14,545</td>
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<tr>
<td>Total Reduces Materials Benefit</td>
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<td></td>
<td>$2,795</td>
<td>$2,851</td>
<td>$2,908</td>
<td>$2,966</td>
<td>$3,025</td>
<td>$14,545</td>
</tr>
<tr>
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<td></td>
<td>$2,795</td>
<td>$2,851</td>
<td>$2,908</td>
<td>$2,966</td>
<td>$3,025</td>
<td>$14,545</td>
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</table>

Information Financial Benefits

Table 7: Information Financial Benefits

<table>
<thead>
<tr>
<th>Reduced Chart Storage Costs</th>
<th>Qty</th>
<th>Unit Cost</th>
<th>Year 1</th>
<th>Year 2</th>
<th>Year 3</th>
<th>Year 4</th>
<th>Year 5</th>
<th>5-yr Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reclaimed Clinic Space</td>
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<td>$925</td>
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<td>$982</td>
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<td>Annual Current Chart Storage Savings</td>
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<td>$4,627</td>
<td>$4,719</td>
<td>$4,814</td>
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<td>$3,426</td>
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<tr>
<td>Total Value of Reduced Chart Storage</td>
<td></td>
<td></td>
<td>$6,109</td>
<td>$6,892</td>
<td>$7,691</td>
<td>$8,506</td>
<td>$9,337</td>
<td>$38,535</td>
</tr>
<tr>
<td>Total Information Benefits</td>
<td></td>
<td></td>
<td>$6,109</td>
<td>$6,892</td>
<td>$7,691</td>
<td>$8,506</td>
<td>$9,337</td>
<td>$38,535</td>
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</table>
Work Practices Financial Benefits

<table>
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<tr>
<th>Reduced Chart Handling Times</th>
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<th>Unit Cost</th>
<th>Year 1</th>
<th>Year 2</th>
<th>Year 3</th>
<th>Year 4</th>
<th>Year 5</th>
<th>5-yr Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chart Pulls / File</td>
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<td>$23,717</td>
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<tr>
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<td>$17</td>
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<td>$1,768</td>
<td>$1,804</td>
<td>$1,840</td>
<td>$1,877</td>
<td>$9,022</td>
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<tr>
<td>Retrieve Charts from Storage</td>
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<td>$17</td>
<td>$1,734</td>
<td>$1,768</td>
<td>$1,804</td>
<td>$1,840</td>
<td>$1,877</td>
<td>$9,022</td>
</tr>
<tr>
<td>Total Work Practices Benefit</td>
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<td></td>
<td>$24,138</td>
<td>$24,621</td>
<td>$25,535</td>
<td>$26,484</td>
<td>$27,470</td>
<td>$128,248</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Total Work Practices Benefits</th>
<th>Year 1</th>
<th>Year 2</th>
<th>Year 3</th>
<th>Year 4</th>
<th>Year 5</th>
<th>5-yr Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$24,138</td>
<td>$24,621</td>
<td>$25,535</td>
<td>$26,484</td>
<td>$27,470</td>
<td>$128,248</td>
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</tbody>
</table>

Total Benefits

<table>
<thead>
<tr>
<th>TOTAL ANNUAL FINANCIAL BENEFITS</th>
<th>Year 1</th>
<th>Year 2</th>
<th>Year 3</th>
<th>Year 4</th>
<th>Year 5</th>
<th>5-yr Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$33,042</td>
<td>$34,364</td>
<td>$36,134</td>
<td>$37,956</td>
<td>$39,832</td>
<td>$181,328</td>
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</table>
PART THREE: CALCULATION OF NET BENEFIT / COST OVER A FIVE-YEAR PERIOD.

The financial costs and benefits identified and applied to the clinic were extrapolated over a five-year period. Present values were calculated for the financial costs of the EMR system and compared to the financial benefits for the categories identified. A summary of the comparison is presented in Table 10.

<table>
<thead>
<tr>
<th>Costs</th>
<th>Initial Cost</th>
<th>Year 1</th>
<th>Year 2</th>
<th>Year 3</th>
<th>Year 4</th>
<th>Year 5</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Technology</td>
<td>$21,632</td>
<td>$2,883</td>
<td>$2,941</td>
<td>$2,999</td>
<td>$21,559</td>
<td>$3,121</td>
<td>$55,135</td>
</tr>
<tr>
<td>Information</td>
<td>$68,400</td>
<td>$0</td>
<td>$0</td>
<td>$0</td>
<td>$0</td>
<td>$0</td>
<td>$68,400</td>
</tr>
<tr>
<td>Participants</td>
<td>$7,957</td>
<td>$0</td>
<td>$0</td>
<td>$0</td>
<td>$0</td>
<td>$0</td>
<td>$7,957</td>
</tr>
<tr>
<td>Total Costs</td>
<td>$113,083</td>
<td>$5,984</td>
<td>$6,103</td>
<td>$6,225</td>
<td>$24,850</td>
<td>$6,477</td>
<td>$162,722</td>
</tr>
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<td>Present Value of Costs</td>
<td>$113,083</td>
<td>$5,753</td>
<td>$5,643</td>
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<table>
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<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Technology</td>
<td>$0</td>
<td>$2,795</td>
<td>$2,851</td>
<td>$2,908</td>
<td>$2,966</td>
<td>$3,025</td>
<td>$14,545</td>
</tr>
<tr>
<td>Information</td>
<td>$0</td>
<td>$6,109</td>
<td>$6,892</td>
<td>$7,691</td>
<td>$8,506</td>
<td>$9,337</td>
<td>$38,535</td>
</tr>
<tr>
<td>Participants</td>
<td>$0</td>
<td>$0</td>
<td>$0</td>
<td>$0</td>
<td>$0</td>
<td>$0</td>
<td>$0</td>
</tr>
<tr>
<td>Work Practices</td>
<td>$0</td>
<td>$24,138</td>
<td>$24,621</td>
<td>$25,535</td>
<td>$26,484</td>
<td>$27,470</td>
<td>$128,248</td>
</tr>
<tr>
<td>Total Benefits</td>
<td>$0</td>
<td>$33,042</td>
<td>$34,364</td>
<td>$36,134</td>
<td>$37,956</td>
<td>$39,832</td>
<td>$181,328</td>
</tr>
<tr>
<td>Present Value of Benefits</td>
<td>$0</td>
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<td>$31,771</td>
<td>$32,123</td>
<td>$32,445</td>
<td>$32,739</td>
<td>$160,850</td>
</tr>
</tbody>
</table>

Net Benefit (Cost)  
- $113,083  
- $86,024  
- $57,763  
- $27,855  
- $14,749  
$18,607  
$18,607

Present Value of Net Benefits (Cost)  
- $113,083  
- $82,716  
- $55,542  
- $26,784  
- $14,181  
$17,891  
$4,271

*Assumes a discount rate of 4% per annum
Over the five-year cost / benefit analysis period, the present value of annual costs was $156,579 while the present value of benefits was found to be $160,850. The overall present value of net benefits under the estimates and assumptions made was found to be marginally positive at $4,721.
DISCUSSION

The background study, literature review, and case analysis put forward by this research project bring up multiple points worthy of consideration by PPPC and the medical community at large. These are examined below.

THE INEVITABILITY OF ELECTRONIC MEDICAL RECORDS

Firstly, this project’s background review found that healthcare systems both nationally and provincially have made their decision to transition from paper to electronic records. The literature indicates that physician adoption of EMR tends to drive adoption in the system. With the physician community in British Columbia at substantially increased levels of adoption, new graduates being increasingly technologically savvy, support of government programs, expanding technological ability of software systems, among other driving forces, the digitization of medical record now seems an unstoppable tide. Keeping in lockstep with this momentum may be reason enough for private practice physiotherapists to move in the same direction as the rest of the medical community, if only for the sake of their professional relevancy. For example, as the medical community adopts eHealth viewers (which allow medical professionals to instantaneously view imaging, specialist consult reports, operative reports, etc.), professionals that have not kept pace with the changing times will find themselves out of touch.
However, the additional benefits of the triple aim make the argument for EMR conversion even stronger. With the PPC being functionally analogous to a community physician office on many levels, many of the benefits realized in the physician context can be expected to transfer to the PPC environment. The quality of patient care will improve will with legible and quickly searchable records. Physiotherapists could develop their own clinical decision support systems with instantaneous access to evidence-based practice linked electronically to the most recent research. Office efficiencies can reduce overall costs to the system of physiotherapy provision. The fact that PPC will use electronic records to improve quality and cost of healthcare delivery does not seem to be a question, however, the timeline on adoption is.

IS EMR CONVERSION FINANCIALLY VAILABLE FOR A PPC?

With the assumption that private industry will not move towards EMR for patient quality reasons alone but only when financially incented to do so, this research attempted to study the viability of EMR conversion for a case clinic. After considering relevant, substantial costs likely to make a difference to the EMR decision against the Work System Method, this study found that the discounted net benefit of an EMR conversion for the case study clinic was $4,712 after five years. This finding essentially represents a five-year break-even period for the case study clinic. Several points around this result are worth discussing.
High Sensitivity to Workflow Practices

The first major point to consider is that the findings were highly sensitive to estimates made around workflow benefits. For example, the case clinic’s financial benefits were largely derived from efficiencies gained from reduced support staff time for chart pulls (approximately $130,000 over the five years), searching for lost charts, and retrieving charts from storage. This is consistent with the literature and Skolnik’s assertion that most productivity gains come from work process re-engineering rather than the technology itself. It should be noted, however, that workflow practice changes are difficult to estimate without a pilot or partial implementation. Even a one to two hour error per day in the estimations could substantially reduce the benefit under these assumptions. Additionally, even with perfect time assumptions, PPPCs must be willing and able to reduce support staff levels or redirect the hours gained to other value activities. This may be quite possible for larger clinics but not as feasible for smaller clinics. Each clinic will need to evaluate how its financial situation will change as a result of the work practice reengineering due to EMR. Simply idle support staff time could quite possibly result in EMR conversion failure due to low return on investment.

Uncertainty of Change Management and Workflow Re-engineering

On a related point, clinic should recognize that the less tangible financial costs around workflow practices, cultural change, and consultation needed in order to successfully implement an EMR are the ones that are the most difficult to make, not the cost of the technology itself. Clinics will need to have a good understanding of what it will take not
to lead successful change management beyond installing new technology. They will need to know how that technology will be best accepted by the people who use it, how it will change the way work is done, and how these aspects of cultural and work practice transformation will affect the financial situation of the clinic.

The High Costs of Historical Chart Conversion
Several literature sources note that EMR conversion may be best done on a ‘going forward’ basis rather than converting historical records to digital files. While there would be expenses in continuing maintaining old paper charts, the costs appear to take a long time to recoup. The cost of converting the case clinic's historical files for was estimated to be high with an immediate outlay of $66,000. Maintaining the storage facility would result in a savings of approximately $23,000 and with discounting this value would be even less. PPPCs may be able to find less expensive conversion processes than the quote obtained by this research, but they will at least want to consider carefully what value the process has to them. The case for EMR conversion on a going-forward basis for this case clinic is considerably stronger than it is when historical charts are converted.

Lost Productivity Estimates May Be Overly Cautious
Lost productivity estimates were made in this analysis. The value of lost productivity was found to be $15,094. This is a considerable amount in the context of the economics considered here. However, the literature debates whether lost productivity with EMR conversion actually occurs. Conversely, some argue that productivity actually increases.
As EMR systems for physiotherapy clinics are considerably simpler than physician systems, it may be that with adequate planning and pre-implementation workflow analysis this cost could be avoided.

**Potential Savings in Hardware Choice**

This paper chose a high-quality hardware and office setup including a relatively expensive tablet option that docked to a separate monitor and included a separate keyboard. The cost of this configuration per therapist for each workstation was nearly $1600. The scanners and routers chosen were also some of the most costly in their class. These choices were made purposefully in order to minimize the chance at failure of the proposed system due to hardware insufficiency. However, it may be quite possible to reduce conversion costs through less costly devices. Clinicmaster, for example, states that their newest version of web-based EMR can be used on a Samsung Galaxy Tablet (cost approximately $350). This would represent a substantial hardware savings. Alternatively, with proper privacy and security protocols, clinics may consider cost sharing devices with contracted or employed physiotherapists.

**Substantial Benefits Expected in Year Six**

This research chose a five-year analysis period based on other work done in the physician literature. Near break-even was demonstrated in year five. Were the study extended to year six, however, it is likely that substantial benefits would begin to be seen as the major costs of conversion had already been realized. Clinics may want to take this into account when analyzing their own benefit potential.
Potential Understatement of Benefits

These cautionary notes should also be accompanied by recognition that a strong argument could be made that the financial benefits are understated in this research. As noted earlier, this work projected a scenario where the case clinic transforms to basic, level three EMR, where all patient data is being entered in electronic form. Typically, once having reached this point, community practice physician clinics will progress their EMR systems through “optimization”. Optimization is the process of fine-tuning the EMR system to increase quality and efficiency benefits to the patient and the clinic. This would also be the expected course for PPPCs. For example, reporting forms frequently filled out for Worksafe BC have the potential to be automatically generated by software packages, thus saving the physiotherapist ten minutes per form. Three forms per week might save the physiotherapist 30 minutes of time, allowing for one additional new patient per week. Over the course of the year, this would generate over $27,000 of revenue after paying the physiotherapist. This is only one of many examples of optimization benefits that might be expected with EMR adoption.

The Intangible Value of Improved Quality of Care

Finally, it should be emphasized that this paper was primarily “business case” in nature for the reasons already discussed. As such, it pays little attention to the quality of care benefits an EMR might provide to the patient. It is these less financially tangible benefits, however, that may be the most desirable result of EMR from a utility perspective. EMR can potentially provide for better care in many ways, particularly in that it sets the physiotherapy profession up for participating in an interoperable health
care record. Potential benefits of such a system include immediate access to diagnostic imaging, enhanced communication with other health care professionals, access to pertinent medical history, access to specialist consult and operative reports, etc. The collection and organization of outcome measures and other data can enhance rehabilitation research and evidence-based practice.
LIMITATIONS

There are certainly limitations that were both expected and discovered through the course of this research. Firstly, as there is little research on EMR in private practice physiotherapy, the projected categories of likely costs and benefits were largely extrapolated from the community practice physician literature. While it was felt this was reasonable considering the settings are functionally analogous on many levels, there are differences and it is possible that some costs or benefits were overlooked. An attempt was made to compensate for this by considering the criteria listed in section ## and considering the potential costs and benefits in light of the author’s 19 years of PPPC experience.

Secondly, it is acknowledged that determining the implications of EMR on workflow practice are difficult to do without actual measurements. A pilot was initially considered, but it was decided it would be beyond the scope of the project. Further research through a pilot project or measurement of a current implementation may be better able to quantify work practice changes in the PPPC setting through objective measurement than through the methods of estimation used here.
RECOMMENDATIONS

It seems clear the medical community in British Columbia and Canada has made its decision to move towards electronic medical records and a national, interoperable EHR. PPPCs need to continue to determine how they will move to EMR in order to remain professionally relevant in the medical community and participate in the quality and efficiency potential of these electronic systems. This research demonstrates that for the case clinic, there is a reasonable economic case to be made for financial EMR conversion under current conditions. However, the process may be difficult for individual clinic owners and the physician experience has shown it is fraught with potential for failure. Recognizing this, the following recommendations are made based on this research.

1. The private practice physiotherapy industry should come alongside the rest of the medical community in order to be involved in and help in the planning of EHR in Canada and the eHealth strategies at local levels. The inclusion of physiotherapy in local and national interoperable electronic health records would result in benefits to the patient, the physiotherapy profession, and provincial and national healthcare systems.

2. Professional associations have been shown to play a large role in advancing EMR adoptions. The Physiotherapy Association of BC (PABC) and Canadian Physiotherapy Association (CPA) should support PPPCs with resources to aid in the transition. A PITO model would be good starting point offering a website of
resources specific to PPPCs and consulting services for pre-implementation planning and budgeting, change management, and EMR optimization.

3. PABC and CPA should establish baselines of current EMR usage and make goals around EMR conversion.

4. PABC / CPA should investigate potential for Ministry of Health subsidization of conversion as was given to physicians.

5. PPPCs should not take the results of this study to be definitive but should consider the framework of identified costs and benefits and determine how these will translate to their own practices.
CONCLUSION

Kashyap states, "Implementing an EMR is probably the most difficult, significant, and potentially beneficial change a practice can make". While he was speaking of physician community practices, both the challenge of the venture and the potential benefits it might bring apply to private practice physiotherapist clinics as well. It seems clear that EMR will come to PPCP clinics, but when is quite in question.

This research has demonstrated a case study in which the conversion appears financially feasible with a basic level of EMR showing a net positive cost-benefit analysis. However, the findings are highly sensitive to whether the clinic is able and willing to re-engineer its workflow to take advantage of the efficiencies gained. In the bigger picture, the benefit of this research project is perhaps not so much in the final numbers generated by the case study clinic, but by the awareness it may create in a profession relatively bereft of EMR knowledge and the categorization of costs and benefits that should be expected. The high sensitivity of the results to the re-engineering of work practices suggests that conversion should not be entered into lightly. An informed process and holistic consideration of how the entire business will be affected is needed. A framework approach such as Alter’s Work System Method can help to inform such analysis. Physiotherapy associations in both BC and Canada, as well as other stakeholders such as government partners, can play important roles in supporting PPCPs.
towards the EMR process in order that the triple aim might be achieved in this arm of the healthcare system.
APPENDIX 1: COST CALCULATIONS

Appendix 1 displays the details of the clinic’s current paper situation, the anticipated EMR transition requirements, the financial costs incurred for that requirement and the source / details of each calculation.

COSTS

Costs: Technological

Computer Hardware

Current Situation:
The Clinic currently has multiple computers, primarily for front office staff use in booking and billing. Each shift of four physiotherapists also two computers for professional access throughout the day.

Requirements for EMR Transition:
PITO lists suggested hardware for physician offices, and these were used as a base for estimation with modification for the specific requirements of a PPPC. In the case of computer hardware, this costing uses a hybrid laptop device rather than the desktop suggested by PITO due to the multi-room nature of physiotherapy practice (portability critical). These recommendations were also reviewed by the Clinic’s IT company for appropriateness. Miscellaneous costs are included at $500 per clinic for cables, etc. Table 2 shows a summary of the current costs of the devices required. Installation costs
were obtained from the clinic’s IT company. Computer hardware is calculated based on replacement after every third year.

<table>
<thead>
<tr>
<th>Hardware Item</th>
<th>Amount Needed</th>
<th>Cost Per Item</th>
<th>Total Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dell Venue 11 (Core i3, 4 MB RAM, 256 GB Hard drive)</td>
<td>8</td>
<td>$800</td>
<td>$6400</td>
</tr>
<tr>
<td>Dell Venue Tablet Keyboards</td>
<td>8</td>
<td>$170</td>
<td>$1360</td>
</tr>
<tr>
<td>Dell Venue Tablet Monitor Docks</td>
<td>8</td>
<td>$150</td>
<td>$1200</td>
</tr>
<tr>
<td>Installation</td>
<td>8</td>
<td>250</td>
<td>$2000</td>
</tr>
<tr>
<td>Miscellaneous</td>
<td>2</td>
<td>500</td>
<td>$1000</td>
</tr>
</tbody>
</table>

Scanning Hardware

Current Situation:
The clinic currently has limited scanning capabilities.

Requirements for EMR Transition:
Scanning ability would need to be significantly improved for EMR. Paper coming into the clinic on a daily basis (referrals, faxes, client documents, x-ray reports) would need to be scanned quickly and reliably. Myriad IT Consulting recommended the HP Scanjet 7500. Each clinic office would require one of these scanners. Scanners are expected to be replaced after every third year.
The Financial Viability of Electronic Medical Records for Private Practice Physiotherapy Clinics in British Columbia

### Technology – Scanning Hardware

<table>
<thead>
<tr>
<th>Hardware Item</th>
<th>Amount Needed</th>
<th>Cost Per Item</th>
<th>Total Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>HP ScanJet 7500</td>
<td>2</td>
<td>$1500</td>
<td>$3000</td>
</tr>
<tr>
<td>Installation</td>
<td>2</td>
<td>$500</td>
<td>$1000</td>
</tr>
</tbody>
</table>

### Network Hardware

**Current Situation:**
The Clinic’s current wireless network is very basic and receives minimal use.

**Requirements for EMR Transition:**
The wireless capabilities would need to be upgraded significantly to allow for portability of computer hardware and fast networking of existing desktops. EMR would require a professionally installed, secure wireless network. Myriad recommends the Sonicwall TZ200 Router and gave pricing for installation. Each clinic would require one of these routers, accessories and installation.

### Technology – Network Hardware

<table>
<thead>
<tr>
<th>Hardware Item</th>
<th>Amount Needed</th>
<th>Cost Per Item</th>
<th>Total Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sonicwall TZ200 Series Router and accessories</td>
<td>2</td>
<td>$1200</td>
<td>$2400</td>
</tr>
<tr>
<td>Installation</td>
<td>2</td>
<td>$500</td>
<td>$1000</td>
</tr>
</tbody>
</table>
EMR and other Software

Current Situation:
Clinicmaster software includes an EMR module at no additional costs. However, costs may be incurred with additional software required to complement the current system. The clinic currently uses free malware protection.

Requirements for EMR Transition:
PITO suggests malware software budgeting. Myriad IT consulting confirmed this requirement. The eight new laptop/tablet hybrids would need updating as would the ten existing computers used for private practice physiotherapy. AddaTech confirmed that there is no further software required. A document importer software package was recommended to ease scanning of documents into patient files.

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
<th>Cost Per Item</th>
<th>Licenses Required</th>
<th>Total Conversion Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>EMR Software</td>
<td>Included in current software subscription</td>
<td>$0</td>
<td>NA</td>
<td>$0</td>
</tr>
<tr>
<td>Malware Protection</td>
<td>One license per computer</td>
<td>$29</td>
<td>18</td>
<td>$522</td>
</tr>
<tr>
<td>Clinicmaster Document Importer</td>
<td>Required for quick document scanning</td>
<td>$750</td>
<td>1</td>
<td>$750</td>
</tr>
</tbody>
</table>
Ongoing Maintenance of EMR

Current Situation:
The clinic paid $3725 for computer maintenance services in 2013.

Requirements for EMR Transition:
An increase in IT maintenance costs would be required. Myriad IT estimates the cost would increase by 50% of the 2013 value with the proposed EMR setup.

<table>
<thead>
<tr>
<th>Technology – Ongoing Maintenance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Item</td>
</tr>
<tr>
<td>Increase in IT maintenance with EMR Conversion</td>
</tr>
</tbody>
</table>

Renovations

Current Situation
PITO suggests a renovation budget be included for potential upgrades to accommodate EMR hardware and logistics.

Requirements for EMR Transition:
Minimal renovations are projected for the case clinic as there is adequate counter space for increased charting and computer hardware. A small renovation budget is included for incidental renovations for each clinic.
### Technology – Other

<table>
<thead>
<tr>
<th>Item</th>
<th>Quantity</th>
<th>Cost Per Item</th>
<th>Total Conversion Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Renovations</td>
<td>2</td>
<td>$500</td>
<td>$1000</td>
</tr>
<tr>
<td><strong>Total Other:</strong></td>
<td></td>
<td></td>
<td><strong>$1000</strong></td>
</tr>
</tbody>
</table>

**Costs: Information**

*Paper Chart Conversion*

**Current Situation:**
The clinic currently stores charts throughout the office space and rents storage space at an offsite facility.

**Requirements for EMR Transition:**
Although many sources suggest not converting historical charts, costing of historical was done to assess its financial viability. This is a laborious process, and the costs could be significant. Clinicmaster suggests this be done by contracting a third party such as Canon or Lexmark to do batch PDF conversion and then use their “document importer” software to match these scans to charts. The clinic was measured approximately 500 linear feet of stored charts. Each foot of charts holds approximately 1350 pages that would need to be scanned (total of approximately 660,000 documents). Iron Mountain
Document Services was contacted for a quote for conversion of this volume of documents. They quoted $0.10 per page.

<table>
<thead>
<tr>
<th># Pages to Scan</th>
<th>Cost Per Page</th>
<th>Total Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>660,000</td>
<td>$0.10</td>
<td>$66,000</td>
</tr>
</tbody>
</table>

**Privacy and Security**

**Current Situation:**
The clinic currently has privacy and security protocols for a paper environment.

**Requirements for EMR Transition:**
Appropriate privacy and security procedures would need to be developed for both clinics for an EMR context. These procedures would need to be in compliance with British Columbia legislation and the requirements of the College of Physical Therapists of British Columbia. It is estimated that the process of developing and testing the privacy and security procedures would require an investment from a consultant or quality control staff member. There is very little information available as to how much investment this would take for a physiotherapist clinic. Having reviewed the legislation and CPTBC requirements, the author estimates an investment of 40 hours at $60 per hour.

**Costs: Participants**
Staff training

Current Situation:
Physiotherapists are currently charting on paper and would need to become familiar with the operation and charting aspects of the Clinicmaster system.

Currently, the secretarial staff are very familiar with Clinicmaster workflow as they have been using the software for billing and booking purposes for two years. For physiotherapists, the software vendor suggests a one-hour training session. This costs $100 and would be paid for by the clinic. A second hour is included for review after one month of use.

Requirements for EMR Transition:
For professional staff, Clinicmaster estimates that a basic level of functional knowledge would require one hour of introductory training and the rest could be gained on the job without additional expenditure. For physiotherapists, each therapist will need to undertake the one-hour training session. The clinic owners would pay for this training. As per regular clinic practice, contractors would be expected to perform this training on their own time but employees would be reimbursed for their time. A second hour is allowed for employees for review. Further training would be done on the job, and costs of this learning curve will be accounted for under “lost productivity” section.

For secretarial staff, converting to EMR would require little adjustment in the operation of the program. However, there would be an adjustment required in regards to scanning
patient completed forms into the chart, accessing records for legal purposes, alerting physiotherapists to patients having arrived for their appointments and various other workflow issues. One hour of training is estimated to be sufficient for this purpose.

<table>
<thead>
<tr>
<th>Participants - Training</th>
<th>Amount Needed</th>
<th>Cost Per Session</th>
<th>Total Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physiotherapists – Training from Clinicmaster</td>
<td>16*</td>
<td>$100</td>
<td>$1600</td>
</tr>
<tr>
<td>Employee Physiotherapist Time for Training Reimbursement</td>
<td>16 **</td>
<td>$40</td>
<td>$640</td>
</tr>
<tr>
<td>Secretarial</td>
<td>7***</td>
<td>$16.67</td>
<td>$117</td>
</tr>
</tbody>
</table>

* 16 physiotherapists, 1 hour each

** 2 hours of reimbursed pay per physiotherapist, 8 employed physiotherapists

*** 7 secretaries, 1 hour each

*Project Lead / Consultant Compensation*

**Current Situation:**
The clinic currently has physiotherapists who are capable of leading change management and experienced in quality improvement projects and could take on the lead role of conversion. Other clinics may need to hire a consultant to help them through this process.

**Requirements for EMR Transition:**
Physician EMR implementations tend to be done over 18 months. Due to the simpler PPPC processes, it is estimated the process could be done in six months from pre-implementation. Based on the author’s experience with EMR, the software, and PPPC practices, it is estimated one day per week would be sufficient through six months to plan, train, and convert the physiotherapy clinic to a successful EMR clinic.

<table>
<thead>
<tr>
<th>Participant</th>
<th>Days</th>
<th># of Days Needed</th>
<th>Total Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Project Lead</td>
<td>14</td>
<td>$480*</td>
<td>$6720</td>
</tr>
<tr>
<td>Total Training Costs</td>
<td></td>
<td></td>
<td>$6720</td>
</tr>
</tbody>
</table>

*Based on an 8-hour day at $60 per hour

Costs: Work Practices

Lost Productivity

Current Situation:
The clinic typically books three patients per hour at an average reimbursement of $50 per patient.

Requirements for EMR Transition:
As discussed in part one, it is prudent to build in a two-week buffer for lost productivity. This is estimated based on the author’s 18 years of clinical experience and extensive reading of the literature. It is estimated that the change to EMR would require, on
average, a two-week adjustment period during which lost productivity is expected to be reduced by one patient per hour. The costs the clinic would incur would include lost revenue to this reduction in patient seen as well as the costs needed to reimburse employed physiotherapists. Contractors would not be compensated for lost time due to their contractor status and that they absorb the risks of such status with changes in working conditions.

<table>
<thead>
<tr>
<th>Work Practices – Lost Productivity</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Lost Productivity - Revenue Costs</strong></td>
</tr>
<tr>
<td>Cost Source</td>
</tr>
<tr>
<td>Lost revenue due to reduced patients seen</td>
</tr>
<tr>
<td><strong>Lost Productivity – Reimbursed Wages</strong></td>
</tr>
<tr>
<td>Cost Source</td>
</tr>
<tr>
<td>Reimbursement of Physiotherapists (employees) for lost wages</td>
</tr>
<tr>
<td><strong>Total Cost of Lost Productivity:</strong></td>
</tr>
</tbody>
</table>

* 3 patients per hour, $50 per patient, 275 PT hours private practice per week (93.5 Sardis, 181.5 Chilliwack), clinic portion average 50% 50%

** Employee hours 137.5, loss of 1 patient per hour, employee portion 45%, 5 days per week
Secretarial Scanning Time

Current Situation:
Currently, paper brought into the clinic is simply inserted into the patient’s paper chart, and no scanning is required.

Requirements for EMR Transition:
EMR would create a new practice for secretaries, as document brought into the clinic would now require scanning to the patient file. Based on a sample of documents that came into the clinic in one week, it was estimated that 15 minutes of scanning per day would be required for the Sardis Clinic and 30 minutes for the Chilliwack Clinic for a total of 45 minutes of secretarial time per day.

<table>
<thead>
<tr>
<th>Work Practice</th>
<th>Annual estimated hours</th>
<th>Average Cost per hour</th>
<th>Total Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scanning</td>
<td>186</td>
<td>$16.67</td>
<td>$3100</td>
</tr>
<tr>
<td><strong>Total Annual Scanning Costs</strong></td>
<td></td>
<td></td>
<td><strong>$3100</strong></td>
</tr>
</tbody>
</table>

*45 minutes of secretarial time per day, 248 open clinic days per year*
APPENDIX 2: FINANCIAL BENEFIT CALCULATIONS

Appendix 2 displays the details of the clinic’s current paper situation, the anticipated EMR transition benefits, the financial benefits expected to be realized from that benefit and the source / details of each calculation.

FINANCIAL BENEFITS

Financial Benefits: Technology

Current Situation:
The clinic currently spends significant funds on paper for progress notes, assessment forms, outcome measures, medical history forms, reports, exercise handouts and various other forms and handouts.

EMR Transition Benefit:
Costs of paper chart related purchases throughout the year were calculated. It is estimated that the reduction in paper use would be 80% with an electronic medical records system. This information was obtained from the Clinic office manager.

| Technology: Reduced Material Related to Paper Charts |
|---------------------------------|----------------|----------------|
| Item                            | Annual Savings | Total Annual Benefit |
| Paper and Related               | 80% of $3494   | $2795           |
Financial Benefits: Information

Reclaimed Clinic Space

Current Situation:
Paper charts are currently stored throughout both clinics.

EMR Transition Benefit
Converting these charts to paper to electronic format frees up office space for other uses. For freed up clinic space, square footage was calculated where floor to ceiling storage clearly took square footage in the facility footprint and could potentially be repurposed for other applications (treatment rooms, desk space, etc.). Where charts took up shelf space, a financial value was not assigned as it does not reflect a practical potential to reclaim clinic space and would be approximately a tradeoff for extra computer equipment.

<table>
<thead>
<tr>
<th>Information – Reclaimed Clinic Space</th>
<th>Location of Charts</th>
<th>Storage Area / Volume</th>
<th>Annual Cost per unit</th>
<th>Total Annual Benefit</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Clinic location one - footprint storage.</td>
<td>12</td>
<td>$25*</td>
<td>$300</td>
</tr>
<tr>
<td></td>
<td>Clinic location two - footprint storage</td>
<td>35</td>
<td>$25</td>
<td>$875</td>
</tr>
<tr>
<td><strong>Total Annual Financial Benefit</strong></td>
<td></td>
<td></td>
<td></td>
<td><strong>$1259</strong></td>
</tr>
</tbody>
</table>
*Annual cost per square foot of clinic including lease, CAM charge, tax, and property tax.

_Paper Chart Storage in Rented Facilities_

_Current Situation_
The clinic currently rents space to store charts up to seven years old.

_EMR Transition Benefit:_
The benefit of not renting the storage facility is straightforward, as the facility would simply not be needed if paper charts were converted to electronic files and the benefit for EMR is calculated as such.

<table>
<thead>
<tr>
<th>Information – Chart Storage in Rented Facility</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Cost of Rent</strong></td>
</tr>
<tr>
<td>$378 per month</td>
</tr>
<tr>
<td>Total Annual Financial Benefit</td>
</tr>
</tbody>
</table>

_Additional Storage Anticipated Due to New Health Care Professionals Act Retention Requirements_

_Current Situation_
Currently, the clinic stores seven years worth of charts. This will increase by 1/7th per year as charts need to be retained for 16 years as of 2014. The seven-year-old charts would be retained rather than being replaced by the new year’s charts.
EMR Transition Benefit:
The transition to EMR would mean paper charts are no longer being produced. Even if historical charts were not converted, this financial benefit would be realized and would be an increasing benefit over the five-year analysis period as shown below. This analysis assumes no overall growth in the number of patients seen by the clinic in the five-year period, which is unlikely and therefore the estimation is conservative. It also assumes no increase in rent cost over the five years. Note that these savings would continue to increase for years six through nine in the pattern shown but those years are beyond the scope of this analysis.

<table>
<thead>
<tr>
<th>Year</th>
<th>Increase in Charts Retained (as a fraction of current stored charts)</th>
<th>Storage Cost</th>
<th>Yearly Benefit</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1/7</td>
<td>$648</td>
<td>$648</td>
</tr>
<tr>
<td>2</td>
<td>2/7</td>
<td>1296</td>
<td>1296</td>
</tr>
<tr>
<td>3</td>
<td>3/7</td>
<td>$1944</td>
<td>$1944</td>
</tr>
<tr>
<td>4</td>
<td>4/7</td>
<td>$2592</td>
<td>$2592</td>
</tr>
<tr>
<td>5</td>
<td>5/7</td>
<td>$3240</td>
<td>$3240</td>
</tr>
<tr>
<td></td>
<td><strong>Total 5 Year Financial Benefit</strong></td>
<td></td>
<td>$9720</td>
</tr>
</tbody>
</table>
Financial Benefits: Work Practices

*Reduced Chart Handling by Support Staff*

**Current Situation:**
Support staff spend considerable time handling paper charts. Each day, the patients’ charts are pulled, sorted, and then filed. Only the current three years of charts are held in clinic. The charts of returning patients who have not been seen in three years are retrieved from the storage facility, which is offsite.

**EMR Savings**
All files would be accessible immediately on computers and pulling of charts. The physical chart handling noted above would no longer be required resulting in significant support staff time savings. Chart pulling and filing typically involve four hours of secretarial time per day at the Chilliwack clinic and one and one-half hours per day at the Sardis clinic.

<table>
<thead>
<tr>
<th>Activity</th>
<th>Estimated Hours Saved Per Year</th>
<th>Cost per Hour</th>
<th>Total Annual Savings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chart Pulls / Chart Filing</td>
<td>1240*</td>
<td>$16.67</td>
<td>$20,671</td>
</tr>
<tr>
<td>Lost Charts Search</td>
<td>104**</td>
<td>$16.67</td>
<td>$1734</td>
</tr>
<tr>
<td>Retrieving Charts from Storage Facilities</td>
<td>104***</td>
<td>$16.67</td>
<td>$1734</td>
</tr>
<tr>
<td><strong>Total Annual Chart Handling ROI</strong></td>
<td></td>
<td></td>
<td><strong>$24,139</strong></td>
</tr>
</tbody>
</table>
*Estimated 5 hours per week (for both clinics)

**Estimated 2 hours per week (for both clinics)

***Estimated 2 hours per week (for both clinics)
REFERENCES


5. Boonstra A, Broekhuis M. Barriers to the acceptance of electronic medical records by physicians from systematic review to taxonomy and interventions. BMC health services research. 2010;10:231-231.


