Evaluating the Impact of Electronic Medical Record Systems on Patient-Centered Primary Care

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ABSTRACT

OBJECTIVES

There is a strong movement towards patient-centered care, as well as electronic medical record systems (EMRS) implementation, particularly in primary care settings. The actual impact of EMRS on patient-centered primary care (PCPC) has yet to be investigated. The Canada Health Infoway national survey offers an opportunity to explore the link between PCPC and EMRS. The objective of this thesis is: (1) to identify a conceptual framework for PCPC that can be used to evaluate the impact of EMRS on PCPC, (2) to evaluate what elements of a screening survey provides relevant information to assess how EMRS impact PCPC, and (3) to evaluate to what extent elements of a screening survey provides adequate information to assess how EMRS impact PCPC.

METHODS

The initial step consisted of conducting a literature search using articles from Embase and MEDLINE, to identify an optimal conceptual framework for PCPC to evaluate the impact of EMRS on PCPC. For the subsequent steps, secondary data from the Canada Health Infoway national screening survey was used. Surveys completed from 70 primary care clinics across Canada were obtained. Variable matching was used for each of the survey's EMRS impact statements to qualitatively identify their relevance to each of the dimensions of the indentified PCPC conceptual framework. Subsequently, PCPC impact scores (%) were calculated from variable matching relevance scores to identify the relevance of patient-centeredness of each of the national survey's EMRS impact statements in primary care. Additionally, for each dimension, PCPC dimensional relevance (%) as ratios amongst each other, were calculated from variable matching relevance scores to identify if the survey unequivalently captured dimensions. Finally, for each EMRS impact statement, physician agreement and PCPC impact scores were used in combination to capture physician agreement on the degree of the EMRS impact on PCPC.

RESULTS

The most prevalently cited conceptual framework for patient-centered care was the 6 dimensional Patient-Centered Clinical Method. Subsequently this framework went on to be revised and condensed into the 5 dimensional Mead and Bower model. Based on these conceptual frameworks the Hudon framework was identified and adopted for this thesis. This

framework consists of four over-lapping dimensions of the previous two frameworks, specifically for primary care. Out of the survey`s 20 EMRS impact statements, only 11 were positive for relevance to PCPC (PCPC impact score > 0%). The Canada Health Infoway national screening survey could only assess 12.3% (s.d. 30.2, overall mean PCPC impact score) of EMRS impact on PCPC. The PCPC dimensional relevance revealed that the survey did not equally capture the four PCPC dimensions: 42.9% for Clinician-Patient Relationship (Therapeutic Alliance) dimension, followed by 28.6% for Whole Person Care (BioPsychoSocial Perspective), 14.3% for Common Ground (Sharing Power and Responsibility), and 14.3% for Disease and Illness Experience (Patient As A Person). Physicians were in agreement that the EMRS apparently had no significant impact on PCPC (0.04 s.d. 0.63, on a Likert scale of -2 to +2).

CONCLUSIONS

The Hudon conceptual framework for patient-centered care was identified as the optimal model for evaluating the impact of EMRS on PCPC. The data from the Canada Health Infoway national survey was able to assess some of the dimensions of PCPC and examine the impact of EMRS on PCPC, but did not capture all the elements consistently. Certain PCPC dimensions may be more sensitive than others to EMRS implementation. Further studies need to be conducted that target the impact of EMRS on PCPC. Additionally, studies need to be conducted to identify if EMRS implementation preferentially affects the distribution of different dimensions of PCPC.

RÉSUMÉ

OBJECTIFS

Il y a un fort intérêt pour les soins centrés sur le patient, ainsi que pour l'implémentations de dossiers médicaux électroniques (DME), en particulier dans les milieux de soins primaires. L'impact réel des DME sur les soins primaires centrés sur les patients (SPCP) doit encore être exploré. L'enquête nationale réalisée par l'Inforoute santé du Canada offre une occasion d'explorer le lien entre SPCP et DME. L'objectif de cette thèse est: 1) d'identifier un cadre conceptuel des SPCP qui peut être utilisé pour évaluer l'impact des DME sur les SPCP, (2) d'évaluer à quel point l'enquête d'Inforoute fournit des renseignements pertinents pour évaluer l'impact des DME sur les SPCP, et (3) enfin d'évaluer à quel point l'enquête d'Inforoute fournit des informations suffisantes pour évaluer l'impact de DME sur les SPCP.

MÉTHODES

La première étape a consisté en une recherche documentaire dans les banques bibliographiques Embase et MEDLINE, afin d'identifier un cadre conceptuel optimal qui permette d'évaluer l'impact des DME sur les SPCP. Pour l'étape suivante des données secondaires de l'enquête de dépistage Inforoute santé du Canada ont été utilisées. Au total, 70 cliniques de premières lignes, réparties sur l'ensemble du Canada, ont complété l'enquête. La correspondance des variables de l'enquête avec le cadre conceptuel sélectionné a été établie pour déterminer leur pertinence vis-à-vis des dimensions des SPCP. Des scores d'impact sur les SPCP (%) ont été calculés pour déterminer la pertinence de chacun des 20 énoncés relatifs aux impacts des DME vis-à-vis des SPCP en mobilisant la méthode suivante. En outre, pour chaque dimension, la pertinence dimensions SPCP (%) sous forme de rapports entre les uns des autres, ont été calculées à partir de variables correspondant scores de pertinence pour identifier si l'enquête dimensions unequivalently capturé. Enfin, pour chaque étude d'impact de EMRS, accord de médecin et SPCP scores d'impact ont été utilisés en combinaison pour capturer accord de médecin sur le degré de l'impact des DME sur les SPCP.

RÉSULTATS

Le cadre conceptuel le plus fréquemment cité pour les soins centrés sur le patient était la *Patient Centered Clinical Method* qui comporte six dimensions. Par la suite, ce cadre a continué à être transformé et condensé dans le modèle de Mead et Bower qui comporte cinq dimensions. Enfin,

sur la base de ces cadres conceptuels, le cadre Hudon a émergé. Ce cadre comporte quatre dimensions et a été adopté pour cette thèse de maîtrise. Sur les 20 énoncés d'impact, seulement 11 étaient pertinents pour mesurer l'impact des DME sur les SPCP (score d'impact > 0%). Sur les déclarations d'impact survey`s 20 EMRS, seulement 11 étaient positifs pour la pertinence de SPCP (score d'impact > 0%). L'enquête nationale d'Inforoute Santé du Canada permet seulement d'évaluer 12.3% (s.d. 30.2) de l'impact des DME sur les SPCP. La pertinence dimensions SPCP a révélé que l'enquête n'a pas capturer également les quatre dimensions 42.9% pour la Relation Entre Clinicien-Patient (Alliance Thérapeutique) dimension, 28.6% pour les Soins Holistiques (du Point de Vue BioPsychoSocial), 14.3% pour le Commun Accord (Partage du Pouvoir et Responsabilité), et 14.3% pour l'Expérience de la Maladie (Patient Comme Une Personne). Les médecins étaient d'accord que les DMS avait apparemment pas d'impact significatif sur SPCP (0.04 s.d. 0.63, sur une échelle de Likert de -2 à +2).

CONCLUSIONS

Le cadre conceptuel de Hudon des soins centrés sur les patients a été identifié comme le meilleur cadre pour évaluer l'impact des DME sur les SPCP. Les données de l'enquête nationale d'Inforoute santé du Canada permet d'évaluer certaines des dimensions des SPCP et d'examiner l'impact des DME, mais ne permet pas d'explorer toutes les dimensions des SPCP. Certaines dimensions des SPCP peuvent être plus sensibles que d'autres à la mise en œuvre des DME. D'autres études doivent être réalisées pour identifier les impacts des DME sur les SPCP. En outre, des études doivent être réalisées afin de déterminer si la mise en œuvre des DME affecte préférentiellement certains dimensions particulières des SPCP.

List of Abbreviations

CDSS	Clinical Decision Support Software/Systems
CFPC	College of Family Physicians of Canada
CHI	Canada Health Infoway
CMA	Canadian Medical Association
EMRS	Electronic Medical Record Systems
IOM	Institute of Medicine
ONC	Office of the National Coordinator
OMA	Ontario Medical Association
PCC	Patient-Centered Care
PCMH	Patient-Centered Medical Home
PCPC	Patient-Centered Primary Care
PHCTF	Primary Health Care Transition Fund

1.0 BACKGROUND

1.1 PRIMARY CARE

Primary care, according the Canadian Medical Association (CMA)[1] and American Academy of Family Practice (AAFP)[2], is a service of general health management specifically provided during first clinician-patient contact and can include continuation of care and coordination of care. Primary care can involve diagnosis, treatment, disease prevention, health promotion, and patient education, of chronic and/or acute illnesses.[1-3] The term and concept is not to be interchangeably used with primary healthcare, which is a broader concept that itself encompassing primary care.[3, 4] Primary health care is an approach to healthcare that includes primary care services, patient income, patient education, etc; whereas primary care is an actual service provided to patients which includes diagnosis, treatment, health promotion, as well as disease and injury prevention.[3, 4]

1.1.1 Primary Care Practitioners

Primary care practitioners are certain clinicians within specific specialties where the majority of their practice encompasses providing primary care services. They serve as first contact entry portals for patients into the health care system, as well as can help coordinate, continue, and advocate for the patients care throughout this system. Base on these parameters, the physician specialities predominantly include family physicians, emergency medicine physicians, and depending on country of practice in North America, general internists and general paediatricians practicing in the United States of America (U.S.A.). Again it is important to note that all physicians practicing within each of these specialties are not necessarily primary care practicing physicians, only those whose practice predominantly provides primary care services. Notably, physicians of specialities that are not amongst those mentioned can arguably provide aspects of health care services that overlap into being primary care service(s).[2] Furthermore, primary care practitioners can also include nurse practitioners and physicians assistants who predominantly provide primary care services.

1.1.2 Primary Care Practices

A primary care practice is a location where primary care services are administered and is usually a portal of entry for the patient into the health care system. As such primary care practices can include community clinics [e.g. Centre local de services communautaires (CLSC), Groupe de médecine de famille (GMF), family health teams (FHT), etc], urgent care clinics,

emergency departments, etc. Almost always they generally focus on providing health care for the members of its surrounding geographic community. In ideal circumstances primary care clinics are also capable of addressing and providing unique health care services required by its surrounding community. In addition to primary care physicians, auxiliary health care services and practitioners may be located within these clinics (e.g. nurses, physician assistants, physiotherapists, pharmacists, nutritionists, social workers, etc).

Prominent primary care advocate, Barbara Starfield[5], provides a commonly used definition of primary care based on 4 key elements, otherwise referred to as the 4 "C"'s:

1. level of a health service system that provides entry into the system for all new needs and problems [contact that is accessible],
2. provides person-focused (not disease-oriented) care over time [continuity],
3. provides care for all but very uncommon or unusual conditions [comprehensiveness], and
4. co-ordinates or integrates care provided elsewhere by others [coordinated]. (page 8-9)[5]

In the context of the Canadian health care system, primary care is the entry-point for a patient. As such almost all patients receiving health care should visit a primary care clinician initially. Notably, this holds true more so in Canada than the U.S.A., considering that in Canada's per provincial health care requirements it is almost always necessary for a patient to first see a family physician, emergency medicine physician, nurse practitioner, or physician assistant for both initial assessment and initial coordination of care. While in the U.S.A. patients are far more readily able to first see a non-primary care physician regarding a health issue, and thus have the option to at least initially coordinate their own care. Hence, first point of health care contact is one key aspect of primary care.

Primary care is strongly linked to improved quality of care resulting in better health outcomes.[6-8] The links are through access to care, utilization of family physicians as health care providers, improved coordination of care, and patient-centered care.[8, 9] As a result, the U.S.A.'s Patient-Centered Primary Care Collaborative[10] in 2006, and the College of Family Physicians of Canada (CFPC)[9] in 2009 began pushing their respective health care systems towards the medical home organizational/systems model that is based in primary care and patient-centered care, in addition to new model-practice and payment reform. Together these 4 components are

considered the 4 cornerstones of the patient-centered medical home model.[11] The organizational/systems push has improved quality of care, access, coordination, reduced emergency department visits and reduced in-patient hospitalizations.[8] The majority of primary care is provided in North America by family physicians.[12, 13] This link to improved quality of care was supported by Macinko et al[6] who conducted a systematic literature review of articles between 1985 and 2005 that identified a positive association between the supply of family physicians and improved health outcomes. Improved health outcomes were particularly found for "all-cause cancer, heart disease, stroke, and infant mortality; low birth weight; life expectancy; self rated health" (page 111).[6] Interestingly, when the results for all-cause mortality were pooled the authors identified that "an increase of one primary care physician per 10,000 population was associated with an average mortality reduction of 5.3 percent, or 49 per 100,000 per year" (page 111).[6] As such, it becomes apparent why primary care physicians and implementing the medical home model in primary care are important to health care. Therefore when considering improvements to the health care system, specifically appropriate health care management at points of entry into health care system and the coordination of patient care, the importance of primary care becomes evident.[9, 10, 14]

1.2 PATIENT-CENTERED PRIMARY CARE

Patient-centered primary care (PCPC) is a newer concept used by health professional bodies. Though a clear definition has not been provided for this full-term in its entirety in literature, rather definitions of patient-centeredness have been more commonly given while leaving the primary care portion of the term undefined.[9, 10] We propose that patient-centered primary care (PCPC) is primary care that is patient-centered care, specifically that PCPC is a combination of the two terms as they are individually defined by this study. As such, the commonly used definition for patient-centered care is the one provided by the institute of medicine (IOM), as recognized and promoted by the U.S. Department of Health and Human Services' Agency for Healthcare Research and Quality. The IOM states that patient-centered care is "[H]ealth care that establishes a partnership among practitioners, patients, and their families (when appropriate) to ensure that decisions respect patients' wants, needs, and preferences and that patients have the education and support they need to make decisions and participate in their own care" (page 7).[15] Several bodies of health such as, the College of Family Physicians of Canada, the U.S.A.'s Patient-Centered Primary

Collaborative at the organization level began shifting primary care towards PCPC.[9, 10] For example, in 2004 the American Academy of Family Physicians (AAFP) began adapting the patient-centered medical home model specifically for primary care.[16] The CFPC[9] asserted that implementing the medical home in primary care would enhance patient-centered care, access, and health outcomes. In doing so, the health bodies aspire that initiatives introduced into primary care are focused on what is best for the patient and respectful of patient autonomy, as opposed to what is best for the providers and/or their health system.[9] Hence, it is important because it redistributes the power from primarily the physician towards care that actively engages the patient and centres on addressing the patient's needs.[9]

Furthermore, it can be argued on both moral and ethical grounds that to truly maintain and respect patient autonomy care should be patient-centered.[17-19] Epstein et al[19] go even further to argue based on evidence that since patient-centered care (PCC) addresses the racial, ethnic, and socioeconomic disparities it is able to subsequently improve both disease outcomes and quality of life. However, as Epstein et al[18] support, regardless of improvements in disease outcomes resulting from PCPC, the superseding rational is that PCC should be conducted because it is the moral and ethical thing to do.

Based on several studies, PCPC is generally associated with improvement in various health outcomes.[17, 20-24] Specifically research has demonstrated that it improves health outcomes in the individuals with chronic illnesses, individuals with diabetes[22, 25] and especially those with higher disease burden[22], decreases emergency care use in a Alaska native population[23], decreases readmission rates[24], amongst several other health outcomes.

At the organizational/systems level, the patient-centered medical home is a conceptual model being pushed forth by health bodies both in Canada (e.g. College of Family Physicians of Canada[9]) and the U.S.A. (e.g. Patient-Centered Primary Care Collaborative[10]). The patient-centered medical home consists of 7 parameters (1. "patients have a personal family physician who provides and directs their medical care"; 2. "care is for the patient as a whole"; 3. "care is coordinated, continuous and comprehensive with patients having access to an inter-professional team"; 4. "there is enhanced access for appointments"; 5. "the practice includes well-supported information technology, including an electronic medical record"; 6. "remuneration supports the model of care"; and, 7. "quality improvement and patient safety")[9] that need to be addressed in order to progress health care towards PCPC, the 5th parameter being "well-supported

information technology, including an electronic medical record."[9] Therefore, as primary health care is moving towards the medical home model, effective information technology will be needed to support this type of interdisciplinary care.

1.3 ELECTRONIC MEDICAL RECORD SYSTEMS

Health information technology (HIT) is any information technology when it is applied to health care. As such the concept encompasses any technology that has to do with storing, retrieving, transmitting, and evaluating health information.[26] HIT includes patient-centered records, patient health records, patient personal health tools, online communities, etc. as well as electronic medical record systems (EMRS).[26] With respect to primary care, EMRS are tools used by clinicians to primarily store, retrieve, and if possible transmit patient health information. Additionally, they can aid in managing patient care.[27] Notably, very early models of EMRS solely consisted of EHR/EMR and did not aid in managing patient care, this does not exclude that they were EMRS. (see Figure 1.1) The term EMRS is not to be confused with electronic medical records (EMRs) nor electronic health records (EHRs), as the latter two solely contain the patient's medical information. With respect to EMRs and EHRs, they themselves are not interchangeable terms; rather though they both consist of patient health information, while conceptually the EMR only exists within one health care organization, the EHR exists within more than one health care organization.[27, 28] In the context of the term EMRS for this study, EMR and EHR are conceptually interchangeable. Furthermore EMRS, in addition to dealing with health information, may also may have tools for guiding clinicians in their practice (e.g. guiding clinicians via prompts and alerts); otherwise known as clinical decision support software/systems (CDSS). Specifically, based on patient information stored in an EMR/EHR, software algorithms are devised by developers that enable EMRS to generate patient-specific recommendations to a clinician-user.[29] With these CDSS features, EMRS are expected to provide significant improvements in health care delivery and outcomes.[30-34] In particular, a systematic review and meta-analysis by Moja et al[35] demonstrated that new generation EMRS may moderately improve morbidity outcomes, but do not affect mortality.

Figure 1.1 Definitions for Electronic Medical Record Systems

Electronic Medical Record Systems = EMR/EHR +/- CDSS		
EMR	Electronic Medical Record	Comprised of patient health information, that is stored, retrieved and if possible transmitted.[27] Only exists within one health care organization. [28]
EHR	Electronic Health Record	Comprised of patient health information, that is stored, retrieved and if possible transmitted.[27] Exists within more than one health care organization.[28]
CDSS	Clinical Decision Support Software/Systems	Based on patient information stored in an EMR/EHR, software algorithms are devised by developers that enable EMRS to generate patient-specific recommendations to a clinician-use.[29]

Notably, very early models of EMRS solely consisted of EHR/EMR and did not have CDSS aid in managing patient care. Hence, though they did not consist of the CDSS component of EMRS, they are still regarded as EMRS none the less.

To support implementation in Canada, the federal government of Canada created and funded Canada Health Infoway (CHI), an organization meant to work with the provinces and territories to implement EMRS.[36, 37] Specifically, the federal government of Canada, via Health Canada, has invested $2.1 billion through numerous grants from 2001 to January 2009 alone.[37, 38] The organization's ultimate goal was to have all clinics and hospitals across Canada implementing EMRS, and by 2016 to have all Canadians receiving care supported by an EMRS.[39] A report recently released by CHI[40] states that from 2006 to 2013, EMRS use in Canada doubled, and that during this period patient safety improved via diminished adverse drug effects, reduced duplicate diagnostic test orders, reduced administrative time spent on paper based tasks, etc. (see Figure 1.1)

In the U.S.A., in 2009 under the Obama administration the American Recovery and Reinvestment Act allocated $19 billion towards aiding health care providers in implementing HIT.[41] The remaining $17 billion via Medicare and Medicaid were provided through incentives for those health care providers adopting HIT before 2015.[42] Specifically, health care providers who implemented EMRS were able to recover up to $44,000 from Medicare over a 4 year period and $63,750 from Medicaid over a 6 year period. Initially in 2009, financial incentives from the

federal government of the U.S.A. for EMRS implementation by both physicians and hospitals totalled to $27 billion over a 6 year period.[39]

EMRS are technological tools and like most technology in this century, EMRS are rapidly advancing via the innovation of novel software features, various portals for data access and sharing, ease of use, etc. Despite the rapidly developing improvement of primary care EMRS and the major investment from the Canadian and U.S.A. federal governments, Lyons et al[43] found that compared to almost all other information intensive industries over the past decade, the adoption of EMRS have been strikingly slower. Specifically, EMRS use in primary care in 2009 was 46% in the U.S.A. and even lower at 37% in Canada. EMRS implementation in primary care in both Canada and the U.S.A. are strikingly low compared to other high resource countries such as New Zealand (97%), Australia (95%), Netherlands (99%), Norway (97%), Italy (94%), Sweden (94%), Germany (72%) and France (68%).[44] In Canada, however, the use of EMRS by primary care physicians has been increasing from 23% in 2006[39], to 37% in 2009[39], and to 64% in 2014[45].

With the expectation that EMRS will improve quality of health and health outcomes, with the strong support by health organizations and the Canadian government to make sure the technology is implemented and adopted nationwide, the role of EMRS in primary care will be significant. However, the impact of EMRS on PCPC has yet to be adequately evaluated.

1.4 IMPACT OF EMRS ON PCPC

To date, PCPC and EMRS have been two independent tracks in primary care. This independent progression will need to change as the Canadian and U.S.A. health bodies are moving towards the patient-centered medical home model and EMRS have been identified by these health bodies as a key parameter involved in facilitating the shift. Thus, these previously parallel aspects of primary care are now merging together and a means to evaluate the impact of EMRS on PCPC needs to be identified.

It is generally supported by the CFPC and the U.S.A.'s Patient-Centered Primary Care Collaborative that EMRS can facilitate PCPC through improved coordination of care, whereby patients may receive better attuned care where and when they need it.[9, 10] Notably, as Epstein et al[17, 18] argue that though there is a push for EMRS to facilitate better coordination of care and subsequent PCC, it does not necessarily mean that EMRS implementation will result in care at the

clinical level that will be patient-centered. All things considered it becomes apparent that the relationship between the two concepts, particularly the impact of EMRS on PCPC, needs to be measured and identified using an appropriate conceptual framework.

1.5 OBJECTIVES

The objectives of this thesis are:

1. To identify a conceptual framework for PCPC that will evaluate the impact of EMRS on PCPC.
2. To evaluate what elements of a screening survey provides relevant information to assess how EMRS impact PCPC
3. To evaluate to what extent elements of a screening survey provides adequate information to assess how EMRS impact PCPC.

2.0 LITERATURE REVIEW

2.1 PRIMARY CARE

To understand how primary care has come to occupy such an important role in the Canadian health care system, it is important to know the current system's historical development. Previous to 1815, physicians in Canada were either military or navy surgeons.[46]

Initially in the 17th century, hospitals were designated locations where health care was provided to individuals. As such it was during this period that the country's first hospitals were built. Arguably the hospitals were funded and founded by Catholic missionaries. North America's first hospital was founded in Québec City in 1639, called Hôtel-Dieu de Québec. Furthermore, outside of the hospital health care professionals of the time did outpatient procedures in their doctor's offices and at local barber shops. The most frequent outpatient procedure being bloodletting.[47, 48]

In 1763 when the British took over Canada, British doctors immigrated and took-up most of the practices in the larger cities, such as Toronto and Montréal, while French physicians were mostly found still providing care in rural settings.[48]

According to Taylor[49], unlike Canada's British counterpart, the Canadian health care system was not implemented on a national level, but was delivered privately at fee-for-service. Health care providers were unlikely to deny health care and as such ended up accumulating vast debts owed to them.[47, 49] Initially there was a resistance by the provinces to the federal government's attempts to install social insurance systems.[49]

Officially in 1847 the College of Physician and Surgeons of lower Canada was established.[50] Then in 1867 the Canadian Medical Association was formed, approximately 100 days following confederation.[50] Later in 1912 Dr. Thomas Roddick founded the Canadian Medical Act, which established national standardized medical licensing procedures.[51] However, it was not until much later in 1954 that the College of General Practice of Canada was founded with 400 members, though in 1967 it changed its name to the one that still persists to date, the College of Family Physicians of Canada.[52]

In 1966 the Medical Care Act was legislatively passed by the federal government of Canada. It allowed health insurance to cover physician fees. As such the act required the federal government to provide approximately 50% of hospital and physician expenditures, in addition to the coverage being provided by each provincially based health care system. However, the

formula for the 50% approximation is somewhat more complicated than the stated definitive 50%. Although the act did not prohibit nor prevent provinces from requiring financial healthcare contributions from patients, it was understood that extra charges to patients would formulaically result in a reduction of federal financial support. Fee-for-service continued the to be the main means of physician income.[53] Then in 1984 the Canada Health Act was passed. It provided legislation for public health insurance and prohibited extra billing by physicians, including charging user fees.[53] The 1984 Canada Health Act also required provinces and territories to meet specific criteria to be eligible for federal health transfers via the Canada Health Transfer.[53]

In 1978 the World Health Organization Alma Ata declaration provided a definition for primary health care and acknowledged its existence. However, it was not until 1994 that the Canadian Medical Association (CMA) gave a clear definition for primary care in Canada.[1]

On September 11, 2000 the Government of Canada initiated the Primary Health Care Transition Fund (PHCTF), totalling $800 million, to support all provinces and territories to reform their primary health care system towards a new and efficient means of delivery.[54] The requirement for each of the provinces and territories to receive their PHCTF was that all their reformation initiatives had to meet 1 of 5 objectives[54]:

1. to increase the proportion of the population with access to primary health care organizations which are accountable for the planned provision of comprehensive services to a defined population;
2. to increase the emphasis on health promotion, disease and injury prevention, and chronic disease management;
3. to expand 24/7 access to essential services;
4. to establish multi-disciplinary teams, so that the most appropriate care is provided by the most appropriate provider; and
5. to facilitate coordination with other health services (such as specialists and hospitals).[55]

It is during this period that one can further identify the Federal Government's growing interest and focus on primary care; through its PHCTF initiative. Soon after initiating the PHCTF, both the Canadian Romanow Commission[56] in 2002 and then the First Minister's Accord[57] in 2003 began adopting and promoting the PHCTFs 5 objectives, which included emphasis upon patient-centered care and Electronic Medical Record Systems (EMRS)[58]

In 2009 the patient-centered medical home, a concept initially developed in the U.S.A, was considered by the College of Family Physicians of Canada (CFPC). Specifically, the CFPC, invited input on adopting the model in Canada and subsequently yielded a discussion paper[9].[9, 58] At the Canadian health care system (organizational) level, the patient-centered medical home is what had begun being predominantly being promoted by the CFPC.[9, 59]

2.2 PATIENT-CENTERED PRIMARY CARE

2.2.1 Patient-Centered Care

Patient-centered care (PCC) has been identified in many ways throughout literature.[46, 60, 61] In the broad sense it can encompass the concept that systems and policies protect the health of patients as a collective[62], to fundamental components such as the best care a patient can receive, respect for patients values, as well as good comprehensible communication directly with the patient[63].

The concept of PCC is believed to have been initially conceived by the U.S.A. humanistic psychologist Carl Rogers in the late 1940s as "client-centered therapy".[64-66] It was not until the late 1950s that psychoanalyst Michael Balint began promoting the concept in the medical field, renaming it to patient-centered care.[67-69] In the late 1960s in Canada, physician Ian McWhinney took over as chairperson of the Family Medicine department at the University of Western Ontario. Research-wise Dr. McWhinney "set the stage for explorations of the breadth of all patient problems. Whether physical, social, or psychological, and the depth" (page4).[46] Then beginning in the late 1970s in Canada, Dr. McWhinney's Ph.D. student, Moira Stewart, began conducting research focusing on the physician-patient relationship and subsequently the greater PCC concept.[46] World-wide, it was in the 1980s that PCC first began being implemented in medical education and research.[46] According to Stewart et al[46] it was in the 1990s that research focusing on PCC in a clinical context began "exploding". The PCC studies globally during that decade were focusing on the patient satisfaction and desire for PCC, as well as positive outcomes resulting from PCC implementation.[46] By the 2000s PCC formed the clinical core of many undergraduate and graduate level medical training curricula worldwide.[46]

At present numerous definitions, as well as conceptual means of measuring PCC exist.[70] The Institute of Medicine (IOM) is a not-for-profit and non-governmental organization recognized and promoted by the U.S. Department of Health and Human Services' Agency for

Healthcare Research and Quality.[71] The IOM's definition of PCC is the one predominantly used: "[H]ealth care that establishes a partnership among practitioners, patients, and their families (when appropriate) to ensure that decisions respect patients' wants, needs, and preferences and that patients have the education and support they need to make decisions and participate in their own care" (page 7).[15] The IOM considers PCC a core component of quality of care.[72] The Canadian Medical Association's (CMA) consideration of PCC is reflected in the first principle of its CMA Code of Ethics[73]. The CMA's[74] definition of PCC is adopted from the Institute of Healthcare Improvement's definition, which is more specific than that provided by the IOM:

> Care that is truly patient-centred considers patients' cultural traditions, their personal preferences and values, their family situations, and their lifestyles. It makes patients and their loved ones an integral part of the care team who collaborate with health care professionals in making clinical decisions.
>
> Patient-centred care puts responsibility for important aspects of self-care and monitoring in patients' hands – along with the tools and support they need to carry out that responsibility.
>
> Patient-centred care ensures that transitions between providers, departments, and health care settings are respectful, coordinated, and efficient. (page 1)[74]

This latter definition of PCC will be used in this thesis, including in the exploration of the importance of PCC in the context of the healthcare system.

2.2.2 Importance of Patient-Centered Primary Care in the Healthcare System

With respect to quality of care, the term has many definitions and various conceptual components of its own.[75, 76] Irrespective, patient-centeredness is considered a key component of quality of care.[22, 71, 72] According to the College of Family Physicians of Canada, the patient-centered medical home model (PCMH) has been proposed to improve quality of care via the implementation of its 7 parameters:

1. patients have a personal family physician who provides and directs their medical care;
2. care is for the patient as a whole;
3. care is coordinated, continuous and comprehensive with patients having access to an inter-professional team;
4. there is enhanced access for appointments;

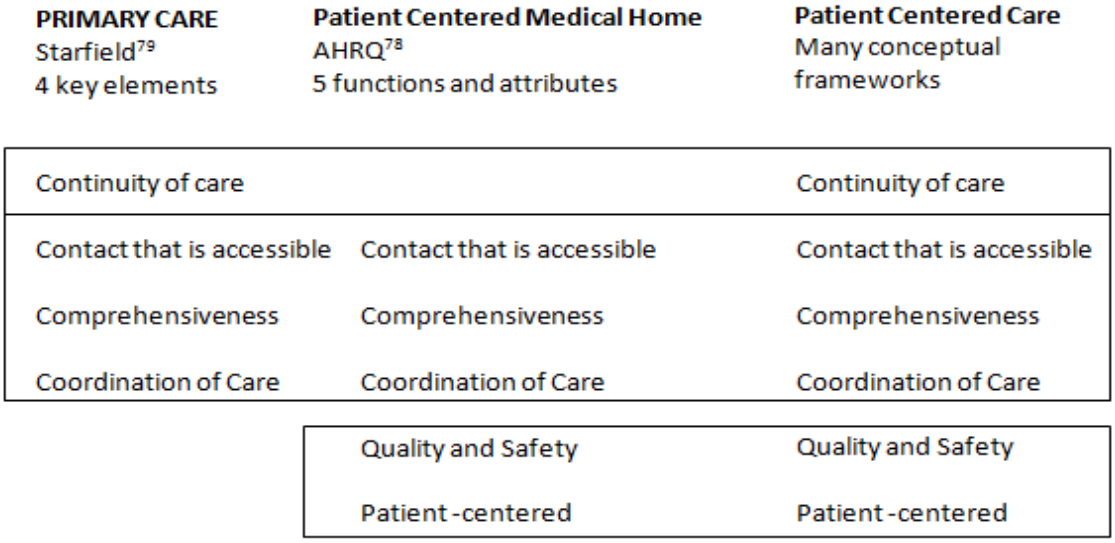
5. the practice includes well-supported information technology, including an electronic medical record;
6. remuneration supports the model of care;
7. quality improvement and patient safety. (page 3)[9, 77]

Furthermore, according to the U.S. Department of Health and Human Services' Agency for Healthcare Research and Quality[78], and further supported by the Patient-Centered Primary Care Collaborative[77], the PCMH consists of 5 functions and attributes:

1. Comprehensive care,
2. Patient-centeredness,
3. Coordinated care,
4. Accessible services,
5. Quality and Safety.[77, 78]

From outlining these 7 parameters from the College of Family Physicians of Canada as well as 5 functions and attributes from the U.S.A. it is clear that the PCMH model acts as a medium for both primary care and patient-centered care to be jointly implemented (see Figure 2.1). Specifically of the CFPC's[9] 7 parameters of the PCMH, the first 5 parameters (1. "patients have a personal family physician who provides and directs their medical care", 2. "care is for the patient as a whole", 3. "care is coordinated, continuous and comprehensive with patients having access to an inter-professional team". 4. "there is enhanced access for appointments", and 5. "the practice includes well-supported information technology, including an electronic medical record")[9] overlap with Starfield's[79] 4 elements of primary care (1. continuity of care, 2. contact that is accessible, 3. comprehensiveness, 4. coordination of care)[79], which both together overlap with the various dimensions of patient-centered care cited in literature. Additionally, the College of Family Physicians of Canada's[9] last 2 parameters of the PCMH model (6. "remuneration supports the model of care" and 7. "quality improvement and patient safety")[9] overlap with the various dimensions of PCC cited in literature.

Figure 2.1. Patient Centered Medical Home 5 functions and attributes, overlaps jointly with primary care and patient-centered care



Several studies have focussed on assessing the impact of the PCMH model. Specifically, the PCMH model was evaluated by Calmanet al[22] via a retrospective study consisting of 8 sites between 2003 to 2011, with PCMH standing granted by the National Committee for Quality Assurance. Calman et al[22] were able to support that "PCMH implementation has the potential to alter process of care and improve outcomes of care, especially among patients with higher disease burden" (page S68).[22] In addition to improved care, Collins et al[80] identified that the PCMH also significantly reduces costs, whereby a Medicaid coordinated program had saved approximately $1 billion over 4 years of PCMH implementation. Another coordinated PCMH implementing program had an approximate 28% reduction in hospital admissions by Medicaid covered patients and 38% reduction by commercially insured patients.[80] This reinforces why implementing PCC in primary care settings via the PCMH model is viewed as being important for the health care system. While there are some studies that have supported negative results[81-83], this conflicting evidence is to be expected as the PCMH is still a relatively new concept[22] and data saturation has not been reached.[82, 84]

PCC can also improve quality of care parameters in the clinic. Specifically, reducing the chance of misdiagnosis as a result of poor communication[85], improved patient adherence to medication regimens[86], improved patient emotional health[87], and decreased patient symptom discomfort[87, 88] to state a few. Furthermore, PCC can also reduce costs to the health care system;

such as, reducing the number of diagnostic tests and referrals[87, 88] and reducing health care system overuse and thus health care system overload[89], amidst other benefits. Therefore when considering improved patient outcome and satisfaction, particularly during PCC implementation in primary care clinics, the importance of patient-centered care at the clinical level of the health care system becomes evident.[71]

2.2.3 Evaluating Patient-Centered Primary Care

There have been several conceptual frameworks proposed for PCC that have a great deal of overlap. These frameworks are described in Table 2.1. In order to assess the benefits as well as potential barriers and facilitators of patient-centered primary care (PCPC), more work is needed to determine which framework would be the most appropriate for evaluation.

Table 2.1 Key patient-centered care conceptual frameworks

Author	Year proposed	Conceptual Framework	
		number of dimensions	dimensions
Pieters[90] (unpublished)	1987	4	-"clarifying the reason for patients attendance" -"making the reason explicit" -finding a common ground for problem formulation -finding a common ground for the management plan
Verhaak[91]	1988	2	-patient involvement in diagnostic decisions -patient involvement in treatment decisions
Stewart et al[92]	1995	6	-both the disease and illness experience -whole person care -common ground between the clinician and patient -preventative medicine and health promotion -improving the patient-physician relationship

Author	Year proposed	Conceptual Framework	
		number of dimensions	dimensions
			-being practically realistic in allocating resources
Laine and Davidoff[60]	1996	3	-shared medical decision making -the physician-patient relationship -disclosure of information to patient (sharing of information)
Farmer and Prideaux[93] (unpublished). Cited in Winefield et al[94]	1995 (cited 1996)	5	-"soliciting the patients views" -responding to the patients views -relating explanations to those views -involving the patient in decision making -"checking the patients understanding"
Mead and Bower[95]	2000	5	-“BioPsychosocial perspective” -“treating the patient as a person” -“sharing power and responsibility” -“therapeutic alliance between patient and physician” -“the physician as a person”
Netherlands Institute of Primary Healthcare (NIVEL)'s Euro-communication scale. Cited in Mead and Bower[95]	(cited 2000)	5	-involving the patient in defining the problem -involving the patient in decision making -identifying patient cues -"exploring patient ambivalence" -overall patient responsiveness
Ogden et al[96]	2002	4	-physician receptiveness to patient -“patients involvement” -“the affective content of the relationship” -“information giving” (sharing information)

Author	Year proposed	Conceptual Framework	
		number of dimensions	dimensions
Epstein et al[97]	2005	3	-"provide care that is concordant with the patient's values, needs and preferences" -allows patients to provide input regarding their care, -allows patients to actively participate in decision making
U.S. Department of Health and Human Services' Agency for Healthcare Research and Quality	2010	4	-patient as a unique person over focusing on -illness -therapeutic alliance -providers perspectives
Hudon et al[98]	2011	4	-"disease and illness experience (patient as a person)" -whole person (BioPsychSocial perspective)" -"common ground (sharing power and responsibility)" -"the patient-doctor relationship (therapeutic alliance)"

There are various methodological approaches to measuring PCPC, with the two most popular being (1) self-assessment of the encounter either by the patient or the physician, and (2) direct observation of a physician-patient encounter.[97]

In regard to patients providing perspectives on PCC, several studies support that patient's perspectives of PCC are more effective compared to either physicians' perspectives and direct external observations.[46, 87, 88, 99] A consensus among Canadian experts in primary care supports that the best measure to evaluate PCC are patient administered questionnaires.[100]

In regard to physicians providing self-reported scales on PCC, Mead and Bower[95] defend their approach by stating that researchers should be concerned about social desirability bias. Social desirability bias occurs when the respondent is in a situation where they have a tendency to provide answers that will be viewed as favourable by others. Bucks et al[101] and Lynn et al[102]

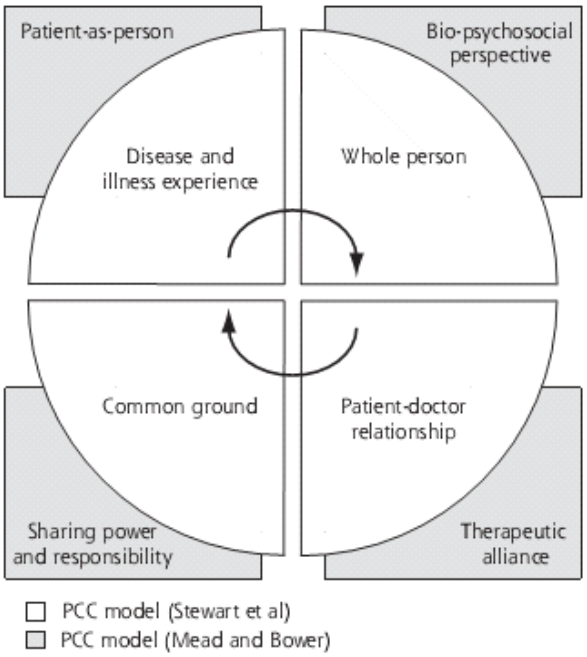
support that such social desirability bias can also occur in physicians, particularly primary care physicians who are increasingly aware of characteristics essential for quality interpersonal care. A self-reported survey on PCPC would be very likely to demonstrate social desirability bias. However, what makes self-reported physician surveys popular amongst researchers collecting data over patient self-reported surveys, according to Mead and Bower[95], is their convenience to administer and feasibility.

Furthermore, Stewart et al[46] support that ideally it is more accurate to assess PCC over a period of time than a single session; as PCC and thus PCPC in actuality is a dynamic relationship over a period of time[98].

2.2.4 Measures for Patient-Centered Primary Care

Hudon et al[98] in their systematic review identified 13 instruments (see Table 2.2), within 26 articles, for measuring PCPC. From their review, they identified that 2 instruments, found in 5 articles, were the most dedicated to assessing PCPC as well as were associated with the best short-term health outcomes. Both instruments assessed the patient's perspective of PCPC using a 4 point Likert scale and are based on the Stewart et al[46] conceptual framework of PCC. See Table 2.2 for a summary of these instruments.

Figure 2.2 A conceptual framework of patient-centered care (Hudon et al 2011[98])



One of the two instruments is the Patient Perception of Patient Centeredness[87, 103], which was actually designed in Canada. It was developed from the Stewart et al[46] model in addition to literature and empirical studies on the physician-patient relationship. The instrument measures 3 out of 4 dimensions of the Hudon et al[98] conceptual framework for PCPC: "disease and illness experience (4 items), whole person (1 item), and "common ground" (9 items)" (page 160).[98] This 14 item survey questionnaire uses a 4 point Likert scale. The Cronbach's α (a measure of internal consistency) for the instruments global score was 0.71, which is considered strong.[98]

The other instrument is the Consultation Care Measure[88, 104, 105] and was designed in England. It was developed from the Stewart et al[46] model in addition to literature and empirical studies on the physician-patient relationship, as well as patient interviews.[46] The instrument measures all 4 dimensions of the Hudonet al[98] conceptual framework for PCPC: "disease and illness experience (6 items),whole person (2 items), common ground (9 items), and patient-doctor relationship (1 item)"[98] This 21 item survey questionnaire also uses a 4 point Likert scale. The Cronbach's α reliability for the instruments global score ranged from 0.84 to 0.96; with the range being the a result of the subscales in the instrument.[98]

These key instruments for measuring PCPC (see Table 2.2), as implemented in previous studies provided a good milieu to understand how such instruments capture PCPC. Furthermore, Hudon et al[98] demonstrated that more ideal instruments, such as the Patient Perception of Patient Centeredness and Consultation Care Measure, assessed the patient's perspective of PCPC as opposed to the clinicians perspective or a third person's perspective. Hudon et al's[98] systematic review, however, did not identify an instrument designed for measuring the impact of clinicians using EMRS on patient-centeredness in primary care.

2.3 EMRS AND PCPC

2.3.1 Link between EMRS and PCPC

In 2009, the CFPC began promoting PCPC through the concept of "a medical home".[9] In shifting the medical home towards PCPC, the CFPC[9] identified 7 parameters (1. "patients have a personal family physician who provides and directs their medical care", 2. "care is for the patient as a whole", 3. "care is coordinated, continuous and comprehensive with patients having access to an inter-professional team", 4. "there is enhanced access for appointments", 5. "the practice includes well-supported information technology, including an electronic medical record", 6.

"remuneration supports the model of care", and 7. "quality improvement and patient safety")[9] that needed to be addressed. Notably the 5th parameter was being "well-supported information technology, including an electronic medical record."[9] This parameter clearly supports that EMRS is an essential component in moving the medical setting towards PCPC. In other words, the CFPC[9] are also further emphasizing the important link between providing EMRS at the clinical level as being a key parameter in delivering PCPC to patients. In addition to the CFPC, the U.S. Department of Health and Human Services' Agency for Healthcare Research and Quality also emphasize the "the central role of health [information technology, including EMRS] in successfully operationalizing and implementing the key [parameters] of the medical home."[106] Such that, properly designed and implemented EMRS should be able to provide optimal PCPC.

Furthermore, the Ontario Medical Association (OMA) produced a policy paper[63] on PCC, incorporating both a practitioner/clinical-level standpoint and an organisational/systems standpoint.[63] With respect to the practitioner/clinical-level standpoint, the policy paper made recommendations for clinicians in the "Principles of Patient-Centered Care for Physicians".[63] The objective of the statement of principles is to make sure that optimal PCC is provided by physicians at the clinical level:

1. The OMA believes that optimal patient care is achieved when accountability for health-care outcomes is shared between physicians and their patients. This is most readily accomplished when their relationship is characterized by mutual respect and trust (from the OMA policy, Accountability in the Health Care Sector).
2. Physicians should share decision-making with patients about all aspects of their health care, including treatment options, risks, benefits, and evidence. For patients with mental health or substance abuse illnesses, physicians may need to augment support in the decision-making process. By default, decisions about care reside with patients.
3. Physicians should endeavour to communicate information about all relevant aspects of health care to their patients in a manner that is comprehensive and comprehensible.

4. To help curtail waste in the system, physicians should endeavour to reduce unnecessary duplication of medical tests and discourage their patients from demanding unnecessary tests.
5. Physicians are patient-centredregarding theirpatients. They should continue to act as advocates for their patients for the resources to meet their health-care needs.
6. Physicians may wish to consider ways to organize their practices so that patients have more convenient access to them. This may occur by same-day appointments, e-mail or telephone communications and may require physicians to undertake an organized effort to reduce backlog and improve access. Use of the [Institute for Health Improvement] "plan, do, study, act" cycle may be beneficial. Physicians should read the Canadian Medical Protective Association's publication, "using email communication with your patients: legal risks," available from: www.cmpa-acpm.a/cmpapd04/docs/resource_files/info sheets/2005/com_is0586-e.cfm before commencing e-mail communications with patients.
7. To facilitate sharing of patient information among physicians and among health sectors, the OMA encourages physicians to avail themselves of opportunities for assistance in obtaining electronic medical records.
8. Physicians should take the leading fostering and promoting compassion and empathy for patients and in promoting behaviours that are patient-centred and positive for patients. This should occur in their own practices including their front office staff, in their health-care teams, and at all stages of the health-care system where they and their patients interact. (page 44)[63]

Amongst the OMA's 8 Principles of PCC for physicians listed above, one principle clearly states that "the OMA encourages physicians to avail themselves of opportunities for assistance in obtaining electronic medical records" (page 44).[63] Again this highlights that properly designed and implemented EMRS conceptually should be able to provide quality patient-centered care in primary care.

2.3.2 Impact of EMRS on Primary Care

Currently studies in general support that EMRS, specifically after sufficient physician-user adoption, improves various elements of primary care; particularly, productivity, patient safety, physician adherence to best practice guidelines, and coordination of care.[107, 108]

Furthermore, when evaluating the impact of EMRS on primary care it is important that the phase of EMRS implementation be taken into consideration: pre-EMRS implementation, EMRS adoption period, and post-EMRS adoption period. During the EMRS adoption period the impact of EMRS is generally supposed to be at its most detrimental phase.[107-111] For, instance if we focus on productivity during the EMRS adoption period, when physicians are in the process of attempting to adjust to the new EMRS they have to work with, Miller et al[110] identified that physicians were taking more time with patients. Subsequently this lead to longer work days and/or fewer patients seen that inevitably resulted in technologically frustrated clinicians with decreased revenue, which in itself lead to financial frustrations by clinicians.[43, 110] Ludwig and Doucette[111] conducted a systematic literature review from which they also identified that physician efficiency during the EMRS adoption period were affected by factors such as graphical interface design quality, functionality of features, the management of the project, and previous experience with EMRS. Furthermore, it is important to note when reviewing and conducting studies that the EMRS adoption period itself can take months to years.[107, 108, 110] Thus, when evaluating the impact of EMRS on primary care it is best to focus on the post-EMR adoption period, which according to Lortie et al[112] is arguably after 3 years, because it gives the long-term[112] projection of EMRS impact as opposed to the immediate variable inefficiencies that occur during the EMRS adoption phase.

2.3.2.a. EMRS on Primary Care Productivity

Relatively few studies have focused on the impact of EMRS on productivity.[32, 113-115] For instance, Furukawa[31] conducted a cross-sectional analysis of the 2006 to 2007 National Ambulatory Medical Care Survey. From the survey Furukawa[31] identified that EMRS use by out-patient physicians were generally associated with improved productivity, particularly during visits for new health problems and chronic care management. Specifically, Furukawa's[31] study demonstrated that with EMRS use there was a higher probability of any physical examination (7.7%, 95% C.I. [Confidence Interval] 2.4-13.1), any health education (4.9%, 95% C.I. 0.2-9.6), and during routine visits for a chronic problem more diagnostic/screening services provided per 20 minute period (11.2%, 95% C.I. 5.7-16.8). Cheriff et al[32] studied EMRS implementation productivity between EMRS adopters versus non-adopters over a 6 month period at Weill Cornell Medical College clinical sites. Productivity measures demonstrated a significant improvement in EMRS adopters versus non-adopters for visit volume (8% increase in visit

volume for EMRS adopters, n=119, p<0.0001; versus only 2% increase in visit volume for non-adopters, n=81, p=0.30) and for work relative value units (9% increase for EMRS adopters, n=158.54, p=0.05; versus 4% decrease for non-adopters, n=203.89, p=0.88).

Furthermore, Canada Health Infoway[116] conducted a case-study of 20 Canadian clinics implementing EMRS, 19 of which were primary care practices. Cases from each of the provinces as well as one from the Northwest Territories were included. To be eligible the respective clinic had to have an EMRS for at least 2 years and had to have been using it for charting, clinical decision support, referrals, and prescriptions in addition to billing and scheduling. As expected, during the EMRS adoption phase productivity from the perspective of the physicians generally went down, but eventually over time improved to pre-EMRS levels if not better.[116]

Importantly, there are more published studies comparing the impact of EMRS on productivity that are hospital based than primary-care clinic based. The prevailing theory in the literature, post-EMRS adoption period, is that EMRS improves clinician productivity. However, the impact of EMRS specifically on primary-care clinic productivity is an area that would benefit from further studies.

2.3.2.b. EMRS on Primary Care Patient Safety

EMRS with Clinical Decision Support Software (CDSS) that provides clinical reminders as well as drug-dosing and prescribing should generally aid physicians to provide care for patients with greater safety. For instance, clinical reminders, generally help physicians better adhere to timely routine screening, vaccination, and ordering of disease related tests that would have otherwise been forgotten.[29, 117, 118]

In contrast, a literature review by Bowman[33] highlighted two factors that compromise patient safety with respect to EMRS use itself: (1) physicians who are not able to use EMRS software properly, and (2) EMRS with flawed design and/or functionality. However, specifically in Canada, EMRS vendors need certification from Canada Health Infoway in order to proceed with implementing their EMRS software in hospitals and/or clinics. Thus, for EMRS implementation in Canada, assuming that Canada Health Infoway blocks EMRS with flawed design and functionality from being sold and implemented, clinicians who are not able to use EMRS software properly would be the major factor that compromises patient safety with respect to EMRS use. Hence, these are key factors to consider when reviewing EMRS impact on patient safety in literature.

2.3.2.c. EMRS on Primary Care Best Practice Guideline Adherence

EMRS with CDSS clinical reminders, should also aid physicians in managing patients by providing clinical reminder prompts (e.g. ordering certain lab tests, conducting certain exams, etc.) based on best practice guidelines that may be otherwise forgotten.[29] In doing so it generally helps physicians to adhere to best practice guidelines, so as to provide optimal screening, vaccination, and disease management.[29, 119, 120]

A systematic review by Shojania et al[34], consisting of published articles between 1950 and 2008, identified that out of 28 studies CDSS clinical reminders at point-of-care generally improved clinician adherence by a median of 4.2% (Inter-Quartile Range [IQR] 0.8%-18.8%) across process outcomes for medication ordering (3.3%, IQR 0.5%-10.6%), vaccinations (3.8%, IQR 0.5%-6.6%), and test ordering (3.8%, IQR 3.0%-28.0%). However, these effects are below a clinically important threshold. Subsequently, a systematic review by Holroyd-Leduc[121] consisting of published articles between 1998 and 2010 within primary-care identified one study, by Keyhani et al[122], which demonstrated that CDSS clinical reminders improved guideline adherence when managing diabetic and hypertensive patients with an association (Odds Ratio [O.R.] 2.58, 95% C.I., 1.22-5.42) on ACE/ARB therapy; while there was no association for ischemic heart disease patients on aspirin therapy, ischemic heart disease patients on beta blocker therapy, as well as asthmatic patients on steroid therapy. Notably the Keyhani et al[122] study did not identify at which phase of EMRS implementation their data was obtained, especially if the majority of which was during the relatively detrimental adoption phase. Lastly, a Cochrane Collaboration systematic review by Arditi et al[123], consisting of articles between 1946 to 2012, identified that out of 32 studies computer-generated/CDSS reminders that were specifically printed-out to be delivered by paper improved guideline adherence by median 11.2% (6.5% to 19.6%) across process outcomes for medication ordering, vaccinations, and discussing certain issues with patients. This supports the commonly accepted theory that post-EMRS adoption phase, EMRS CDSS clinical reminders help clinicians to adhere to best practice guidelines.

2.3.2.d. EMRS on Primary Care Coordination of Care

The definition for coordination of care varies in literature; such that, McDonald et al[124] conducted a systematic review that identified over 40 definitions for coordination of care. The

researchers[124] proceeded to intentionally develop a broad definition for coordination of care, so as to capture the major elements of the various definitions:

> Care coordination is the deliberate organization of patient care activities between two or more participants (including the patient) involved in a patient's care to facilitate the appropriate delivery of health care services. Organizing care involves the marshalling of personnel and other resources needed to carry out all required patient care activities and is often managed by the exchange of information among participants responsible for different aspects of care. (page 41)[124]

McDonald et al's[124] definition of coordination of care is what will be used in this thesis.

O'Malley et al[125] conducted a qualitative study from which they identified that EMRS is beneficial for coordination of care within EMRS linked practices, but not very beneficial across practices. The key factor for O'Malley et al's[125] findings being that EMRS within clinics allowed for data to be available when clinicians were making decisions in real-time (at the point-of-care) with patients; whereas, when EMRS were not linked across practices useful data was not available in real-time for real-time decision making. McDonald et al[126] went on to propose that when it comes to measuring care coordination using EMRS, that documentation and information transmission are measurable items; whereas, aspects such as interpersonal communication outside EMRS and supporting factors for clinicians, which are both also impact coordination of care even during EMRS use, will be difficult to account for quantitatively. Furthermore, O'Malley et al[126] go on to identify that EMRS is a linear point-in-time structured design, while coordination of care is a process that is dynamic; such that, the difficulty for studies will be to identify more dynamic coordination of care by point-in-time EMRS data capture measures.

In present literature it is generally supported in theory that EMRS, via linking clinicians as well as allied health practitioners (e.g. pharmacists, physiotherapists, etc), provides the ability to improve real-time communication and in doing so improves coordination of care.[9, 125-127] Furthermore, as previously discussed, at the organizational/system level EMRS facilitates improved PCPC by enabling patients to receive better linguistically and culturally attuned care, where and when they need it, by improved care coordination.[9, 10]

Therefore for EMRS, post-EMRS adoption phase, as it is commonly supported based on quantifiable measures, improves care coordination amongst EMRS linked practices including in primary care settings.

2.3.2.e. EMRS on Primary Care Other Benefits

The other conveniences that EMRS offers is that it is available to users on all days at all hours especially when a patients primary care clinic may be closed, it is accessible to multiple users simultaneously, it should be accessible from remote locations, and it is clear and legible presuming the information is typed.[128]

2.3.2.f. EMRS on Primary Care Drawbacks

Clinicians who are not well-accustomed to their respective EMRS can experience worsened satisfaction although this can also be due to software-interfaces that do not match work-flow.[129] El-Kareh[130] as well as Fernandopulle and Patel[131] demonstrated that physicians who enter notes via a keyboard during the clinical interview diminished face-to-face patient care.[129] Both studies, however, were conducted during the EMRS adoption phase (both less than 3 years[112]) which may explain the degree of diminished face-to-face patient care. O'Malley et al[132] in addressing the reduced face-to-face patient care during the EMRS adoption phase, further suggest that "policies promoting EMRS adoption should consider incorporating physician-patient communication-skills training for medical trainees and clinicians using EMRs" (page 1).[132] In doing so they[132] suggested that poor physician EMRS use/skills during the EMRS adoption phase accounts for the degree of reduced face-to-face time.

Additional issues not necessarily limited to adoption issues are EMRS incompatibility between or within clinics which hinders access and transfer of information[125, 129], EMRS causing reduced work-flow[129, 133], a growing body of literature suggesting that EMRS "screen gazing" focuses attention away from the patient and potentially detracts from the clinicians ability to provide care that is more patient-centered[134-136], compared to paper and pen EMRS use reduced physician gaze at the patient more[134], EMRS use in managing depression patients with three or more chronic conditions is associated with significantly decreasing the odds of depressed patients receiving treatment[137], the initial financial investment of a clinic for EMRS that puts it in a position of increased financial risk[110, 129, 138, 139], etc. Krist et al.[140] go on to demonstrate that EMRS functionality needs to better support primary care.

Vendor certifiers and heath care organizations are hoping that such issues, including issues not necessarily limited to EMRS adoption, will be diminished and preferably alleviated with improved EMRS and hardware-clinician interface technology, in addition to overall improved clinician user-ability of EMRS.[141-144]

2.4 Summary and Research Questions

While there has been a great deal of work on measuring performance of both patient-centered care and EMRS, the impact of EMRS on patient-centered care has relatively largely been conducted in non-primary care settings. Present literature and professional health bodies predominantly support the hypothesis that EMRS implementation should facilitate PCPC; however, insufficient work[22, 145] has focussed on investigating whether this is true in actual practice. Notably, studies by Nutting et al[146] as well as Fernandopoulle and Patel[131] demonstrate that EMRS implementation may be detrimental to the patient-centered medical home; however, these studies assessed EMRS implementation during the adoption phase.[112] The patient-centered medical home model, which jointly consists of patient-centered care and primary care (see Figure 1) and promotes EMRS implementation to facilitate it, is fairly new and also requires further investigation to adequately identify its impact in actual practice.[8, 9, 63, 106]

Puentes et al[147] and Kjeldmand et al[148] argue that the main conceptual frameworks of PCC are designed to "evaluate physicians' self-perceived degree of patient-centeredness"[147]. Specifically the frameworks were not initially designed to evaluate the physician's self-perceived degree of patient-centeredness as a result of using EMRS.[147] This is an important issue as EMRS are considered to be essential to PCPC implementation. Through the implementation of EMRS in Canada a unique opportunity exists to assess EMRS impact on PCPC.

This thesis will address the following research questions:

1. What is the optimal conceptual framework for PCPC that can be used to evaluate the impact of EMRS on PCPC?
2. Which elements of a screening survey can be used to provide relevant information to assess how EMRS impacts PCPC?
3. To what extent do elements of a screening survey provide information to assess how EMRS impact PCPC?

3.0 METHODS

3.1 STUDY DESIGN

To best meet the study objectives, a mixed methods exploratory sequential study[149] was conducted. The initial qualitative component is a literature review that focuses on **(objective 1)** identifying the optimal conceptual framework for PCPC that can be used to evaluate the impact of EMRS on PCPC. The selected conceptual framework for PCPC will then be used to guide the analyses of secondary quantitative data provided by a national self-reported screening survey. Specifically, the data analysis of the quantitative component will **(objective 2)** evaluate what elements of a screening survey provides relevant information to assess how EMRS impact PCPC, and **(objective 3)** to evaluate to what extent the elements in the survey provides adequate information to assess how EMRS impact PCPC (**objectives 2 – 3**). This study was approved by the St. Mary's Hospital (McGill University) Institutional Review Board.

3.2 SITES AND PARTICIPANTS

The main source of data for the quantitative analysis came from Canada Health Infoway (CHI). CHI conducted a national cross-sectional self-reported survey for the study entitled "The EMR Physician Value Study: The Impact of Mature Electronic Medical Record implementations on productivity, operational efficiencies and clinical functionalities in Canadian primary care settings."[112] CHI identified several pools of candidate primary care practices, EMRS vendors, and EMRS program offices in several provinces. This resulted in a total of 132 clinics from across Canada being selected to receive the survey, with at least one clinic from each province and territory.[112]

Of the 132 clinics, 62 clinics declined to participate, mostly citing time constraints, only 70 clinics agreed to complete the survey. The sample size selected in the main study[112] was set to ensure adequate power for the statistical analyses. At least one family medicine physician was surveyed at each clinic. The clinics themselves had implemented EMRS for at minimum 1 year and 2 months, and on average 5 years and 11 months.[112]

3.3 QUALITATIVE: DATA COLLECTION & ANALYSIS

3.3.1 Data Collection

To identify patient-centered care conceptual frameworks a literature review was conducted with searches in MEDLINE (Ovid) and Embase (Ovid) from 1996 to December 2014 for English articles. The searches consisted of the following combination of terms: EMRS (intervention), patient-centered care (outcome), and primary care (setting). To identify and remove duplicates articles, EndNote X6 reference manager was used and duplicate articles were identified by the reference manager's "find duplicates" tab, and then manually removed/deleted.

3.3.2 Data Analysis

In the first step, the numbers of citations for each identified framework were counted. This was used to identify the most highly cited conceptual framework for patient-centered care. Then subsequent frameworks that were based on the most cited framework were evaluated for appropriateness, with articles screened based on title and abstract. After identifying a conceptual framework for patient-centered primary care that can evaluate the impact of EMRS on PCPC **(objective 1)**, this framework was used to determine which elements of the survey would be retained to address the remaining thesis objectives.

3.4 QUANTITATIVE: DATA COLLECTION & ANALYSIS

3.4.1 The Canada Health Infoway National Screening Survey

The quantitative component used secondary data from the Canada Health Infoway (CHI)'s national screening survey[112]. The CHI sponsored project was initiated in 2012 through collaboration between McGill University Desautels Faculty of Management, St. Mary's Hospital Research Center, and MEdbASE Research. CHI provided candidate pools of primary care practices across Canada and funding for the project. The goals of the original main project[112] were to (1) "establish an average time required to recover the cost of converting a clinic from paper based records management system to an EMRS (break-even point) and identify the principal levers regulating the cost recovery period", (2) "based on quantitative analysis" describe "the motives behind the conversion to EMRS as well as the clinics' impression of the benefits and shortcomings of the conversion", and (3) "establish the changes in the process brought about in the course of the EMRS implementation and assess their effect on the clinical and financial success" (page 4).[112]

3.4.2 Data Collection

The data for the CHI national cross sectional screening survey was collected after EMRS implementation (see Appendix 1 for a copy of the survey questions under the column items). The survey was conducted either online or through a telephone interview. The questions were developed from previously validated questionnaires[150, 151] that attempted to identify user satisfaction, EMRS functionality, patient care, and practice efficiency. The aim of the main study[112] was to identify whether 8 specific EMRS features were used based on yes/no responses. In addition, respondents were provided with a statement that gauged the impact of different aspects of the implementation of the EMRS (e.g. "With the EMRS, I am better able to monitor patient progress"). From the CHI national screening survey only 20 questions were identified as potential "EMRS impact statements." The other screening survey questions evaluated the existence of specific EMRS features (17 questions) and clinical characteristics (8 questions), as such they were eliminated (25 questions in total eliminated). The physicians responded to these twenty "EMRS impact statements" using a Likert scale of 0 which corresponded to "strongly disagree", to 4 which corresponded to "strongly agree" (see Appendix 1 for CHI screening survey data on physician agreement under the "frequency of answers by category" columns).

3.4.3 Data Analysis

3.4.3.a. *Identifying PCPC Positive EMRS Impact Statements* **(objective 2)**

To identify the patient-centeredness of EMRS impact statements in primary care, each of the EMRS impact statements underwent a process of variable matching. First each EMRS impact statement was evaluated for relevance to each of the dimensions of PCPC identified from the framework identified in objective 1 using Likert scores from 0 ("not relevant") to 4 ("strongly relevant") (see Appendix 3 for variable matching relevance scores). The Likert score was done first by me, an individual with practical clinical EMRS experience, and supporting literature was included for each score that was greater than 0. This rating was then validated by two health information technology experts (Isabelle Vedel, M.D., Ph.D. and Gillian Bartlett Ph.D.). Each EMRS impact statement was scored for every dimension of the identified framework. For example, if the patient-centered primary care conceptual framework identified had 3 dimensions, each EMRS impact statement would have a possible score 0 to 4 for each dimension (e.g. if the statement was rank 4 for all three dimensions, the total score for the impact statement would be 12). Thus, EMRS impact statements with a score greater than 0 on at least one PCPC dimension

were identified as PCPC positive, and were thus identified as having a potential degree of impact on PCPC.

3.4.3.b. *Degree of patient-centeredness in primary care: PCPC impact score* **(objective 3)**

To capture how well each EMRS impact statement covered the dimension(s) of the PCPC conceptual framework, the PCPC impact score (%) was calculated. Using the EMRS impact statement relevance scoring from the previous section, for each EMRS impact statement the scores were summed across the dimension(s) identified through the conceptual framework. This sum was then divided by the maximum possible score attainable per EMRS impact statement (e.g. 4 x the number of PCPC dimensions used by the framework; so if there were 5 dimensions the maximum possible score would be 20). The summed score was multiplied by 100 to provide a percentage value for the respective EMRS impact statement's PCPC impact score. The closer the EMRS impact statement's PCPC score is to 100%, the more accurately the EMRS impact statement itself measures PCPC (see Figure 3.1).

Figure 3.1 Patient-centered primary care (PCPC) impact score (%) formula

PCPC impact score (%) =

$$\frac{(w + x + y + z + \text{etc. PCPC dimensions})}{(\text{total \#PCPC dimensions} \times \text{maximum Likert score of 4 per PCPC dimension})} \times \frac{\text{\# PCPC dimensions covered}}{\text{total \# possible PCPC dimensions}} \times 100\%$$

NOTE: w, x, y, z are variable matching Likert values (0 "strongly not relevant" to 4 "strongly relevant")

Notably, the PCPC impact score can thus also be used to identify how well an EMRS impact statement (e.g. "EMRS reduces the risk of making errors") supports its impact on patient-centeredness in primary care. Notably, EMRS impact statements with a PCPC impact score greater than 0% can also be used to identify which of the EMRS impact statements are PCPC positive **(objective 2)**.

3.4.3.c. *Physician Agreement of EMRS Impacts Statements, Relative to the Statement's Patient-centeredness of that Statement in Primary Care (PCPC Impact Score)* **(objective 3)**

After the expert consensus on how well the survey statements measured PCPC, the actual physician agreement responses for the survey were evaluated. The degree that each respondent was in agreement with the EMRS impact statements that were retained was calculated to quantify the impact of EMRS on PCPC. For example, if an EMRS impact statement scored

highly as impacting PCPC with a large PCPC impact score, and in addition, physicians were in strong agreement on average with that statement; then we expected that aspect of the EMRS to promote PCPC (EMRS impact on PCPC).

In order to calculate the average agreement with the EMRS impact statements, the physician agreement responses were transformed from a (0) to (4) scale to a (-2) to (+2) scale so that -2 would correspond with "strongly disagree" to +2 with "strongly agree". A score of 0 would represent neutral. This was done to facilitate the interpretation of these results (e.g. a negative number would indicate disagreement instead of a low positive number). The percent for the PCPC impact score and the mean of the transformed physician agreement score were multiplied together. This allowed each EMRS impact statement to have a number that was respectively associated with the degree of PCPC for that statement as well as whether or not physicians were in agreement with a statement. As such, a resulting large negative number for a given aspect of EMRS would indicate a high measure of PCPC that physicians are in strong disagreement with (i.e. therefore worsening the impact of PCPC). While a large positive number would be an aspect of EMRS that is strongly PCPC as well as highly endorsed by physicians, and thus would have a strong positive impact on PCPC. This enabled the study to identify what aspects of EMRS examined by the CHI national screening survey had a positive or negative impact on PCPC, as well as their overall impact on PCPC.

3.3.4 Statistical Analysis

General descriptive statistics were produced to describe responses in the CHI National screening survey and the patient-centeredness in primary care of the EMRS statements. For the PCPC impact score produced from variable matching, the mean Likert value per PCPC dimension and the mean PCPC dimension distribution (%) were estimated. For the Canada Health Infoway national screening survey descriptive statistics, the Likert scores of 0 to 4 capturing physician agreement were assessed for frequency of answers per Likert value, mean frequency of physician agreement per EMRS impact statement, and the respective standard deviation. For the resulting values from combining physician agreement of EMRS impact statements and PCPC impact score; descriptive statistics for the overall mean and standard deviation were provided in addition to the standard deviation. Bivariate analysis was conducted for evaluating the association between physician agreement of EMRS impact statements and PCPC impact score (%).

3.5 SUMMARY

A summary of the study objectives, data sources, and analytic focus are provided in Table 3.1.

Table 3.1 Objectives, Data source, Analytic focus

*Abbreviations: Patient-centered primary care (*PCPC*)*
*Electronic Medical Record Systems (*EMRS*)*

	OBJECTIVE	DATA SOURCE	ANALYTIC FOCUS
1	To identify a conceptual framework for PCPC that will evaluate the impact of EMRS on PCPC	Ovid (MEDLINE), Ovid (Embase)	Examining conceptual frameworks for PCPC
2	To evaluate what elements of a screening survey provides relevant information to assess how EMRS impact PCPC	Canada Health Infoway national screening survey	Rating EMRS impact statements on dimensions of PCPC.
3	To evaluate to what extent elements of a screening survey provides adequate information to assess how EMRS impact PCPC	Canada Health Infoway national screening survey	Using physicians' agreement to assess the degree that relevant EMRS impact statements affect patient-centeredness in primary care.

4.0 RESULTS

4.1 IDENTIFYING CONCEPTUAL FRAMEWORK FOR PCPC (objective 1)

The literature search in MEDLINE (Ovid) and Embase (Ovid) from 1996 to February 2014 for English articles with the combination of concepts of EMRS (intervention), patient-centered care (outcome), and primary care (outcome) yielded 960 and 951 articles for each database respectively (see Appendix 2 for Ovid literature searches). Stewart et al[92] had the most highly cited patient-centered care (PCC) conceptual framework in literature.[88, 95, 152] Mead and Bower[95] in their systematic review identified that the Stewart et al[92] had not only the most highly cited PCC conceptual framework, but also the most comprehensive. The Stewart et al[46] framework consists of 6 dimensions: (1) a combination of the disease and illness experience, (2) "understanding the whole person", (3) common ground between the clinician and patient,(4) "preventative medicine and health promotion", (5) improving the patient-physician relationship, and (6) being practically realistic in allocating resources.[46] After the 1995 Stewart et al[92] framework, Mead and Bower[95] in 2000 conducted a systematic review which included a revision and condensation of the Stewart et al[92] framework into a 5 dimension model that included: "(1) biopsychosocial perspective, (2) treating the patient as a person, (3) sharing power and responsibility, (4) therapeutic alliance between patient and physician, and (5) the [physician] as a person" (page 1087).[95] More recently in 2011, with greater emphasis on patient-centered care in primary care, Hudon et al[98] conducted another systematic review taking into account both the Stewart et al[46] framework and the Mead and Bower[95] framework, and further condensing the dimensions by exclusively focusing on those that were common between the two: "(1) disease and illness experience (patient as a person), (2) whole person (biopsychosocial perspective), (3) common ground (sharing power and responsibility) and (4) the patient-doctor relationship (therapeutic alliance)."[98] This framework was retained as the patient-centered primary care (PCPC) conceptual framework to address the remaining objectives of the thesis.[98] For the Hudon et al[98] patient-centered care conceptual framework in primary care see Figure 2.2 in the literature review section.

4.2 DESCRIPTIVE RESULTS

Based on the selection criteria used in the larger "The EMR Physician Value Study: The Impact of Mature Electronic Medical Record implementations on productivity, operational efficiencies and clinical functionalities in Canadian primary care settings"[112] the final study

sample for the Canada Health Infoway (CHI) national screening survey consisted of 48 different clinics out of 70 that initially agreed to participate. Some sites chose not to answer certain EMRS impact statements, resulting in the number of respondents being 44 to 48 for different EMRS impact statements; yielding survey response rates of 66 to 69% (n=70). (see Table 4.1, Appendix 1 for CHI screening survey data)

Table 4.1 Canada Health Infoway National Screening Survey response rate
[Highlighted EMRS impact statements - are those with relevance to patient-centered primary care; PCPC impact score > 0%]

EMRS Impact Statement #		# of Sites Surveyed	Response Rate % (total of 70 sites surveyed)
1	With EMRS, administrative staff at our site are able to finish their work much faster than before	44	63
2	With EMRS, family physicians are able to complete the billing process more efficiently and effectively	44	63
3	With EMRS, I am better able to monitor patient progress	44	63
4	With EMRS, clinicians at our site are able to finish their work much faster than before	44	63
5	Easy to access data from EMRS	45	64
6	Easy to enter data into EMRS	45	64
7	Easy to read text on the computer screen	45	64
8	EMRS decreases the number of laboratory tests	44	63
9	EMRS will make patient care less expensive	44	63

EMRS Impact Statement #		# of Sites Surveyed	Response Rate % (total of 70 sites surveyed)
10	With EMRS, family physicians are better able to bill for each respective patient encounter and associated incentive programs	44	63
11	EMRS eliminates a lot of paperwork for the administrated staff	44	63
12	EMRS eliminates a lot of paperwork for our clinicians	44	63
13	With EMRS, overhead costs are saved	44	63
14	It is confusing to follow the sequence of screens	45	64
15	EMRS improves the quality of medical care received by the patients	44	63
16	EMRS use improves continuity of care and patient access which will decrease his need to visit the Emergency Department	44	63
17	EMRS decreases patient waiting time	44	63
18	EMRS reduces the risk of making errors	44	63
19	Patient information is more confidential with EMRS than our paper records	44	63
20	Is this site part of a new primary care model supported by public funding	48	69

CALCULATIONS

Range	**44 to 48**	**63 to 69**
Mean	**44**	**63**

4.2.1 CHI'S National Screening Survey: Elements that Capture the Impact of EMRS on PCPC

4.2.1.a. The 8 Specific EMRS Features

The use of the 8 EMRS features evaluated by the CHI national screening survey ranged from 6% to 94% (n=17 physicians surveyed). Only 3 of the screening survey's EMRS features were used in at least half of the sites. Details of these features are reported in Table 4.2.

Table 4.2 Percentage of site clinicians using EMRS features (n=17 clinicians per site surveyed)

ADVANCED FEATURES (Assessed)	Mean sites using EMRS feature (%)
Are you able to electronically transfer prescriptions to a pharmacy	94
Electronic referring to specialists	65
Electronic ordering of laboratory tests	59
Electronic receipt of laboratory results integrated into the EMRS (not scanned)	41
Electronic exchange outside practice: patient clinical summaries	24
Electronic exchange outside practice: laboratory and diagnostic tests	18
Electronic prompts about a potential problem with drug dose or drug interaction	12
Electronic prescribing of medication (selection of treatment from EMRS and printing script)	6

4.2.1.b. PCPC Positive EMRS Impact Statements that can capture EMRS impact on PCPC (**objective 2)**

Of the 20 EMRS impact statements, only 11 EMRS impact statements were identified through variable matching as PCPC positive, and thus actually having relevance to PCPC. (see Table 4.3, and details in Table 4.4 and Appendix 3 variable matching) Only 55% (n=20) of the screening survey's potential EMRS impact statements were PCPC positive. Furthermore, if we consider all the questions of the screening survey by also including the 25 excluded questions, then only 24.4% (n=45 total questions in CHI national screening survey) of the screening survey in its entirety actually evaluates EMRS impact on PCPC.

Table 4.3 Patient-centered relevance score per patient-centered primary care (PCPC) dimension and PCPC impact score (%)

[Highlighted EMRS impact statements - are those with relevance to patient-centered primary care; PCPC impact score > 0%]

EMRS Impact statement #		Patient-Centered Relevance Score per Patient-Centered Primary Care Dimension (0 strongly disagree to 4 strongly agree Likert Scale)				TOTAL per EMRS impact statement	Total # of Dimensions	Patient-Centered Primary Care Impact Score (%)
		Whole Person Care [BioPsychoSocial Perspective]	Disease & Illness experience [Patient As A Person]	Common Ground [Sharing Power & Responsibility]	Clinician-Patient relationship [Therapeutic Alliance]			
1	With EMRS, admin staff at our site are able to finish their work much faster than before	0	0	0	0	0	0	0.0
2	With EMRS, family physicians are able to complete the billing process more efficiently and effectively	0	0	0	0	0	0	0.0
3	With EMRS, I am better able to monitor patient progress	0	0	0	1	1	1	1.6
4	With EMRS, clinicians at our site are able to finish their work much faster than before	0	0	0	1	1	1	1.6
5	Easy to access data from EMRS	4	0	0	0	4	1	6.3
6	Easy to enter data into EMRS	0	0	0	3	3	1	4.7
7	Easy to read text on the computer screen	0	0	0	0	0	0	0.0
8	EMRS decreases the number of laboratory tests	0	0	0	1	1	1	1.6

EMRS Impact statement #		Patient-Centered Relevance Score per Patient-Centered Primary Care Dimension (0 strongly disagree to 4 strongly agree Likert Scale)				TOTAL per EMRS impact statement	Total # of Dimensions	Patient-Centered Primary Care Impact Score (%)
		Whole Person Care [BioPsychoSocial Perspective]	Disease & Illness experience [Patient As A Person	Common Ground [Sharing Power & Responsibility]	Clinician-Patient relationship [Therapeutic Alliance]			
9	EMRS will make patient care less expensive	0	0	0	0	0	0	0.0
10	With EMRS, family physicians are better able to bill for each respective patient encounter and associated incentive programs	0	0	0	0	0	0	0.0
11	EMRS eliminates a lot of paperwork for the administrative staff	0	0	0	0	0	0	0.0
12	EMRS eliminates a lot of paperwork for our clinicians	0	0	0	0	0	0	0.0
13	With EMRS, overhead costs are saved	0	0	0	0	0	0	0.0
14	It is confusing to follow the sequence of screens	0	0	0	0	0	0	0.0
15	EMRS improves the quality of medical care received by the patients	4	4	4	4	16	4	100.0
16	EMRS use improves continuity of care and patient access which will decrease his need to visit the Emergency Department	4	0	0	1	5	2	15.6

EMRS Impact statement #		Patient-Centered Relevance Score per Patient-Centered Primary Care Dimension (0 strongly disagree to 4 strongly agree Likert Scale)				TOTAL per EMRS impact statement	Total # of Dimensions	Patient-Centered Primary Care Impact Score (%)
		Whole Person Care [BioPsychoSocial Perspective]	Disease & Illness experience [Patient As A Person	Common Ground [Sharing Power & Responsibility]	Clinician-Patient relationship [Therapeutic Alliance]			
17	EMRS decreases patient waiting time	0	0	0	1	1	1	1.6
18	EMRS reduces the risk of making errors	0	0	0	4	4	1	6.3
19	Patient information is more confidential with EMRS than our paper records	0	0	0	4	4	1	6.3
20	Is this site part of a new primary care model supported by public funding	4	4	4	4	16	4	100.0

CALCULATIONS

All EMRS impact statements

mean 12.3

s.d. 30.2

Only those that evaluate PCPC (PCPC impact score > 0%)

mean 14.5

s.d. 30.3

Table 4.4 Variable matching and relevant articles supporting the validated patient-centered primary care relevance scores

	EMRS impact statements	The 4 Dimensions of Patient-Centered Primary Care (Hudon et al[98])							
		Whole Person Care [BioPsychoSocial Perspective] Includes the full range of difficulties patients have (not just their biomedical problems) [95]		**Disease & Illness experience [Patient As A Person]** "Understanding the patient's as a person"[95], where the physician makes an attempt to illicit the patients experience(s) as a result of having the illness[95]		**Common Ground [Sharing Power & Responsibility]** "Reflect recognition of patients' needs and preferences"[95] (e.g. "Encouraging to patient to voice ideas" [95], "offering collaboration" [95] where shared decisions are made, etc.) [95]		**Clinician-Patient relationship [Therapeutic Alliance]** Enhance or maintain the bond with patient. For instance a good measure would be when the patient understands the relevance and effectiveness of recommendations - hence facilitating treatment goals[95]
		Likert Scale (0 "not relevant" to 4 "strongly relevant")							
1	With EMRS, administrative staff at our site are able to finish their work much faster than before	0 Speed of staff finishing work, is irrelevant to addressing the BioPsychoSocial aspect.		0 Completing billing process efficiently and effectively, is irrelevant to understanding the patient as a person.		0 Speed of staff finishing work, is irrelevant to sharing power and responsibility with the patient.		0 Speed of staff finishing work, is irrelevant to enhancing/maintaining the bond with patients.
2	With EMRS, family physicians are able to complete the billing process more efficiently and effectively	0 Completing billing process efficiently and effectively, is irrelevant to addressing the BioPsychoSocial aspect.		0 Completing billing process efficiently and effectively, is irrelevant to understanding the patient's illness as a person.		0 Completing billing process efficiently and effectively, is irrelevant to sharing power and responsibility with patients.		0 Completing billing process efficiently and effectively, is irrelevant to enhancing/maintaining the bond with patients.
3	With EMRS I am better able to monitor patient progress	0 If the patient's progress included other non biomedical problems then relevance points could have been allotted for this section. However, physicians being better able to monitor patient progress is irrelevant to addressing the BioPsychoSocial aspect		0 For physicians to be better able to monitor patient progress they should in turn be able to better assess/understand the patient's in general; however, this is directly irrelevant do understanding the patient's "illness as a person".		0 If monitoring patient progress incorporated electronic input from the patients for physicians to see then points could have been awarded for this section. However, this is directly irrelevant to sharing power and responsibility with the patient.		1 Presumably if clinicians are better able to monitor patient progress (and the patients are aware of this) then it tends to enhance or at least maintain the bond that they have with patients. -Mainous et al[153] -Goold et al[154] -Clemence et al[155]
4	With EMRS, clinicians at our site are able to finish their work much faster than before	0 With EMRS, clinicians finishing their work much faster than before, is directly irrelevant to addressing the BioPsychoSocial aspect.		0 Theoretically by having clinicians finish their work much faster than before, they could spend more time understanding the patient's illness as a person. However,		0 Theoretically by having clinicians finish their work much faster than before, they could spend more time reflecting the patient's needs and preferences.		0 Presumably when clinicians finish their work faster, they are able to reduce wait times as well as have opportunity to spend more time with patients , which both in turn improves patient

EMRS impact statements	The 4 Dimensions of Patient-Centered Primary Care (Hudon et al[98])						
	Whole Person Care [BioPsychoSocial Perspective] Includes the full range of difficulties patients have (not just their biomedical problems) [95]		**Disease & Illness experience [Patient As A Person]** "Understanding the patient's as a person"[95], where the physician makes an attempt to illicit the patient's experience(s) as a result of having the illness[95]		**Common Ground [Sharing Power & Responsibility]** "Reflect recognition of patients' needs and preferences"[95] (e.g. "Encouraging to patient to voice ideas" [95], "offering collaboration" [95] where shared decisions are made, etc.) [95]		**Clinician-Patient relationship [Therapeutic Alliance]** Enhance or maintain the bond with patient. For instance a good measure would be when the patient understands the relevance and effectiveness of recommendations - hence facilitating treatment goals[95]
	Likert Scale (0 "not relevant" to 4 "strongly relevant")						
			Clinicians finishing work faster than before, is directly irrelevant to addressing the patient as a person.		However, clinicians finishing work faster than before, is directly irrelevant to sharing power and responsibility with the patient.		satisfaction, creating a positive state to build therapeutic alliance on. Additionally, by having clinicians finish their work much faster than before, theoretically allows for physicians to spend more time enhancing or maintaining their bond with the patient. -McMullen and Netland[156] -Moon et al [157] -Khankeh et al[158] -Anderson et al[159]
5 Easy to access data from EMRS (for clinicians & medical staff)	4 Theoretically with easier access to data from EMRS clinicians may have a higher propensity to review other aspects of a patient's care (e.g. physiotherapist, occupational therapist, social worker, nursing staff, nutritionist, home-care providers, psychologist, etc). Such that, there's improved/efficient coordination of care. -O'Malley et al[125] -Brown et al[160] -Jones et al [161]		0 Easy to access data into EMRS, is directly irrelevant to understanding the patient's as a person.		0 Easy to access data into EMRS, is directly irrelevant to sharing power and responsibility with patients.		0 Easy to access data into EMRS, is directly irrelevant to enhancing or maintaining the bond with the patient.

	EMRS impact statements	The 4 Dimensions of Patient-Centered Primary Care (Hudon et al[98])			
		Whole Person Care [BioPsychoSocial Perspective] Includes the full range of difficulties patients have (not just their biomedical problems) [95]	**Disease & Illness experience [Patient As A Person]** "Understanding the patient's as a person"[95], where the physician makes an attempt to illicit the patients experience(s) as a result of having the illness[95]	**Common Ground [Sharing Power & Responsibility]** "Reflect recognition of patients' needs and preferences"[95] (e.g. "Encouraging to patient to voice ideas" [95], "offering collaboration" [95] where shared decisions are made, etc.) [95]	**Clinician-Patient relationship [Therapeutic Alliance]** Enhance or maintain the bond with patient. For instance a good measure would be when the patient understands the relevance and effectiveness of recommendations - hence facilitating treatment goals[95]
		Likert Scale (0 "not relevant" to 4 "strongly relevant")			
6	Easy to enter data into EMRS	0 Easy to enter data into EMRS, is directly irrelevant to addressing the BioPsychoSocial aspect.	0 Easy to enter data into EMRS, is directly irrelevant to understanding the patient's as a person.	0 Easy to enter data into EMRS, is directly irrelevant to sharing power and responsibility with the patient.	3 Easy to enter data into EMRS would presumably help clinicians finish their work faster, as well as be able to have the opportunity to spend more time with patients during medical interviews, which in turn improves patient satisfaction creating a positive state to build therapeutic alliance. -McMullen and Netland[156] -Moon et al [157] -Khankeh et al[158] -Anderson et al[159]
7	Easy to read text on the computer screen	0 Easy to read text on the computer screen, is directly irrelevant to addressing the BioPsychoSocial aspect.	0 Easy to read text on the computer screen, is directly irrelevant to understanding the patient's as a person.	0 Easy to read text on the computer screen, is directly irrelevant to sharing power and responsibility with the patient.	0 Easy to read text on the computer screen, is directly irrelevant to enhancing or maintaining the bond with the patient.
8	EMRS decreases the number of laboratory tests	0 Decreasing the number of laboratory tests, is directly irrelevant to addressing the BioPsychoSocial aspect.	0 Decreasing the number of laboratory tests, is directly irrelevant to understanding the patient's as a person.	0 Decreasing the number of laboratory tests, is directly irrelevant to sharing power and responsibility with the patient.	1 Presumably when clinicians can decrease the number of laboratory tests, it "can" in turn improve patient satisfaction, creating a positive state to build therapeutic alliance on. -Malone[162] -Forsyth and Winarko[163] -Graeber et al[164]

	EMRS impact statements	The 4 Dimensions of Patient-Centered Primary Care (Hudon et al[98])							
		Whole Person Care [BioPsychoS.ocial Perspective] Includes the full range of difficulties patients have (not just their biomedical problems) [95]		**Disease & Illness experience [Patient As A Person]** "Understanding the patient's as a person"[95], where the physician makes an attempt to illicit the patients experience(s) as a result of having the illness[95]		**Common Ground [Sharing Power & Responsibility]** "Reflect recognition of patients' needs and preferences"[95] (e.g. "Encouraging to patient to voice ideas" [95], "offering collaboration" [95] where shared decisions are made, etc.) [95]		**Clinician-Patient relationship [Therapeutic Alliance]** Enhance or maintain the bond with patient. For instance a good measure would be when the patient understands the relevance and effectiveness of recommendations - hence facilitating treatment goals[95]
		Likert Scale (0 "not relevant" to 4 "strongly relevant")							
9	EMRS will make patient care less expensive	0 EMRS making patient care less expensive is directly Irrelevant to addressing the BioPsychoSocial aspect		0 EMRS making patient care less expensive is directly irrelevant to addressing the patient's illness as a person.		0 EMRS making patient care less expensive is directly irrelevant to sharing power and responsibility with the patient.		0 EMRS making patient care less expensive is directly irrelevant to enhancing or maintaining the bond with the patient.
10	With EMRS, family physicians are better able to bill for each respective patient encounter and associated incentive programs	0 Family physicians being better able to bill for each respective patient encounter and associated incentive programs, is directly irrelevant to addressing the BioPsychoSocial aspect.		0 Family physicians being better able to bill for each respective patient encounter and associated incentive programs, is directly irrelevant to addressing the patient's illness as a person.		0 Family physicians being better able to bill for each respective patient encounter and associated incentive programs, is directly irrelevant to sharing power and responsibility with the patient.		0 Family physicians being better able to bill for each respective patient encounter and associated incentive programs, is directly irrelevant to enhancing or maintaining the bond with the patient.
11	EMRS eliminates a lot of paperwork for the administrative staff	0 Eliminating a lot of the paperwork for administrative staff is directly irrelevant to addressing the BioPsychoSocial aspect.		0 Eliminating a lot of the paperwork for administrative staff is directly irrelevant to understanding the patient's illness as a person.		0 Eliminating a lot of the paperwork for administrative staff is directly irrelevant to sharing power and responsibility with the patient.		0 Eliminating a lot of the paperwork for administrative staff is directly irrelevant to enhancing or maintaining the bond with the patient.
12	EMRS eliminates a lot of paperwork for our clinicians	0 Eliminating a lot of the paperwork for clinicians is directly irrelevant to addressing the BioPsychoSocial aspect.		0 Eliminating a lot of paperwork for clinicians could hypothetically allow physicians to have more time in the medical interview to understand the		0 Eliminating a lot of paperwork for clinicians could hypothetically allow physicians to have more time to reflect recognition of patient's needs		0 Eliminating a lot of paperwork for clinicians could hypothetically allow physicians to have more time to enhance or maintain the bond with patient. However, eliminating a lot of the

EMRS impact statements	The 4 Dimensions of Patient-Centered Primary Care (Hudon et al[98])							
	Whole Person Care [BioPsychoS.ocial Perspective] Includes the full range of difficulties patients have (not just their biomedical problems) [95]		**Disease & Illness experience [Patient As A Person]** "Understanding the patient's as a person"[95], where the physician makes an attempt to illicit the patients experience(s) as a result of having the illness[95]		**Common Ground [Sharing Power & Responsibility]** "Reflect recognition of patients' needs and preferences"[95] (e.g. "Encouraging to patient to voice ideas" [95], "offering collaboration" [95] where shared decisions are made, etc.) [95]		**Clinician-Patient relationship [Therapeutic Alliance]** Enhance or maintain the bond with patient. For instance a good measure would be when the patient understands the relevance and effectiveness of recommendations - hence facilitating treatment goals[95]
	Likert Scale (0 "not relevant" to 4 "strongly relevant")							
			patient's illness as a person. However, eliminating a lot of the paperwork for clinicians is directly irrelevant to understand the patient's illness as a person. However, eliminating a lot of the paperwork for clinicians is directly irrelevant to understand the patient's illness as a person.		and preferences, and offer collaboration. However, eliminating a lot of the paperwork for clinicians is directly irrelevant to sharing power and responsibility with the patient.		paperwork for clinicians is directly irrelevant to understand the patient's illness as a person
13 With EMRS, overhead costs are saved	0 Saving overhead costs, is directly irrelevant to addressing the BioPsychoSocial aspect.		0 Saving overhead costs, is directly irrelevant to understanding the patient's illness as a person.		0 Saving overhead costs, is directly irrelevant to sharing power and responsibility with the patient.		0 Saving overhead costs, is directly irrelevant to enhancing or maintaining the bond with the patient.
14 It is confusing to follow the sequence of screens	0 Confusion and difficulty following the sequence of screens is directly irrelevant to the BioPsychoSocial aspect.		0 If the physician is spending too much time on the computer the clinician may not be able to focus more on understand the patient's illness as a person. Confusion and difficulty following the sequence of screens is directly irrelevant to understanding the patient's illness as a person.		0 Confusion and difficulty following the sequence of screens is directly irrelevant to sharing power and responsibility with the patient.		0 Hypothetically if the patient encounter involved the physician appearing confused using the EMRS and in turn the patient felt that they were losing confidence in their physician's abilities; it could hinder the therapeutic alliance. However, confusion and difficulty following the sequence of screens is directly irrelevant to enhancing or maintaining the bond with the patient.

	EMRS impact statements	The 4 Dimensions of Patient-Centered Primary Care (Hudon et al[98])							
		Whole Person Care [BioPsychoSocial Perspective] Includes the full range of difficulties patients have (not just their biomedical problems) [95]		**Disease & Illness experience [Patient As A Person]** "Understanding the patient's as a person"[95], where the physician makes an attempt to illicit the patients experience(s) as a result of having the illness[95]		**Common Ground [Sharing Power & Responsibility]** "Reflect recognition of patients' needs and preferences"[95] (e.g. "Encouraging to patient to voice ideas" [95], "offering collaboration" [95] where shared decisions are made, etc.) [95]		**Clinician-Patient relationship [Therapeutic Alliance]** Enhance or maintain the bond with patient. For instance a good measure would be when the patient understands the relevance and effectiveness of recommendations - hence facilitating treatment goals[95]
		Likert Scale (0 "not relevant" to 4 "strongly relevant")							
15	EMRS improves the quality of medical care received by the patients	4 Quality of care can encompass providing the full range of difficulties patients have. - Saha et al[165] -Committee on Quality of Health Care in America & Institute of Medicine[72]		4 Quality of care can encompass understanding the patient's illness as a person. - Saha et al[165] -Committee on Quality of Health Care in America & Institute of Medicine[72] -Khan et al[166] -Marcum[167]		4 Quality of care can encompass reflecting and preferences. - Saha et al[165] -Committee on Quality of Health Care in America & Institute of Medicine[72]		4 Quality of care can encompass enhancing or maintains the bond with patients. - Saha et al[165] -Committee on Quality of Health Care in America & Institute of Medicine[72]
16	EMRS use improves continuity of care and patient access (to health care); which will decrease his need to visit the Emergency Department [8]	4 Improving continuity of care and patient access (to health care) will (A) improve coordinated care for the patient amongst multidisciplinary providers[9, 168], and (B) decrease the stress the patient experiences subsequently improving the biopsychosocial wellbeing of the patient. -The College of Family Physicians of Canada[9] -Wong et al[168] -Borrell-Carrio[169]		0 Improving continuity of care and patient access (to health care), is irrelevant to understanding the patient's as a person.		0 Improving continuity of care and patient access (to health care), is directly irrelevant to sharing power and responsibility with the patient.		1 Improving continuity of care and patient access to health care, assuming that the patient consistently access the same physician(s), provides physicians the ability to enhance or maintain the bond with the patient. However this variable/question does not directly measure whether or not the bond with patient is enhanced or maintained. -Noyes et al[170] -Nutting et al[146] -Donahue et al[171]
17	EMRS decreases patient waiting time	0 Reducing patient waiting time is directly irrelevant to addressing the BioPsychoSocial aspect.		0 Reducing patient waiting time is directly irrelevant to understanding the patient's illness as a person.		0 Reducing patient waiting time is directly irrelevant to sharing power and responsibility with the patient.		1 Reducing patient waiting time reduces frustration of the patient towards the physician; thus providing a better opportunity for the physician to maintain or enhance the bond, with patient. While, increased

	EMRS impact statements	The 4 Dimensions of Patient-Centered Primary Care (Hudon et al[98])							
		Whole Person Care [BioPsychoSocial Perspective] Includes the full range of difficulties patients have (not just their biomedical problems) [95]		**Disease & Illness experience [Patient As A Person]** "Understanding the patient's as a person"[95], where the physician makes an attempt to illicit the patients experience(s) as a result of having the illness[95]		**Common Ground [Sharing Power & Responsibility]** "Reflect recognition of patients' needs and preferences"[95] (e.g. "Encouraging to patient to voice ideas" [95], "offering collaboration" [95] where shared decisions are made, etc.) [95]		**Clinician-Patient relationship [Therapeutic Alliance]** Enhance or maintain the bond with patient. For instance a good measure would be when the patient understands the relevance and effectiveness of recommendations - hence facilitating treatment goals[95]
		Likert Scale (0 "not relevant" to 4 "strongly relevant")							
								waiting times increases patient frustration towards the physician making it more difficult to maintain or enhance the bond with the patient during the medical interview. -Moon et al [157] -Khankeh et al[158] -Anderson et al[159]
18	EMRS reduces the risk of making errors	0 Reducing the risk of medical errors is directly irrelevant to addressing the BioPsychoSocial aspect.		0 Reducing the risk of medical errors is directly irrelevant to addressing the BioPsychoSocial aspect.		0 Reducing the risk of medical errors is directly irrelevant to sharing power and responsibility with the patient.		4 Reducing medical errors promotes the physician's competence with the patient, which in turn can further facilitate patient trust in the physician's abilities. -Hovey et al[172] -Rathert et al[173] -Rowe et al[174]
19	Patient information is more confidential with EMRS than our paper records	0 Whether patient information is more confidential with EMRS than our paper records, is irrelevant to addressing the BioPsychoSocial aspect.		0 Whether patient information is more confidential with EMRS than our paper records, is irrelevant to understanding the patient's illness as a person.		0 Whether patient information is more confidential with EMRS than our paper records, is irrelevant to sharing power and responsibility.		4 Maintaining confidentiality is an important part of a trusting relationship between patient and physician. Better confidentiality that a physician offers for their patient, the increased trust that forms, and subsequently this should enhance or maintain the bond with the patient. However, this variable aims to discern whether EMRS or paper records are more confidential, and thus does not assess the impact of confidentiality on therapeutic alliance.

EMRS impact statements	The 4 Dimensions of Patient-Centered Primary Care (Hudon et al[98])							
	Whole Person Care [BioPsychoSocial Perspective] Includes the full range of difficulties patients have (not just their biomedical problems) [95]		**Disease & Illness experience [Patient As A Person]** "Understanding the patient's as a person"[95], where the physician makes an attempt to illicit the patients experience(s) as a result of having the illness[95]		**Common Ground [Sharing Power & Responsibility]** "Reflect recognition of patients' needs and preferences"[95] (e.g. "Encouraging to patient to voice ideas" [95], "offering collaboration" [95] where shared decisions are made, etc.) [95]		**Clinician-Patient relationship [Therapeutic Alliance]** Enhance or maintain the bond with patient. For instance a good measure would be when the patient understands the relevance and effectiveness of recommendations - hence facilitating treatment goals[95]
	Likert Scale (0 "not relevant" to 4 "strongly relevant")							
							-Reilly[175] -The College of Physicians and Surgeons of Ontario[176] -Goold and Lipkin[177]
20 Is this site part of a new primary care model supported by public funding	4 Presuming the "new primary care model" provides better BioPsychoSocial care (e.g. such as through multidisciplinary healthcare teams who help address these various areas) -The College of Family Physicians of Canada[9] -Carver and Jessie[178] -Ontario Medical Association[63] -Patient-Centered Primary Care Collaborative[10]		4 Presuming the "new primary care model" includes treating the patient as a person. -The College of Family Physicians of Canada[9] -Carver and Jessie[178] -Ontario Medical Association[63] -Patient-Centered Primary Care Collaborative[10]		4 Presuming the "new primary care model" includes sharing power & responsibility. -The College of Family Physicians of Canada[9] -Carver and Jessie -Ontario Medical Association[63] -Patient-Centered Primary Care Collaborative[10]		4 Presuming the "new primary care model" includes addressing therapeutic alliance. -The College of Family Physicians of Canada[9] -Carver and Jessie[178] -Ontario Medical Association[63] -Patient-Centered Primary Care Collaborative[10]

4.2.2 CHI'S National Screening Survey: Extent that EMRS Impact Statements Provide Adequate Information to Assess How EMRS Impacts PCPC (objective 3)

4.2.2.a. EMRS Impact Statements & their PCPC Dimensions Covered

The number of EMRS impact statements that covered none of the PCPC dimensions was 9, those covering only 1 PCPC dimension was 8, and those covering all 4 PCPC dimensions was 2. For the 11 EMRS impact statements that had relevance to PCPC, 8 of them each evaluated only 1 of the PCPC dimensions. Specifically, for EMRS impact statements evaluating at least 1 of the PCPC dimensions: 10 of them evaluated the Clinician-Patient Relationship (Therapeutic Alliance) dimension of PCPC, while the remaining 1 (the PCPC impact statement #5 "Easy to

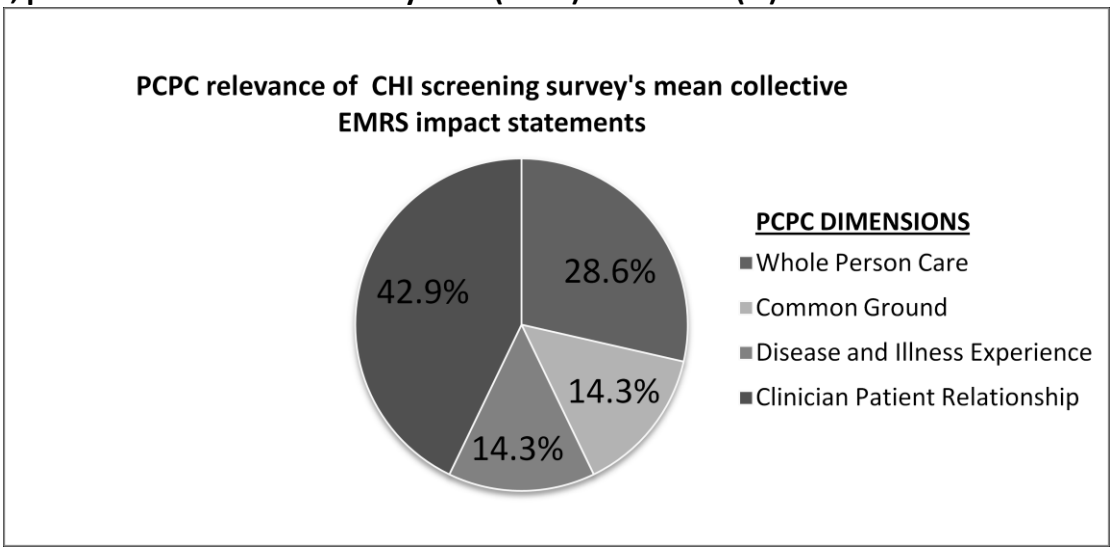
access data from EMRS") evaluated only Whole Person Care (BioPsychoSocial Perspective) dimension. (see Table 4.4, and details in Appendix 3 variable matching data)

Overall for all 20 EMRS impact statements the PCPC impact score (%) was relatively low; with a mean of 12.3% (s.d. [standard deviation] 30.2), and with only 2 EMRS impact statements reaching 100% PCPC impact score [(#15)"EMRS improves the quality of medical care received by the patients" and (#20)"Is this site part of a new primary care model supported by public funding (with respect to new patient-centered medical home primary care model, based on the CFPC discussion paper[9] that it's more multidisciplinary, with better quality of care, more patient-centered, better follow-up)"], while the rest are inclusive or below 15.6% PCPC impact score. (see Table 4.4)

4.2.2.b. PCPC Dimensional Relevance

The PCPC dimensional relevance revealed that the CHI national screening survey does not equally capture the 4 PCPC dimensions: 42.9% for Clinician-Patient relationship (Therapeutic Alliance) dimension, followed by 28.6% for Whole Person Care (BioPsychoSocial Perspective), 14.3% for Common Ground (Sharing Power and Responsibility), and 14.3% for Disease and Illness Experience (Patient as a Person). Notably, a survey that equally captures PCPC dimensions would consist of PCPC dimensional relevance values of 25% for all 4 dimensions. (see Figure 4.1)

Figure 4.1 Mean collective Electronic Medical Record System (EMRS) impact statement relevance, per Patient-Centered Primary Care (PCPC) dimension (%)



4.2.3 CHI'S National Screening Survey: Physician Perception on Evaluating EMRS impact on PCPC (objective 3)

4.2.3.a. Physician agreement of EMRS impact statements

Of the 11 EMRS impact statements with relevance to PCPC; the mean frequency of physician agreement of EMRS impact statements with respect to their site ranged from 0.60 (s.d. 0.49, n=48) to 3.55 (s.d. 0.72, n=44) with a total mean of 2.71 (s.d. 0.91) [0 "strongly disagree" to 4 "strongly agree"]. Only 1 EMRS impact statement had a mean frequency of physician agreement between 0 (strongly disagree) to 1 (disagree), 0 EMRS impact statements had a mean frequency of physician agreement between 1 (disagree) to 2 (neutral), 3 EMRS impact statements had a mean frequency of physician agreement between 2 (neutral) to 3 (agree), and finally 6 EMRS impact statements had a mean frequency of physician agreement between 3 (agree) to 4 (strongly agree). These 6 EMRS impact statements specifically were: (#3)"With EMRS, I am better able to monitor patient progress", (#5)"Easy to access data from EMRS", (#6)"Easy to enter data into EMRS", (#15)"EMRS improves the quality of medical care received by patients, (#18)"EMRS reduces the risk of making errors", and (#19)"Patient information is more confidential with EMRS than our paper records." (see Table 4.6, and details in both Appendix Table 5 and 6 for physician agreement per EMRS impact statement) The greatest proportion of EMRS impact statements that have relevance to PCPC had a mean frequency of physician agreement between3 to 4 at 55% (n=11), followed by a mean frequency of physician agreement between 2 to 3 at 27% (n=11). (see Table 4.5)

Table 4.5 Mean of physician agreement of Electronic Medical Record Systems (EMRS) impact statements

[Highlighted EMRS impact statements - are those with relevance to patient-centered primary care (PCPC); PCPC impact score > 0%]

EMRS Impact statement #	PCPC IMPACT (dependant variable)	SAMPLE SIZE	Frequency of answers by category (0 disagree to 4 agree Likert scale)					Frequency of answers by category (0 disagree to 4 agree Likert Scale)					COMPOSITE MEASURE		
			0	1	2	3	4	0	1	2	3	4	Mean frequency of how well physicians agree with EMRS impact statement (between 0 to 4)	standard deviation	variance
1	With EMRS, administrative staff at our site are able to finish their work much faster than before	44	1	1	6	16	20	0.023	0.023	0.136	0.364	0.455	3.20	0.92	0.845
2	With EMRS, family physicians are able to complete the billing process more efficiently and effectively	44	2		1	15	26	0.045		0.023	0.341	0.591	3.43	0.00	0.836
3	With EMRS, I am better able to monitor patient progress	44	0	1	3	11	29	0.000	0.023	0.068	0.250	0.659	3.55	0.72	0.521
4	With EMRS, clinicians at our site are able to finish their work much faster than before	44	0	1	12	12	9	0.000	0.023	0.273	0.273	0.205	1.98	1.07	1.14
5	Easy to access data from EMRS	45	1	2	0	11	31	0.022	0.044	0.000	0.244	0.689	3.53	0.88	0.782
6	Easy to enter data into EMRS	45	1	1	1	12	30	0.022	0.022	0.022	0.267	0.667	3.53	0.83	0.693
7	Easy to read text on the computer screen	45		2		10	33	0.000	0.044	0.000	0.222	0.733	3.64	0.70	0.496
8	EMRS decreases the number of laboratory tests	44	0	7	10	23	4	0.000	0.159	0.227	0.523	0.091	2.55	0.86	0.748

EMRS Impact statement #	PCPC IMPACT (dependant variable)	SAMPLE SIZE	Frequency of answers by category (0 disagree to 4 agree Likert scale)					Frequency of answers by category (0 disagree to 4 agree Likert Scale)					COMPOSITE MEASURE		
			0	1	2	3	4	0	1	2	3	4	Mean frequency of how well physicians agree with EMRS impact statement (between 0 to 4)	standard deviation	variance
9	EMRS will make patient care less expensive	44	3	4	14	17	6	0.068	0.091	0.318	0.386	0.136	2.43	1.05	1.109
10	With EMRS, family physicians are better able to bill for each respective patient encounter and associated incentive programs	44	2		3	15	24	0.045		0.068	0.341	0.545	3.34	0.95	0.907
11	EMRS eliminates a lot of paperwork for the administrated staff	44	3	2	9	14	16	0.068	0.045	0.205	0.318	0.364	2.86	1.16	1.345
12	EMRS eliminates a lot of paperwork for our clinicians	44	4	6	5	15	14	0.091	0.136	0.114	0.341	0.318	2.66	1.30	1.679
13	With EMRS, overhead costs are saved	44	5	4	12	13	10	0.114	0.091	0.273	0.295	0.227	2.43	1.25	1.564
14	It is confusing to follow the sequence of screens	45	12	20	4	6	3	0.267	0.444	0.089	0.133	0.067	1.29	1.19	1.405
15	EMRS improves the quality of medical care received by the patients	44	0	1	2	18	23	0.000	0.023	0.045	0.409	0.523	3.43	0.69	0.473
16	EMRS use improves continuity of care and patient access which will decrease his need to visit the Emergency Department	44	0	5	12	18	9	0.000	0.114	0.273	0.409	0.205	2.70	0.92	0.845
17	EMRS decreases patient waiting time	44	1	6	13	20	4	0.023	0.136	0.295	0.455	0.091	2.45	0.92	0.839

EMRS Impact statement #	PCPC IMPACT (dependant variable)	SAMPLE SIZE	Frequency of answers by category (0 disagree to 4 agree Likert scale)					Frequency of answers by category (0 disagree to 4 agree Likert Scale)					COMPOSITE MEASURE		
			0	1	2	3	4	0	1	2	3	4	Mean frequency of how well physicians agree with EMRS impact statement (between 0 to 4)	standard deviation	variance
18	EMRS reduces the risk of making errors	44	1	2	5	19	17	0.023	0.045	0.114	0.432	0.386	3.11	0.93	0.873
19	Patient information is more confidential with EMRS than our paper records	44		3	7	19	15	0.000	0.068	0.159	0.432	0.341	3.05	0.88	0.771
20	Is this site part of a new primary care model supported by public funding	48	19	29				0.396	0.604	0.000	0.000	0.000	0.60	0.49	0.239

4.2.3.b. Physician agreement of the actual PCPC impact of EMRS statements: -2 to +2 Likert scale

Only 2 EMRS impact statements with relevance to PCPC (PCPC impact score > 0%) according to physician agreement had a negative EMRS impact on PCPC: -0.00036 and -1.4 on a -2 to +2 likert scale. The respective EMRS impact statements were (#4)"With EMRS, physicians at our site are able to finish their work much faster than before" and (#20) "Is this a part of the new [patient-centered medical home model] supported by public funding." The remaining 8 of 9 EMRS statements with relevance to PCPC were between 0 (physicians agree has no EMRS impact on PCPC) to 1 (physicians agree improves EMRS impact on PCPC) on the -2 to +2 Likert scale. The final remaining EMRS statement, (#15)"EMRS improves the quality of medical care received by the patients", was between 1 (physicians agree improves EMRS impact on PCPC) to 2 (physicians strongly improves EMRS impact on PCPC), and thus had the most positive EMRS impact on PCPC. Overall, in examining physician agreement and the patient-centeredness of EMRS impact statements, it appeared that physicians agreed EMRS had no

apparent significant impact on PCPC. Specifically, the physician agreement of EMRS impact on PCPC with respect to the 20 EMRS impact statements was 0.02 (s.d. 0.46) and the 11 EMRS impact statements that had relevance to PCPC (PCPC impact score > 0%) was 0.04 (s.d. 0.63).

Table 4.6 Mean of physician agreement of Electronic Medical Records Systems (EMRS) impact statements and Patient-Centered Primary Care (PCPC) impact score
[Highlighted EMRS impact statements - are those with relevance to PCPC; PCPC impact score > 0%]

EMRS Impact statement #		Mean frequency of physician agreement of EMRS impact statement (between 0 to 4 likert scale)	Mean frequency of physician agreement of EMRS impact statement (between -100% to 100%)	PCPC impact score %	Mean frequency of physician agreement of PCPC impact of EMRS statement (between -2 to 2 likert scale)
1	With EMRS, administrative staff at our site are able to finish their work much faster than before	3.20	60.23	0.0	0.0
2	With EMRS, family physicians are able to complete the billing process more efficiently and effectively	3.43	71.59	0.0	0.0
3	With EMRS, I am better able to monitor patient progress	3.55	77.27	1.6	0.0 (0.0241)
4	With EMRS, clinicians at our site are able to finish their work much faster than before	1.98	-1.14	1.6	0 (-0.00035)
5	Easy to access data from EMRS	3.53	76.67	6.3	0.1
6	Easy to enter data into EMRS	3.53	76.67	4.7	0.1 (0.072)
7	Easy to read text on the computer screen	3.64	82.22	0.0	0.00
8	EMRS decreases the number of laboratory tests	2.55	27.27	1.6	0.0 (0.0085)

EMRS Impact statement #		Mean frequency of physician agreement of EMRS impact statement (between 0 to 4 likert scale)	Mean frequency of physician agreement of EMRS impact statement (between -100% to 100%)	PCPC impact score %	Mean frequency of physician agreement of PCPC impact of EMRS statement (between -2 to 2 likert scale)
9	EMRS will make patient care less expensive	2.43	21.59	0.0	0.0
10	With EMRS, family physicians are better able to bill for each respective patient encounter and associated incentive programs	3.34	67.05	0.0	0.0
11	EMRS eliminates a lot of paperwork for the administrative staff	2.86	43.18	0.0	0.0
12	EMRS eliminates a lot of paperwork for our clinicians	2.66	32.95	0.0	0.0
13	With EMRS, overhead costs are saved	2.43	21.59	0.0	0.00
14	It is confusing to follow the sequence of screens	1.29	-35.56	0.0	0.0
15	EMRS improves the quality of medical care received by the patients	3.43	71.59	100.0	1.4
16	EMRS use improves continuity of care and patient access which will decrease his need to visit the Emergency Department	2.70	35.23	15.6	0.1
17	EMRS decreases patient waiting time	2.45	22.73	1.6	0.0 (0.007)
18	EMRS reduces the risk of making errors	3.11	55.68	6.3	0.0 (0.0696)

EMRS Impact statement #		Mean frequency of physician agreement of EMRS impact statement (between 0 to 4 likert scale)	Mean frequency of physician agreement of EMRS impact statement (between -100% to 100%)	PCPC impact score %	Mean frequency of physician agreement of PCPC impact of EMRS statement (between -2 to 2 likert scale)
19	Patient information is more confidential with EMRS than our paper records	3.05	52.27	6.3	0.1 (0.065)
20	Is this site part of a new primary care model supported by public funding	0.60	-69.79	100.0	-1.4

CALCULATIONS	**on a 0 to 4 scale**	**on a -100% to 100 scale**	**on a 100% scale**	**on a -2 to 2 scale**
All EMRS impact statements				
mean	2.79	39.46	12.3	0.02
s.d.	0.80	39.78	30.2	0.46
Only those that evaluate PCPC				
mean	2.77	35.29	14.5	0.04
s.d.	0.89	45.32	30.3	0.63

5.0 DISCUSSION

The Hudon et al[98] conceptual framework for patient-centered care (PCC), specifically for primary care, was chosen as the optimal framework to be used to evaluate the impact of EMRS on patient-centered primary care (PCPC). Of the Canada Health Infoway (CHI) national screening survey's 20 EMRS impact statements, only 55% were positive for relevance to PCPC and thus could potentially evaluate the impact of EMRS on PCPC. The CHI national screening survey's 20 EMRS impact statements were able to only capture 12.3% (s.d. 30.2) of patient-centeredness in primary care. Furthermore, the CHI national screening survey's 11 EMRS impact statements that were relevant to PCPC (PCPC impact score > 0%) were able to only capture 14.5% (s.d. 30.3) of patient-centeredness in primary care. Additionally, for these 11 EMRS impact statements; when the total accumulated relevance score for each of their PCPC dimensions were compared (PCPC dimensional relevance), the PCPC dimensions amongst each other did not equally capture patient-centeredness in primary care. Specifically the Clinician-Patient relationship (Therapeutic Alliance) dimension, followed by the Whole Person Care (BioPsychoSocial perspective) dimension where the dimensions best captured by the items of the survey. Lastly, the EMRS impact statement that physicians had the strongest agreement for EMRS impact on PCPC was (#14)"EMRS improves the quality of medical care received by patients", and physicians had the strongest disagreement for EMRS impact on PCPC was (#20)"Is this a part of the new [patient-centered medical home model] supported by public funding." Overall, in examining physician agreement and the patient-centeredness of EMRS impact statements, the results of the CHI national screening survey demonstrated that EMRS had no apparently significant impact on PCPC.

Although the conceptual framework for PCPC that was selected, the Hudon et al[98] model, was comparatively more applicable to primary care as well as parsimonious to use with its condensed 4 dimensions; it can be argued that the Stewart et al[46] conceptual framework with 6 dimensions and the Mead and Bower[95] conceptual framework with 5 dimensions can also both be independently used to evaluate the impact of EMRS on patient-centered care also in a primary care context. Notably, the Stewart et al[92] conceptual framework was developed by researchers in a department of family medicine.[46] For a future study it would be interesting to utilize the Stewart et al[46] conceptual framework and Mead and Bower[95] conceptual framework each

independently to the quantitative objectives of this thesis, and then examine the contrasting and/or similar results with each other as well as with those of this thesis.

Based on the results of the literature search and review, this thesis is the first to date in attempting to evaluate the impact of EMRS on PCPC. It is novel in evaluating the impact of EMRS on patient-centered care, particularly in a primary care setting, as well as in conducting such an evaluation using the variable matching method and PCPC impact score (%). Although studies do exist, such as the study by Frenzel et al[179], that evaluated the impact of a specially designed EMRS (SOAPware version 5) on patient-centered care, the studies indirectly evaluate some of the concepts from this thesis. Specifically, Frenzel et al[179] attempted to "develop, implement, and evaluate the use of electronic medical record [systems] in disease state management activities to teach pharmacy students patient-centered care skills" (page 1).[179] Their[179] evaluation included a 18 item pre-course survey and 21 item post-course survey; however, no conceptual framework nor definition for patient-centered care (PCC) were clearly provided, other than that PCC "include[s] the ability to obtain, interpret, and evaluate patient information; determine the presence of a disease or medical condition; assess the need for treatment and/or referral; and identify patient-specific factors that affect health, pharmacotherapy, and/or disease management" (page 1).[179] Furthermore the survey Frenzel et al[179] used did not assess the patient-centeredness of its statements [e.g. sample statement: "It is important for pharmacists to gain access to a patient's chart to document their role in the healthcare process" (page 3)[179]]. Lastly, in the Frenzel et al[179] study the EMRS was not evaluated in a primary care setting. Therefore, although the Frenzel et al[179] study supports that EMRS use by pharmacy students improved their patient care skills, based on the generated conclusion by Frenzel et al[179], it cannot be further concluded that EMRS improves PCC nor improves PCPC. Other studies, such as the one by Rouf et al[180], exist where the researchers coincidentally assessed the impact of EMRS on particular dimension(s) of PCC or PCPC without having these specific intentions. Specifically, in the Rouf et al[180] study, one of their assessments included evaluating the impact of EMRS on the physician-patient encounter in primary care. From the variable matching component of this thesis, we can hypothesize that aspects of the physician-patient encounter that Rouf et al[180] evaluated can include the Hudon et al[98] dimensions of Common Ground (Sharing Power and Responsibility) as well as Patient-Clinician Relationship (Therapeutic Alliance). However, such studies did not define nor provide a conceptual

framework for PCC, nor PCPC, and therefore cannot be fully nor directly attributed to appropriately evaluating the impact of EMRS on PCPC without further objective reassessment and/or reconfiguration of their methods and results. Therefore, this thesis is novel in being able to assess which EMRS characteristics evaluated by a survey are PCPC.

The CHI national screening survey included in this thesis, however, covers only some dimensions of PCPC. The survey's EMRS impact statements had the most PCPC dimensional relevance towards the Clinician-Patient Relationship (Therapeutic Alliance) dimension of PCPC. Of the 11 EMRS impact statements that evaluated PCPC: 10 of them had relevance to the Clinician-Patient Relationship (Therapeutic Alliance) dimension. Hence, primary care physicians with really strong clinician-patient relationships, according to the national screening survey's relevance across dimensions, should have better provided PCPC while implementing EMRS. Furthermore, both clinician-patient relationships and whole person care together account for almost three-quarters of the national screening survey's score attributed to the different PCPC dimensions. None of the literature reviews on the conceptual framework of patient-centered care, particularly those conducted by Mead and Bower[95] and Hudon et al[98], support the importance of one particular PCPC dimension over another in impacting patient-centered care. In other words, these studies assume that all PCPC dimensions are equally important. Therefore, when inserting EMRS in the dynamic between primary care clinicians and patients, it would be interesting to assess which of the PCPC dimensions gain more and/or less relevance.

Out of the 11 EMRS impact statements with relevance to PCPC only two are completely relevant to PCPC (PCPC impact score of 100%): (#15)"EMRS improves the quality of medical care received by the patients" and (#20)"Is this site part of a new primary care model supported by public funding." With respect to EMRS statement #15 ("EMRS improves the quality of medical care received by the patients") pertaining to quality of care, this is key factor in patient-centered care according to the Institutes of Medicine.[22, 71, 72] Thus, providing patients with high quality of care requires that high quality patient-centered care be provided. As such, EMRS statements related to quality of care are arguably more likely to receive high Likert scores for relevance for all 4 PCPC dimensions of the Hudon et al[98] conceptual framework.[72, 76, 165-167]Also notably, with respect to EMRS statement #20 ("Is this site part of a new primary care model supported by public funding"), it is important to understand that the question is asking whether the new patient-centered medical home model was being implemented at the site and therefore

providing patient-centered care (PCC).[9, 78] Specifically, to reiterate, the Patient-Centered Primary Care Collaborative[77] support that PCC is one of the 5 functions and attributes of the patient-centered medical home and the College of Family Physicians of Canada[9] stated that PCC is one of the 7 parameters of the patient-centered medical home. As such, patient-centered medical home implementation type EMRS statements during variable matching are arguably more likely to receive high Likert scores for relevance for all 4 PCPC dimensions of the Hudon et al[98] conceptual framework..

For all 20 EMRS impact statements the overall mean PCPC impact score (12.3%, s.d. 30.2) was relatively low. As such this was the best that the CHI national screening survey could capture the patient-centeredness of EMRS's various characteristics in primary care. On closer examination, 8 of the 11 EMRS impact statements with PCPC relevance (PCPC impact score > 0%) had relevance to only one PCPC dimension: 7 EMRS impact statements only had relevance with the Clinician-Patient Relationship (Therapeutic Alliance) PCPC dimension, except for (#5)"Easy to access data from EMRS" which only had relevance with Whole Person Care (BioPsychoSocial Perspective) PCPC dimension. This supports that the majority of the survey's PCPC positive EMRS impact statements were focused on one particular PCPC dimension, which was the Clinician-Patient Relationship (Therapeutic Alliance) PCPC dimension.

If we look at all of the physician agreement scores of EMRS statements, an overall mean of 2.79 (s.d.0.80) [0 "strongly disagree" to 4 "strongly agree"] was identified. The impact statement that physicians most strongly disagreed with is (#20)"Is this site part of the new primary care model supported by public funding" (0.60, s.d.0.49, n=48). It is thus quite apparent that the patient-centered medical home model was not successfully implemented amongst the 48 sampled sites. As such, according to the College of Family Physicians of Canada's 2009 discussion paper[9] and the U.S. Department of Health and Human Services' Agency for Healthcare Research and Quality[78]; the relative lack of the patient-centered medical home model implementation amidst the survey's sites would theoretically support that, independent of EMRS implementation, the patient-centeredness and thus resulting quality of care at these clinics would not be strong.

Furthermore upon examining physician perceptions, we found that the EMRS impact statements that have the top 4 largest positive means for physician agreement were: (#3)"With EMR, I am better able to monitor patient progress", (#5)"Easy to access data on

EMRS",(#6)"Easy to enter data into EMRS", and (#7)"Easy to read text on the computer screen". Reasons for these large positive means may be that physicians were proficient at using EMRS and/or that the EMRS themselves were easy to use. However, the relatively proficient use of EMRS by physicians surveyed would have been initially questionable, because at minimum they had less than 3 years worth of EMRS implementation at their sites and thus should have still been in the relatively detrimental adoption period.[107, 108, 112] Specifically, the CHI national screening survey's clinics minimum adoption period, post-EMRS implementation was 1 year and 2 months. It is thus more probable that the EMRS were typically easy to use.

On closer examination of the association between physician perception and PCPC impact score, particularly with respect to the top four EMRS impact statements that physicians most agreed with [(#3)"With EMRS, I am better able to monitor patient progress", (#5)"Easy to access data on EMRS", (#6)"Easy to enter data into EMRS", and (#7)"Easy to read text on the computer screen"]; physicians were agreeing highly with the EMRS impact statements that evaluated physician ease of EMRS use. However, these same four EMRS impact statements were very low in PCPC impact score ranging from 0 to 6.2%: (#3)"With EMRS, I am better able to monitor patient progress" at 3.55 (s.d. 0.72, n=44) physicians agreeing and 1.6% PCPC impact score; (#5)"Easy to access data on EMRS" at 3.53 (s.d. 0.88, n=45) physicians agreeing and 6.2% PCPC impact score; (#6)"Easy to enter data into EMRS" at 3.53 (s.d.0.83, n=45) and 4.7% PCPC impact score; and finally (#7)"Easy to read text on the computer screen" at 3.64 (s.d. 0.70, n=45) and 0% PCPC impact score. In addition to the low PCPC impact scores, it becomes apparent that 3 of the statements (#3, #5, and #6) were PCPC positive. Specifically, 2 of these 3 statements (#3 and #6) had relatively low relevance only to the Clinician-Patient Relationship (Therapeutic Alliance) dimension of PCPC; while the remaining 1 statement (#5) had a relatively high relevance only to the Whole Person (BioPsychoSocial perspective) dimension of PCPC. As such, though the findings provide evidence that these physicians show greater ease of EMRS use, these four EMRS characteristics themselves are inherently very PCPC mono-dimensional. Hence, based on these findings, as well as considering the PCPC dimensional relevance of the survey across dimensions, the argument could be made that perhaps EMRS predominantly impacts the Clinician-Patient Relationship (Therapeutic Alliance) and Whole Person Care (BioPsychoSocial Perspective) dimensions of PCPC. Therefore, the need for future studies to

identify PCPC dimensional relevance and the distribution of the dimensions resulting from EMRS implementation is apparent.

EMRS impact statement #20 with a mean physician agreement of 0.60 (s.d. 0.49, n=48) [0 "strongly disagree" to 4 "strongly agree"] demonstrated that physicians strongly disagree that their clinics are implementing the new patient-centered medical home model supported by public funding. Major organizations such as the College of Family Physicians of Canada[9], the U.S. Department of Health and Human Services' Agency for Healthcare Research and Quality[78], and the U.S.'s Patient Centered Primary Care Collaborative[77] strongly state that EMRS is a key parameter/function/attribute of the patient-centered medical home that facilitates the improvement of quality of care. In our study, the only other EMRS impact statement that had 100% PCPC impact score (e.g. was given a relevance of 4 out of 4 for each and every one of the four PCPC dimensions) was #15, which assessed whether "EMRS improves the quality of medical care received by the patients". Though poor quality of care findings would be expected based on EMRS impact statement #20 ("Is this site part of [the new patient-centered medical home] model supported by public funding"),[9, 77, 78] the physician agreement with EMRS impact statement #15 demonstrated that physicians strongly agree "EMRS improves quality of medical care received by patients." Therefore, a key finding from the results of both EMRS impact statements (#15 and #20) is that the patient-centered medical home model and EMRS implementation act independently in improving quality of care. In other words, the patient-centered medical home model does not need to be present in its entirety, as the presence of EMRS implementation by itself yields high of quality of care.

In conclusion, overall for the 11 EMRS impact statements that were PCPC positive, physicians at the various EMRS implementing sites agreed that EMRS has no apparent significant impact on PCPC (0.20, s.d. 0.19, on a Likert scale of -2 to +2). The resulting lack of significant impact may have been influenced by the fact that the survey mainly covered the Clinician-Patient Relationship (Therapeutic Alliance) and the Whole Person Care (BioPsychoSocial Perspective) PCPC dimensions. If the survey had covered all four dimensions more equally, the results might have been different.

5.1 STRENGTHS AND LIMITATIONS

The in-depth literature search of published studies revealed that there were no conceptual frameworks for PCPC that were designed to evaluate the impact of EMRS on PCPC. As such, this thesis was the first to make such an attempt.

The variable matching process was sufficiently validated by me an individual with practical clinical EMRS experience, and then further validated by two health information technology experts (Isabelle Vedel, M.D., Ph.D. and Gillian Bartlett Ph.D.) for each EMRS impact statement. Additionally the validation process for assigning relevance values to each of the four dimensions of PCPC per national screening survey EMRS impact statement was further substantiated by peer-reviewed published literature.

This thesis went further to assess the actual relevance of each EMRS impact statement to PCPC via a PCPC impact score (%). Instead of only identifying whether or not an EMRS impact statement was PCPC positive, which would have required the assumption that the patient-centeredness of every EMRS impact statement was the same, evaluating the degree of PCPC relevance (PCPC impact score) enabled the data analysis to more appropriately examine if the CHI national screening survey could capture physician agreement for the impact EMRS's various characteristics had on the varying degrees of patient-centeredness.

One advantage of the CHI national screening survey is that it captured at least one EMRS implementing site from every province and territory. In doing so it was a legitimate attempt at assessing the impact of EMRS on PCPC at Canada's national level. However, the disadvantage brought about by this approach, as some may argue, is that it resulted in capturing the impact resulting from only 18 different EMRS with their own differences.

The response rate for the questions (EMRS impact statements) of the survey, specifically considering that it is a Canadian primary care survey, was relatively sufficient with an overall mean of 63%. (see Results Table 4.1) Based on national medical journals in Canada[181] and the U.S.A.[182], the generally recommended response rate minimum for physician self-reported surveys to ensure that non-response bias does not invalidate the results is 60%.[183] Thus, the response rate of the CHI national screening survey is above this minimum of 60%.[183] Comparatively, Parsons et al[184] conducted a study identifying factors involved with response rates in a national survey of primary care physicians. Their study[184] identified that the initial response rate of family medicine physicians to mailed questionnaires was 40% (n=359).

Additionally, Sudman[185] identified that professionals require more contact attempts than the general population to receive a completed survey. Furthermore, Wiebe et al[183] identified that a proportion of their survey elicited Canadian primary care sites that had an office policy not to participate in surveys. Such offices in their study[183] with the no survey policy were more likely to be urban-based practices, more likely male physicians, and physicians in practice for more than 15 years. Therefore the self-reported primary care CHI national screening survey response rate was adequate enough not to be invalidated by non-response bias.

The Hudon et al[98] conceptual framework for PCPC was specifically designed for primary care. It is also the most condensed framework that can be used for evaluating EMRS impact; however, it was not specifically designed for this purpose. Since the Hudon et al[98] conceptual framework consists of dimensions of both the Stewart et al[46] conceptual framework and Mead and Bower[95] conceptual framework, although the latter two were not designed for patient-centeredness specifically in primary care, it can be argued that these two frameworks may also be capable and if so perhaps more effective at capturing EMRS impact on PCPC. As such, further studies are warranted in assessing which of these three conceptual frameworks for patient-centered care best capture EMRS impact on PCPC.

The variable matching process was limited to me and by two health information technology experts for each EMRS impact statement. Though sufficient for this thesis, a more accurate assessment could have been made using more physicians with practical EMRS experience. In doing so, perhaps certain additional practical nuances could have been brought to light for further discussion by such experienced EMRS practicing physicians during variable matching. Additionally, an even more thoroughly refined process of variable matching, for future studies, could be conducted via the Delphi method by experts. The Delphi method for the purpose of variable matching could be conducted; whereby the first round of questionnaires regarding EMRS impact statement relevance to each of the four PCPC dimensions would use broad or open-ended questions.[186, 187] Hence, the initial phase is called the "exploratory phase".[188] Subsequent rounds of questionnaires inquiring about relevance are part of the "evaluation phase";[188] whereby, results of the previous round would be used to frame another set of questions.[186, 187] For each round, it would be ideal if the experts backup their responses with peer-reviewed published articles. Thus, "each round provides an opportunity for the experts to respond and to revise their answer in light of the group members' previous response" (page 3)[186];

such that, after several rounds, "the process [should] gradually lead to a consensus or near-consensus" (page 3).[186] Thus, the Delphi method would be a more thoroughly refined process for variable matching. However, given the timeframe of this thesis, it was not possible to conduct such a Delphi study.

This study was not conceived until after the final report of the larger main study[112] was released, titled "The EMR Physician Value Study: The Impact of Mature Electronic Medical Record implementations on productivity, operational efficiencies and clinical functionalities in Canadian primary care settings."[112] Thus, the main study's[112] objectives were not designed to evaluate the impact of EMRS on PCPC. Specifically, the primary focus of the Canada Health Infoway national screening survey was to identify productivity and quality of care[112]. As such, the survey's questions and statements were not originally designed to serve as an ideal instrument to evaluate the patient-centeredness of EMRS in primary care. A means of using the survey to evaluate the impact of EMRS on PCPC was only subsequently developed. Therefore, this thesis identified that 44% (n=45) of the CHI survey's overall questions could potentially assess EMRS impact on PCPC, and thus were used.

Most notably the 48 clinics surveyed had not all implemented the same EMRS. Due to the insufficient number of identical EMRS implemented by the CHI national screening survey's practices, for statistical purposes this thesis collectively examined the impact of 18 different EMRSs (Accuro, Bell, CIS, Jonoke, Kinlogix, Med Access 4.3, Nightingale, Physician's solution, Practice Solutions 5.1, Profile, Telus Health Solutions, Telus Physician's solutions 2011.1A, Wolf, and 5 unknown)[112]. Understandably, the 18 different EMRS vary in visual interface design, features, potential user ability, etc. As such, the survey did capture the mean site's use of certain features. (see Results Table 4.1) However, an ideal sample of EMRS implementing primary care sites nationally would have consisted of all the same EMRS, with samples from all provinces and territories.

The approach of data collection source used by this thesis involved obtaining perceptions from only physicians via a survey. The alternate, or even additional, approach would have been to obtain perceptions from patients via a survey.[97] The self-reported physician survey approach of data collection on EMRS impact was used because of its convenience to administer and feasibility, which according to Mead and Bower[95] are common reasons for implementing self-reported physician surveys. However, a consensus of Canadian experts in primary care supports

that the best measure for patient-centered care in primary health care is a self-reported patient survey questionnaires.[101, 102] Furthermore, several studies support that patient's perspectives of PCC are more effective compared to physician's perceptions and even direct external observations.[46, 87, 88, 99] In regard to drawbacks to physician self-reported surveys, Mead and Bower[95] support that researchers should be concerned about social desirability bias. Social desirability bias occurs when the respondent is in a situation where they have a tendency to provide answers that will be viewed as favourable by others. Bucks et al[101] and Linn et al[102] support that such social desirability bias can occur in physicians, particularly primary care physicians who are increasingly aware of characteristics essential for quality interpersonal care; such that, physician surveys on PCPC would also be very likely to demonstrate social desirability bias. Therefore, under ideal circumstances, a patient survey assessing for PCPC would have also been conducted.

The cross-sectional study design of the CHI national screening survey was again conducted for convenience to administer, low-cost, and feasibility given the national scale. But the cross-sectional study design limited this thesis to only assessing PCPC post-EMRS implementation. Stewart et al[46] support that ideally it is more accurate to assess patient-centered care over a period of time than a single session; as patient-centered care and thus patient-centered primary care in actuality is a dynamic relationship over a period of time[98]. Hence, compared to the current cross-sectional study, a prospective pre-post EMRS implementation study should theoretically be more ideally appropriate. Under ideal circumstances assessing PCPC longitudinally over a period of time given PCPC's dynamic relationship[98] would be more appropriate.

Furthermore, with respect to the data collection source of the CHI national screening survey and four PCPC dimensions assessed, it can be even further argued that each of the four dimensions [1."disease and illness experience (patient as a person)", 2."whole person (biopsychosocial perspective)", 3."common ground (sharing power and responsibility)," and 4."the patient-doctor relationship (therapeutic alliance)"][98] may be best evaluated for EMRS impact on PCPC via different data collection sources (e.g. patients, physicians, etc). Specifically, in accessing the PCPC dimension Disease and Illness Experience (Patient As A Person) it would be ideal to actually capture the patient's perspective, as there are most knowledgeable about their own subjective experience[95]. In assessing the PCPC dimension Whole person (BioPsychoSocial

Perspective) it is important to understand that the purpose of this dimension is to "develop a full understanding of the patient's presentation and provide effective management the doctor should strive to understand the patient as an idiosyncratic personality within his or her unique context" (page 1089).[95, 189] Thus for this PCPC dimension, it would be ideal to actually capture the physician's perspective, and in doing so identify whether the physician is accessing and incorporating information from the interdisciplinary team and the patient. In assessing the PCPC dimension Common Ground (Sharing Power and Responsibility), where the focus is more on whether the "ideal of an egalitarian doctor-patient"(page 1089)[95] relationship is maintained as opposed to previously "conventional 'paternalistic' relationship"(page 1089)[95], it would be ideal to capture the patient's perspective. Finally in assessing the PCPC dimension the Patient-Doctor Relationship (Therapeutic Alliance), since a relationship consists of two or more directly interacting bodies, which in this case is the physician and patient, it would be ideal to capture both the physician's and patient's perspectives. In capturing both the physicians' and patients' perspectives it would also be interesting to note any conflicting opinions. Therefore, it becomes apparent that the ideal assessment of EMRS impact on PCPC would not be a data collection source exclusively to self-reported physician surveys, nor self-reported patient surveys; rather that the ideal assessment would consist of one or a combination of the two depending on the PCPC dimensions assessed.

5.2 CONCLUSION

To begin with, EMRS developers do not seem to be immersed in appropriate awareness of the conceptual framework for PCPC. When creating such systems the certification criteria they aim to fulfill does not include patient-centeredness. Specifically, Canada Health Infoway (CHI) which certifies EMRS for legitimate distribution in Canada directly omits patient-centeredness in its certification criteria (CHI's pre-EMRS implementation certification consists of 3 criteria: privacy, security, and interoperability)[190]. In the U.S.A., the Office of the National Coordinator for Health Information Technology (ONC for HIT) certifies EMRS, after which their users then become potentially eligible for the Medicare and Medicaid Electronic health Record Incentives program. The standards and certification criteria of the ONC for HIT also directly omit patient-centeredness.[191] To create EMRS that optimally improves patient-centered care, at the very least developers should be made aware of what patient-centered care

conceptually is, and then strive to design software that is satisfactorily patient-centered. Therefore, it becomes apparent that this is another reason of importance for identifying a conceptual framework for PCPC as well as for creating a means for evaluating the impact of EMRS on PCPC.

The CHI screening survey demonstrated, across the four dimensions of PCPC, that there was an unequal distribution of relevance amongst PCPC dimensions (PCPC dimensional relevance). Notably the results of this thesis support that Clinician-Patient Relationship dimension and the Whole Person Care dimension are the key PCPC dimensions that are being impacted by EMRS implementation. However, none of the literature reviews on the conceptual framework of patient-centered care, particularly those conducted by Mead and Bower[95] and Hudon et al[98], support the degree of importance of one PCPC dimension over the others in impacting patient-centered care. If such an unequal PCPC dimensional relevance is substantially proved to exist by further studies, it would be pertinent to primary care clinicians so that when they implement EMRS they know which dimensions to focus-on providing to yield higher overall PCPC. Furthermore, such a finding would be pertinent to EMRS certifiers and developers, as they could then emphasize certain EMRS characteristics with respect to these most impactful PCPC dimensions, so as to yield higher overall delivery of PCPC supported by EMRS. Therefore, it is important that further studies be conducted to evaluate which PCPC dimensions are most relevant when implementing EMRS.

Upon having identified the existence of unequal PCPC dimensional relevance; speculation then arises whether implementing EMRS itself changes the PCPC dimensional dynamic between primary care clinicians and patients. As such, a study examining PCPC dimensional relevance before EMRS implementation and post-EMRS adoption period should be revealing of any PCPC dimensional relevance re-distribution caused by EMRS implementation. By identifying if dimensional relevance re-distribution occurs, and if so which PCPC dimensions during EMRS implementation have more of an impact on PCPC, EMRS developers can then decide what dimensions they need to focus on to efficiently improve positive impact on overall PCPC. Additionally, by identifying the existence and amount of PCPC dimensional re-distribution, EMRS certifiers can proceed to set additional eligibility criteria based on the EMRS product's focus on the particular dimensions that are supposed to improve overall PCPC.

Finally, in regard to quality of medical care resulting from EMRS implementation and the patient-centered medical home model implementation: the results of this thesis suggest that EMRS implementation alone improves quality of care in the relative absence of the patient-centered medical home. Therefore, a key finding from the results of both EMRS impact statements (#20 and #15) is that patient-centered medical home model and EMRS implementation act independently in providing quality of care. That EMRS implementation does not need to be present in addition to the patient-centered medical home model to yield strong physician agreement on high quality of care. Hence, it is important that further studies be conducted to identify the relevance of the each patient-centered medical home parameter/function/attribute in impacting both quality of care and PCPC. Such findings would then in turn help policy makers and clinics identify which aspects are most important in providing optimal PCPC and quality of care (e.g. if the EMRS implementation parameter/function/attribute of the patent centered medical home model accounts for 70% of quality of care then it would be beneficial to clinics and policy makers to invest as well as focus more on implementing this particular aspect of the patient-centered medical home model).

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APPENDICIES

Continued...

+ associate with parameters.

Appendix E – Screening participants vs. non-participants

Note: The statistically significant differences between participants and non-participants are highlighted in yellow.

Table 1. Continuous items

DO NOT NEED

Item	PARTICIPANTS						NON-PARTICIPANTS						p-value of the difference
	Sample Size	Average	Standard deviation	Mini-mum	Median	Maxi-mum	Sample Size	Average	Standard deviation	Mini-mum	Median	Maxi-mum	
Months between now and implementation kick-off date	18	279.1	496.5	15.0	71.0	1358.0	33	233.3	427	23	1358	73	0.745
How many months from the go-live date, managed the change from paper to EMR-based operations?	17	8.6	16.1	0.0	5.0	69.0	29	5.62	11.11	0	60	3	0.511
Indicate the TOTAL FTE these clinicians represent	18	4.8	3.4	1.0	5.0	13.0	31	4.63	3.58	1	13	3	0.908
How many family clinicians practice at this site	18	5.8	4.6	1.0	6.0	17.0	31	5.58	4.29	1	15	4	0.884
How many family clinicians are participating in the study	18	2.1	1.7	1.0	1.0	5.0	30	2.23	1.48	1	5	2	0.801
How many registered patients does this site service	18	9193.0	6440.0	1600.0	9012.0	23000.0	34	5921	7413	500	36000	4000	0.113
How many active patients does this site service	18	11049.0	9067.0	1500.0	9809.0	36112.0	28	7516	7943	500	38000	4759	0.192

Continued...

Item	PARTICIPANTS						NON-PARTICIPANTS						p-value of the difference
	Sample Size	Average	Standard deviation	Mini-mum	Median	Maxi-mum	Sample Size	Average	Standard deviation	Mini-mum	Median	Maxi-mum	
How many nurse practitioner practice at this site	18	0.6	1.3	0.0	0.0	5.0	31	0.45	0.96	0	3	0	0.653

Table 2. Dichotomous or ordinal items.

Features (yes/no)

Item	Format Label	PARTICIPANTS						NON-PARTICIPANTS						p-value of the difference
		Sample size	Frequency of answers by category					Sample size	Frequency of answers by category					
			0	1	2	3	4		0	1	2	3	4	
Electronic referring to specialists - DOES NOT KNOW	0 (No) to 1 (Yes)	17	17	.	.	.	.	29	29	.	.	.	.	.
Electronic referring to specialists	0 (Routinely) to 2 (No)	17	6	2	9	.	.	29	14	2	13	.	.	0.482
Electronic prompts about a potential problem with drug dose or drug interaction - DOES NOT KNOW	0 (No) to 1 (Yes)	17	17	.	.	.	.	29	28	1	.	.	.	0.326
Electronic prompts about a potential problem with drug dose or drug interaction	0 (Routinely) to 2 (No)	17	15	1	1	.	.	28	20	6	2	.	.	0.311
Electronic receipt of laboratory results integrated into the EMR (not scanned) - DOES NOT KNOW	0 (No) to 1 (Yes)	17	17	.	.	.	.	29	29	.	.	.	.	.
Electronic receipt of laboratory results integrated into the EMR (not scanned)	0 (Routinely) to 2 (No)	17	10	2	5	.	.	29	26	3	.	.	.	0.019
Electronic ordering of laboratory tests - DOES NOT KNOW	0 (No) to 1 (Yes)	17	17	.	.	.	.	29	29	.	.	.	.	.

Continued...

Features (yes/no)

Item	Format Label	PARTICIPANTS Sample size	PARTICIPANTS Frequency of answers by category 0	1	2	3	4	NON-PARTICIPANTS Sample size	NON-PARTICIPANTS Frequency of answers by category 0	1	2	3	4	p-value of the difference
Electronic ordering of laboratory tests	0 (Routinely) to 2 (No)	17	7	3	7	.	.	29	13	4	12	.	.	0.906
Are you able to electronically transfer prescriptions to a pharmacy - DOES NOT KNOW	0 (No) to 1 (Yes)	17	17	.	.	.	.	29	29	.	.	.	.	.
Are you able to electronically transfer prescriptions to a pharmacy	0 (Routinely) to 2 (No)	17	1	.	16	.	.	29	10	2	17	.	.	0.006
Electronic exchange outside practice: laboratory and diagnostic tests - does not know	0 (No) to 1 (Yes)	17	17	.	.	.	.	29	29	.	.	.	.	.
Electronic exchange outside practice: laboratory and diagnostic tests	0 (No) to 1 (Yes)	17	14	3	.	.	.	29	18	11	.	.	.	0.141
Electronic exchange outside practice: patient clinical summaries - does not know	0 (No) to 1 (Yes)	17	17	.	.	.	.	29	28	1	.	.	.	0.326
Electronic exchange outside practice: patient clinical summaries	0 (No) to 1 (Yes)	17	13	4	.	.	.	28	18	10	.	.	.	0.397
Electronic prescribing of medication (selection of Rx from EMR and printing script) - DOES NOT KNOW	0 (No) to 1 (Yes)	17	17	.	.	.	.	29	29	.	.	.	.	.
Electronic prescribing of medication (selection of Rx from EMR and printing script)	0 (Routinely) to 2 (No)	17	16	.	1	.	.	29	24	1	4	.	.	0.289
Is a multi-practice site	0 (No) to 1 (Yes)	18	10	8	.	.	.	31	16	15	.	.	.	0.797

Continued...

EMRS Impact statement

Item	Format Label	PARTICIPANTS						NON-PARTICIPANTS						p-value of the difference
		Sample size	Frequency of answers by category					Sample size	Frequency of answers by category					
			0	1	2	3	4		0	1	2	3	4	
With EMR, admin staff at our site are able to finish their work much faster than before	0 (s. disagree) to 4 (s. agree)	16	1	1	2	8	4	28	.	.	4	8	16	0.064
With EMR, family physicians are able to complete the billing process more efficiently and effectively	0 (s. disagree) to 4 (s. agree)	16	1	.	.	5	10	28	1	.	1	10	16	0.977
With EMR, I am better able to monitor patient progress	0 (s. disagree) to 4 (s. agree)	16	.	1	2	3	10	28	.	.	1	8	19	0.321
With EMR, clinicians at our site are able to finish their work much faster than before	0 (s. disagree) to 4 (s. agree)	16	1	5	5	4	1	28	.	7	7	6	8	0.100
Easy to access data from EMR	0 (s. disagree) to 4 (s. agree)	17	1	2	.	6	8	28	.	.	.	5	23	0.026
Easy to enter data into EMR	0 (s. disagree) to 4 (s. agree)	17	1	1	1	4	10	28	.	.	.	8	20	0.134
Easy to read text on the computer screen	0 (s. disagree) to 4 (s. agree)	17	.	2	.	5	10	28	.	.	.	5	23	0.082
EMR decreases the number of laboratory tests	0 (s. disagree) to 4 (s. agree)	16	.	3	4	8	1	28	.	4	6	15	3	0.549
EMR will make patient care less expensive	0 (s. disagree) to 4 (s. agree)	16	2	.	8	5	1	28	1	4	6	12	5	0.261
With EMR, family physicians are better able to bill for each respective patient encounter and associated incentive programs	0 (s. disagree) to 4 (s. agree)	16	1	.	.	8	7	28	1	.	3	7	17	0.649
EMR eliminates a lot of paperwork for the administrative staff	0 (s. disagree) to 4 (s. agree)	16	2	1	3	5	5	28	1	1	6	9	11	0.355

EMRS Impact statement

Item	Format Label	PARTICIPANTS						NON-PARTICIPANTS						p-value of the difference
		Sample size	Frequency of answers by category					Sample size	Frequency of answers by category					
			0	1	2	3	4		0	1	2	3	4	
EMR eliminates a lot of paperwork for our clinicians	0 (s. disagree) to 4 (s. agree)	16	3	2	2	6	3	28	1	4	3	9	11	0.148
With EMR, overhead costs are saved	0 (s. disagree) to 4 (s. agree)	16	3	2	4	6	1	28	2	2	8	7	9	0.100
It is confusing to follow the sequence of screens	0 (s. disagree) to 4 (s. agree)	17	5	6	.	4	2	28	7	14	4	2	1	0.350
EMR improves the quality of medical care received by the patients	0 (s. disagree) to 4 (s. agree)	16	.	.	1	7	8	28	.	1	1	11	15	0.967
EMR use improves continuity of care and patient access which will decrease his need to visit the Emergency Department	0 (s. disagree) to 4 (s. agree)	16	.	3	5	5	3	28	.	2	7	13	6	0.307
EMR decreases patient waiting time	0 (s. disagree) to 4 (s. agree)	16	1	2	5	7	1	28	.	4	8	13	3	0.472
EMR reduces the risk of making errors	0 (s. disagree) to 4 (s. agree)	16	1	2	1	8	4	28	.	.	4	11	13	0.098
Patient information is more confidential with EMR than with paper records	0 (s. disagree) to 4 (s. agree)	16	.	1	3	7	5	28	.	2	4	12	10	0.802
Is this site part of a new primary care model supported by public funding? - does not know	0 (No) to 1 (Yes)	17	17	.	.	.	.	31	31	.	.	.	.	.
Is this site part of a new primary care model supported by public funding?	0 (No) to 1 (Yes)	17	6	11	.	.	.	31	13	18	.	.	.	0.662

APPENDIX 2
Literature search articles

Search Items	Articles
I. MEDLINE	
1. Exp Medical Records/	62491
2. (medical or health).mp	1857103
3. (record or records).mp	216257
4. 2 and 3	125166
5. 1 or 4	146596
6. Patient-Centred Care/	10125
7. (patient centered or patient centred or centered care or centred care or patient focused)	16581
8. 6 or 7	16581
9. 5 and 8	**960 articles**
II. EMBASE	
1. Exp Medical Record/	111275
2. (medical or health). mp.	3029421
3. (record or records). mp.	314572
4. 2 and 3	231132
5. 1 or 4	231190
6. (patient centered or patient centred or centered care or centred care or patient focused).mp	14023
7. 5 and 6	**951 articles**

APPENDIX 3
Variable Matching

		"The 4 Dimensions of Patient-Centered Primary Care" (*Hudon et al 2011)						
		Whole Person Care [BioPsychoSocial]		Disease & Illness experience [Patient As A Person]		Common Ground [Sharing Power & Responsibility]		Clinician-Patient relationship [Therapeutic Alliance]		REFERENCES
	EMRS impact statements	*includes the full range of difficulties patients have (not just their biomedical problems)		*"understanding the patient's illness as a person", where the physician makes an attempt to illicit the patient's experience(s) as a result of having the illness		*"reflect recognition of patients' needs and preferences" (e.g. Encouraging to patient to voice ideas, "offering collaboration"* where shared decisions are made, etc)		*enhance or maintain the bond with patient. For instance a good measure would be when the patient understands the relevance and effectiveness of recommendations - hence facilitating treatment goals*		Hudon C, Fortin M, Haggerty JL, Lambert M, Poitras ME. Measuring patients' perceptions of patient-centered care: a systematic review of tools for family medicine. Annals of family medicine 2011; 9(2): 155-64. *Mead N, Bower P. 2000. "Patient-centeredness: A Conceptual Framework and Review of the Empirical Literature." Social Science and Medicine. 51:1087-1110.
		Likert Scale (0 "not relevant" to 4 "strongly relevant")								
1	With EMRS, administrative staff at our site are able to finish their work much faster than before	0	Speed of staff finishing work, is **irrelevant** to addressing the BioPsychoSocial aspect	0	Speed of staff finishing work, is irrelevant to understanding the patients illness as a person	0	Speed of staff finishing work, is **irrelevant** to sharing power and responsibility with the patient	0	Speed of staff finishing work, is irrelevant to enhancing/maintaining the bond with patient	
2	With EMRS, family physicians are able to complete the billing process more efficiently and effectively	0	Completing billing process efficiently and effectively, is **irrelevant** to addressing the BioPsychoSocial aspect	0	Completing billing process efficiently and effectively, is irrelevant to understanding the patient as a person	0	Completing billing process efficiently and effectively, is irrelevant to sharing power and responsibility with the patient	0	Completing billing process efficiently and effectively, is irrelevant to enhancing/maintaining the bond with patient	
3	With EMRS I am better able to monitor patient progress	0	If the patient's progress included other non biomedical problems then relevance points could have been allotted for this section. However, physicians being better able to monitor patient progress is irrelevant to addressing the BioPsychoSocial aspect	0	For physicians to be better able to monitor patient progress they should in turn be able to better assess/understand the patients illness in general; however, this is directly irrelevant do understanding the patient's "illness as a person".	0	If monitoring patient progress incorporated electronic input from the patients for physicians to see then points could have been awarded for this section. However, this is directly irrelevant to sharing power and responsibility with the patient.	1	[1,2,3] presumably if clinicians are better able to monitor patient progress (and the patients are aware of this) then it tends to enhance or at least maintain the bond with patients	**[1] Mainous AG 3rd, Goodwin MA, Stange KC. (2004) "Patient-physician shared experiences and value patients place on continuity of care." Annals of Family Medicine. 2(5):452-454. [2] Goold SD, Lipkin Jr M. (1999) "The Doctor–Patient Relationship: Challenges, Opportunities, and Strategies." Journal of General Internal Medicine. 14:S26-533. [3] Clemence, A. Jill; Hilsenroth, Mark J; Ackerman, Steven J; Strassle, Carla G; Handler, Leonard. (2006) " Facets of the therapeutic alliance and perceived progress in psychotherapy: Relationship between patient and therapist perspectives." Clinical Psychology & Psychotherapy. 12 (6):443-454.**
4	With EMRS, clinicians at our site are able to finish their work much faster than before	0	Clinicians finishing work faster than before, is directly **irrelevant** to addressing the BioPsychoSocial aspect.	0	Theoretically by having clinicians finish their work much faster than before, they could spend more time understanding the patients illness as a person. However, Clinicians finishing work faster than before, is directly irrelevant to addressing the patient as a person.	0	Theoretically by having clinicians finish their work much faster than before, they could spend more time reflecting the patient's needs and preferences. However, clinicians finishing work faster than before, is directly irrelevant to sharing power and responsibility with the patient.	1	[4, 5,6,7] presumably when clinicians finish their work faster, they are able to reduce wait times as well as have opportunity to spend more time with patients , which both in turn improves patient satisfaction, creating a positive state to build therapeutic alliance on. Additionally, by having clinicians finish their work much faster than before, theoretically allows for physicians to spend more time enhancing or maintaining their bond with the patient.	[4] McMullen M, Netland PA. (2013). "Wait time as a driver of overall patient satisfaction in an ophthalmology clinic." Clinical Ophthalmology. 7:1655-1660. [5] Moon TD. Laurens MB. Weimer SM. Levy JA. (2005) "Nonemergent emergency room utilization for an inner-city pediatric population." Pediatric Emergency Care. 21(6):363-366. [6] Khankeh HR, Khorasani-Zavareh D, Azizi-Naghdloo F, Hoseini MA, Rahgozar M. (2013). "Triage effect on wait time of receiving treatment services and patients satisfaction in the emergency department: Example from Iran. 18:79-83. [7] Anderson RT, Camacho FT, Balkrishnan R. (2007). "Willing to wait?: the influence of patient wait time on satisfaction with primary care." BMC Health Services Research. 7:31.
5	Easy to access data from EMRS (for physician & medical staff)	4	[searches for this on next tab] [8,9,10]("interdisciplinary teams")Theoretically with easier access to data from EMRS, clinicians may have a higher propensity to review other aspects of a patient's care (e.g. OTPT, Social worker, Nursing staff, nutritionist, home-care providers, psychologist, etc). Such that, there's improved/efficient coordination of care. Easy to access data from EMRS, is directly irrelevant to	0	Easy to access data from EMRS, is directly irrelevant to understanding the patient's illness as a person.	0	If it was easy for patient to access their own data and provide input then a higher score could have been given. However, easiness to access data from EMRS, is directly irrelevant to understanding the patient's illness as a person.	0	If it was easy for patient to access their own data and to provide interactive input with clinician then a higher score could have been given (e.g. patient says that HTN medication dosage isn't helping to achieve standardized target blood pressure, then physician replies by recommending doubling the dosage). However, easiness to access data from EMRS, is directly irrelevant to	**[8] O'Malley AS, Grossman JM, Cohen GR, Kemper NM, Pham HH. (2010) "Are Electronic Medical Records Helpful for Care Coordination? Experiences of Physicians Practices." JGIM. 25:177-185. [9] Brown MA, Blodworth L, Ross LA, Jack L, Kennedy K. 2013. "Health Information Technology Use in a Rural Clinic: The Pharmacist's Perspective." Journal of Health Care for the Poor and Underserved. 24: 1 Suppl. [10] Jones KL, Jamerson C, Pike S. "The Journey of Electronic Interdisciplinary Care Plans". Nurse Management. 43:9-12.**
6	Easy to enter data into EMRS	0	Clinicians entering data into EMRS faster than before, is directly irrelevant to addressing the BioPsychoSocial aspect.	0	Ease to enter data into EMRS, is directly irrelevant to understanding the patients illness as a person.	0	Ease to enter data into EMRS, is directly irrelevant to understanding the patient's illness as a person.	3	[4,5,6,7] Easy to enter data into EMRS would presumably help clinicians finish their work faster, as well as be able to have the opportunity to spend more time with patients during medical interviews, which in turn improves patient satisfaction creating a positive state to build therapeutic alliance	
7	Easy to read text on the computer screen	0	Easy to read text on the computer screen, is directly **irrelevant** to addressing the BioPsychoSocial aspect.	0	Easy to read text on the computer screen, is directly **irrelevant** to understanding the patient's illness as a person.	0	Easy to read text on the computer screen, is directly irrelevant to sharing power and responsibility with the patient.	0	Easy to read text on the computer screen, is directly irrelevant to enhancing or maintaining the bond with the patient.	
8	EMRS decreases the number of laboratory tests	0	Decreasing the number of laboratory tests, is directly **irrelevant** to addressing the BioPsychoSocial aspect.	0	Decreasing the number of laboratory tests, is directly **irrelevant** to understanding the patient's illness as a person.	0	Decreasing the number of laboratory tests, is directly irrelevant to sharing power and responsibility with the patient.	1	[11,12,13] presumably when clinicians can decrease the number of laboratory tests, it "can" in turn improves patient satisfaction, creating a positive state to build therapeutic alliance on	[11] Malone B. (2013.) "Our Daily Blood". Clinical Laboratory News. 39:9. [12] Forsyth RA, Winarko S. (2001). "Peer Discussion in Family Practice." The Permanente Journal. 5:3. [13] Graeber S, Richter S, Folz J, Pham PT, Jacob P, Schilling MK. (2007). "Clinical pathways in general surgery. Development, implementation, and evaluation." Methods of Information in Medicine. 46:574-579.

Continued...

		"The 4 Dimensions of Patient-Centered Primary Care" (*Hudon et al 2011)							
		Whole Person Care [BioPsychoSocial]		Disease & Illness experience [Patient As A Person]		Common Ground [Sharing Power & Responsibility]		Clinician-Patient relationship [Therapeutic Alliance]	REFERENCES
	EMRS impact statements	*includes the full range of difficulties patients have (not just their biomedical problems)		*"understanding the patient's illness as a person", where the physician makes an attempt to illicit the patient's experience(s) as a result of having the illness		*"reflect recognition of patients' needs and preferences" (e.g. Encouraging to patient to voice ideas, "offering collaboration"* where shared decisions are made, etc)		*enhance or maintain the bond with patient. For instance a good measure would be when the patient understands the relevance and effectiveness of recommendations - hence facilitating treatment goals*	Hudon C, Fortin M, Haggerty JL, Lambert M, Poitras ME. Measuring patients' perceptions of patient-centered care: a systematic review of tools for family medicine. Annals of family medicine 2011; 9(2): 155-64. *Mead N, Bower P. 2000. "Patient-centeredness: A Conceptual Framework and Review of the Empirical Literature." Social Science and Medicine. 51:1087-1110.
		Likert Scale (0 "not relevant" to 4 "strongly relevant")							
9	EMRS will make patient care less expensive	0	EMRS making patient care less expensive is, directly **irrelevant** to addressing the BioPsychoSocial aspect.	0	EMRS making patient care less expensive is, directly irrelevant to addressing the patients illness as a person.	0	EMRS making patient care less expensive is, is directly irrelevant to sharing power and responsibility with the patient.	0	EMRS making patient care less expensive is, is directly irrelevant to enhancing or maintaining the bond with the patient.	
10	With EMRS, family physicians are better able to bill for each respective patient encounter and associated incentive programs	0	Family physicians being better able to bill for each respective patient encounter and associated incentive programs, is directly **irrelevant** to addressing the BioPsychoSocial aspect.	0	Family physicians being better able to bill for each respective patient encounter and associated incentive programs, is directly irrelevant to addressing the patients illness as a person.	0	Family physicians being better able to bill for each respective patient encounter and associated incentive programs, is directly irrelevant to sharing power and responsibility with the patient.	0	Family physicians being better able to bill for each respective patient encounter and associated incentive programs, is directly irrelevant to enhancing or maintaining the bond wit the patient.	
11	EMRS eliminates a lot of paperwork for the administrative staff	0	Eliminating a lot of the paperwork for administrative staff, is directly **irrelevant** to addressing the BioPsychoSocial aspect.	0	Eliminating a lot of the paperwork for administrative staff, is directly **irrelevant** to understanding the patient's illness as a person.	0	Eliminating a lot of the paperwork for administrative staff, is directly irrelevant to sharing power and responsibility with the patient.	0	Eliminating a lot of the paperwork for administrative staff, is directly irrelevant to enhancing or maintaining the bond wit the patient.	
12	EMRS eliminates a lot of paperwork for our clinicians	0	Eliminating a lot of the paperwork for clinicians, is directly **irrelevant** to addressing the BioPsychoSocial aspect.	0	Eliminating a lot of paperwork for clinicians could hypothetically allow physicians to have more time in the medical interview to understand the patient's illness as a person. **However,** eliminating a lot of the paperwork for clinicians, is directly **irrelevant** to understand the patient's illness as a person.	0	Eliminating a lot of paperwork for clinicians could hypothetically allow physicians to have more time to reflect recognition of patient's needs and preferences, and offer collaboration. **However**, eliminating a lot of the paperwork for clinicians, is directly **irrelevant** to understand the patient's illness as a person.	0	Eliminating a lot of paperwork for clinicians could hypothetically allow physicians to have more time to enhance or maintain the bond with patient. However, eliminating a lot of the paperwork for clinicians, is directly irrelevant to understand the patient's illness as a person.	
13	With EMRS, overhead costs are saved	0	Saving overhead costs, is directly **irrelevant** to addressing the BioPsychoSocial aspect.	0	Saving overhead costs, is directly **irrelevant** to understanding the patient's illness as a person.	0	Saving overhead costs, is directly irrelevant to sharing power and responsibility with the patient.	0	Saving overhead costs, is directly irrelevant to enhancing or maintaining the bond with the patient.	
14	It is confusing to follow the sequence of screens	0	Confusion and difficulty following the sequence of screens is directly **irrelevant** to the BioPsychoSocial aspect.	0	If the physician is spending too much time on the computer the clinician may not be able to focus more on understand the patient's illness as a person. Confusion and difficulty following the sequence of screens is directly **irrelevant** to understanding the patient's illness as a person.	0	Confusion and difficulty following the sequence of screens is directly **irrelevant** to sharing power and responsibility with the patient.	0	Hypothetically if the patient encounter involved the physician appearing confused using the EMRS and in turn the patient felt that they were losing confidence in their physicians abilities it could hinder the therapeutic alliance. However, confusion and difficulty following the sequence of screens is directly	
15	EMRS improves the quality of medical care received by the patients (quality of care is defined in many different ways throughout literature [14])	4	[14,15,16] Quality of care can encompasses providing the full range of difficulties patients have.	4	[14,15,16,17,18] Quality of care can encompasses understanding the patient's illness as a person.	4	[14,15,16] Quality of care can encompasses reflecting and recognition of the patient's needs and preferences.	4	[14,15,16] Quality of care can encompasses enhancing or maintain the bond with patients.	**[14]** Campbell SM, Roland MO, Buetow SA. (2000). "Defining quality of care." Social Science & Medicine. 51:1611-1625. **[15]** Saha S, Beach MC, Cooper LA. (2008). "Patient Centeredness, Cultural Competence, and Healthcare Quality." Journal of the National Medical Association. 100(11): 1275–1285. **[16]** Committee on Quality of Health Care Institute of Medicine. (2001) "Crossing the Quality Chasm: A New Health System for the 21st Century." National Academy Press, Washington DC. **[17]** Khan S, McIntosh C, Sanmartin C, Watson D, Leeb K. 2008. "Primary health care teams and their impact on processes and outcomes of care." Stats Canada, Health Research Working Paper Series. Ottawa. **[18]** Marcum JA. (2008) "Humanizing Modern Medicine: Patient as a Person." Philosophy and Medicine. 99:49-61.
16	EMRS use improves continuity of care and patient access (to health care); which will decrease his need to visit the Emergency Dept [19]	4	Improving continuity of care and patient access (to health care) will (A) improve coordinated care for the patient amongst multidisciplinary providers [20, 21], and (b) decrease the stress the patient experiences subsequently improving the biopsychosocial wellbeing of the patient. [22]	0	Improving continuity of care and patient access (to health care), is **irrelevant** to understanding the patient's illness as a person.	0	Improving continuity of care and patient access (to health care), is directly irrelevant to sharing power and responsibility with the patient.	1	[23,24,25] improving continuity of care and patient access to health care, assuming that the patient consistently access the same physician(s), provides physicians the ability to enhance or maintain the bond with the patient. However this variable/question does not directly measure whether or not the bond with patient is enhanced or maintained.	**[19]** Grumbach K, Bodenheimer T, Grundy P. (2009). "The Outcomes of Implementing Patient-Centred Medical Home Interventions: A Review of the Evidence on Quality, Access and Costs from recent Prospective Evaluation Studies." Patient-Centred Primary Care Collaborative, Centre for Excellence in Primary Care. **[20]** The College of Family Physicians of Canada. "Patient-Cetered Primary Care in Canada: Bring It On Home." **[21]** Wong HJ, Caesar M, Bandali S, Agnew J, Abrams H. (2009). "Electronic Inpatient Whiteboards: Improving Multidisciplinary Communication and coordination of Care." International Journal of Medical Informatics. 78(4):239-247. **[22]** Borrell-Carrio F, Suchman AL, Epstein RM. (2004) "The Biopsychosocial Model 25 years Later: Principles, Practice, and Scientific Inquiry." Annals of Family Medicine. 2(6):576-582. **[23]** Noyes R Jr, Kukoyi OA, Longley SL, Langbehn DR, Stuart SP. (2011). "Effects of continuity of care and patient dispositional factors on the physician-patient relationship." Annals of Clinical Psychiatry. 3:180-185. **[24]** Nutting PA, Goodwin MA, Flocke SA, Zyzanski SJ, Stange KC. (2003) "Continuity of primary care: to whom does it matter and when?". Annals of Family Medicine. 3:149-155. **[25]** Donahue KE, Ashkin E, Pathman DE. (2005). "Length of patient-physician relationship and patients' satisfaction and preventive service use in the rural south: a cross-sectional telephone study." BMC Family Practice. 6:40.

Continued...

		"The 4 Dimensions of Patient-Centered Primary Care" (*Hudon et al 2011)								REFERENCES
	EMRS impact statements	Whole Person Care [BioPsychoSocial]		Disease & Illness experience [Patient As A Person]		Common Ground [Sharing Power & Responsibility]		Clinician-Patient relationship [Therapeutic Alliance]		
		*includes the full range of difficulties patients have (not just their biomedical problems)		*"understanding the patient's illness as a person", where the physician makes an attempt to illicit the patient's experience(s) as a result of having the illness		*"reflect recognition of patients' needs and preferences" (e.g. Encouraging to patient to voice ideas, "offering collaboration"* where shared decisions are made, etc)		*enhance or maintain the bond with patient. For instance a good measure would be when the patient understands the relevance and effectiveness of recommendations - hence facilitating treatment goals*		Hudon C, Fortin M, Haggerty JL, Lambert M, Poitras ME. Measuring patients' perceptions of patient-centered care: a systematic review of tools for family medicine. Annals of family medicine 2011; 9(2): 155-64. *Mead N, Bower P. 2000. "Patient-centeredness: A Conceptual Framework and Review of the Empirical Literature." Social Science and Medicine. 51:1087-1110.
		Likert Scale (0 "not relevant" to 4 "strongly relevant")								
17	EMRS decreases patient waiting time	0	Reducing patient waiting time, is directly **irrelevant** to addressing the BioPsychoSocial aspect.	0	Reducing patient waiting time, is directly **irrelevant** to understanding the patient's illness as a person.	0	Reducing patient waiting time , is directly irrelevant to sharing power and responsibility with the patient.	1	[5,6,7] reducing patient waiting time reduces frustration of the patient towards the physician, thus providing a better opportunity for the physician to maintain or enhance the bond with patient. Where as increased waiting times increases patient frustration towards the physician making it more difficult to maintain or enhance the bond with the patient during the medical interview.	
18	EMRS reduces the risk of making errors	0	Reducing the risk of medical errors, is directly **irrelevant** to addressing the BioPsychoSocial aspect.	0	Reducing the risk of medical errors, is **irrelevant** to understanding the patient's illness as a person.	0	Reducing the risk of medical errors, is directly irrelevant to sharing power and responsibility with the patient.	4	[26,27,28] reducing medical errors promotes the physician's competence with the patient, which in turn can further facilitate patient trust in the physicians abilities.	**[26]** Hovey RB, Dvorak ML, Burton T, Worsham S, Padilla J, Hatlie MJ, Morck AC. (2011) "Patient Safety: a consumer's perspective." Quality Health Research. 21(5):662-672. **[27]** Rathert C, May DR, Williams ES. (2011). "Beyond service quality: the mediating role of patient safety perceptions in the patient experience-satisfaction relationship." Health Care Management Review. 36(4):359-368. **[28]** Rowe R, Calnan M. (2006). "Trust Relations in Health Care - the New Agenda." European Journal of Public Health. 16 (1): 4-6.
19	Patient information is more confidential with EMRS than our paper records	0	Whether patient information is more confidential with EMRS than our paper records, is irrelevant to addressing the BioPsychoSocial aspect.	0	Whether patient information is more confidential with EMRS than our paper records, is irrelevant to understanding the patients illness as a person.	0	Whether patient information is more confidential with EMRS than our paper records, is irrelevant to sharing power and responsibility	4	[29,30,31] Maintaining confidentiality is an important part of a trusting relationship between patient and physician. Better confidentiality that a physician offers for their patient, the increased trust that forms, and subsequently this should enhance or maintain the bond wit the patient. However, this variable aims to discern whether EMRS or paper records are more confidential, and thus does not assess the impact of confidentiality on therapeutic alliance.	**[29]** Reilly DR. 2008. "Breaching Confidentiality and Destroying Trust: the Harm to Adolescents on Physicians' rosters." Canadian Family Physician. 54 (6): 834-835. **[30]** College of Physicians and Surgeons of Ontario. (2006). "Confidentiality of Personal Health Information: Policy Statement #8-05". Accessed: September 29, 2013. http://www.cpso.on.ca/policies/policies/default.aspx?ID=1500 **[31]** Goold SD, Lipkin M. 1999. "The Doctor-Patient Relationship: Challenges, Opportunities, and Strategies." Journal of General Internal Medicine. 14 (Supplemental 1): S26-S33.
20	Is this site part of a new primary care model supported by public funding (with respect to new model, one can presume that it's more multidisciplinary, with better quality of care, more patient centered, follow-up)	4	[20, 32,33,34] Presuming the 'new primary care model' provides better BioPsychoSocial care (e.g. such as through multidisciplinary healthcare teams who help address these various areas)	4	[20, 32,33,34] Presuming the 'new primary care model' includes treating the patient as a person.	4	[20, 32,33,34] Presuming the 'new primary care model' includes sharing power & responsibility.	4	[20, 32,33,34] Presuming the 'new primary care model' includes addressing therapeutic alliance.	**[32]** Carver MC, Jessie A. (2011) "Patient-Centered Care in a Medical Home." The Online Journal of Issues in Nursing. 16(2). **[33]** Ontario Medical Association. "Patient-Centred Care." Ontario Medical Association Policy Paper. **[34]** Patient-Centered Primary Care Collaborative. (2007) "Joint Principles of the Patient Centered Medical Home."

APPENDIX 4
Variable Matching Scores & Calculations

Electronic Medical Record Systems (EMRS) Impact statement #		Patient Centered Relevance Score per Patient-Centered Primary Care Dimension (0 strongly disagree to 4 strongly agree Likert Scale)				TOTAL per EMRS impact statement
		Whole Person Care [BioPsychoSocial Perspective]	**Disease & Illness experience [Patient As A Person]**	**Common Ground [Sharing Power & Responsibility]**	**Clinician-Patient relationship [Therapeutic Alliance]**	
1	With EMRS, admin staff at our site are able to finish their work much faster than before	0	0	0	0	0
2	With EMRS, family physicians are able to complete the billing process more efficiently and effectively	0	0	0	0	0
3	With EMRS, I am better able to monitor patient progress	0	0	0	1	1
4	With EMRS, clinicians at our site are able to finish their work much faster than before	0	0	0	1	1
5	Easy to access data from EMRS	4	0	0	0	4
6	Easy to enter data into EMRS	0	0	0	3	3
7	Easy to read text on the computer screen	0	0	0	0	0
8	EMRS decreases the number of laboratory tests	0	0	0	1	1
9	EMRS will make patient care less expensive	0	0	0	0	0
10	With EMRS, family physicians are better able to bill for each respective patient encounter and associated incentive programs	0	0	0	0	0
11	EMRS eliminates a lot of paperwork for the administrative staff	0	0	0	0	0

continued...

12	EMRS eliminates a lot of paperwork for our clinicians	0	0	0	0	0
13	With EMRS, overhead costs are saved	0	0	0	0	0
14	It is confusing to follow the sequence of screens	0	0	0	0	0
15	EMRS improves the quality of medical care received by the patients	4	4	4	4	16
16	EMRS use improves continuity of care and patient access which will decrease his need to visit the Emergency Department	4	0	0	1	5
17	EMRS decreases patient waiting time	0	0	0	1	1
18	EMRS reduces the risk of making errors	0	0	0	4	4
19	Patient information is more confidential with EMRS than our paper records	0	0	0	4	4
20	Is this site part of a new primary care model supported by public funding	4	4	4	4	16

CALCULATIONS

Total relevance score per PCPC dimension (column totals)	16	8	8	24	sum = 56
PCPC Dimension impact potential, Distribution per Dimension (%) [ideal 25%, 25,%, 25%, 25% for a survey that can consistently evaluate EMRS impact]	[16/56 X100%=] 28.6 %	[8/56 X100%=] 14.3 %	[8/56 X100%=] 14.3 %	[24/56 X100%=] 42.9 %	sum = 100%

APPENDIX 5

Mean physician agreement with

PCPC impact of EMRS statements (on a 0 to 4 Likert Scale) -- Calculations

EMRS Impact statement #		Mean frequency of physician agreement with EMRS impact statement (0 to 4 likert scale)	Mean frequency of physician agreement with EMRS impact statement (-100% to 100%)	PCPC impact score %	Mean frequency of physician agreement with PCPC impact of EMRS statement (-100 to 100%)	Mean frequency of physician agreement with PCPC impact of EMRS statement (0 to 4 likert scale)
			x 100		=	convert scle
1	With EMRS, admin staff at our site are able to finish their work much faster than before	3.20	60.23	0	0.00	2.00
2	With EMRS, family physicians are able to complete the billing process more efficiently and effectively	3.43	71.59	0	0.00	2.00
3	With EMRS, I am better able to monitor patient progress	3.55	77.27	1.56	1.21	2.02
4	With EMRS, clinicians at our site are able to finish their work much faster than before	1.98	-1.14	1.56	-0.02	2.00
5	Easy to access data from EMRS	3.53	76.67	6.25	4.79	2.10
6	Easy to enter data into EMRS	3.53	76.67	4.69	3.59	2.07
7	Easy to read text on the computer screen	3.64	82.22	0	0.00	2.00
8	EMRS decreases the number of laboratory tests	2.55	27.27	1.56	0.43	2.01
9	EMRS will make patient care less expensive	2.43	21.59	0	0.00	2.00
10	With EMRS, family physicians are better able to bill for each respective patient encounter and associated incentive programs	3.34	67.05	0	0.00	2.00

continued...

11	EMRS eliminates a lot of paperwork for the administrative staff	2.86	43.18	0	0.00	2.00
12	EMRS eliminates a lot of paperwork for our clinicians	2.66	32.95	0	0.00	2.00
13	With EMRS, overhead costs are saved	2.43	21.59	0	0.00	2.00
14	It is confusing to follow the sequence of screens	1.29	-35.56	0	0.00	2.00
15	EMRS improves the quality of medical care received by the patients	3.43	71.59	100	71.59	3.43
16	EMRS use improves continuity of care and patient access which will decrease his need to visit the Emergency Department	2.70	35.23	15.62	5.50	2.11
17	EMRS decreases patient waiting time	2.45	22.73	1.56	0.36	2.01
18	EMRS reduces the risk of making errors	3.11	55.68	6.25	3.48	2.07
19	Patient information is more confidential with EMRS than our paper records	3.05	52.27	6.25	3.27	2.07
20	Is this site part of a new primary care model supported by public funding	0.60	-69.79	100	-69.79	0.60

CALCULATIONS	**on a 0 to 4 scale**	**on a -100% to + 100% scale**	**on a 100% scale**	**on a -100% to +100% scale**	**on a 0 to 4 scale**
All EMRS impact statements					
mean (per dimension aka column)	2.79	39.46	1.22	1.22	2.02
SD (per dimension aka column)	0.80	39.78	23.01	23.01	0.46
Only those that evaluate PCPC (PCPC impact score >0%)					
mean (per dimension aka column)	2.71	35.29	-4.72	-4.72	1.91
SD (per dimension aka column)	0.91	45.32	22.95	22.95	0.46

APPENDIX 6

Mean physician agreement with

PCPC impact of EMRS statements (on a -2 to +2 Likert Scale) -- Calculations

	EMRS Impact statement #	Mean frequency of physician agreement with EMRS impact statement (0 to 4 likert scale)	Mean frequency of physician agreement with EMRS impact statement (-100% to 100%)	PCPC impact score %	Mean frequency of physician agreement with PCPC impact of EMRS statement (-2 to +2 Likert scale)
			X 100	also convert scale (+/- 100% to -/+2) =	
1	With EMRS, admin staff at our site are able to finish their work much faster than before	3.20	60.23	0	0.00
2	With EMRS, family physicians are able to complete the billing process more efficiently and effectively	3.43	71.59	0	0.00
3	With EMRS, I am better able to monitor patient progress	3.55	77.27	1.56	0.02
4	With EMRS, clinicians at our site are able to finish their work much faster than before	1.98	-1.14	1.56	-0.00036
5	Easy to access data from EMRS	3.53	76.67	6.25	0.10
6	Easy to enter data into EMRS	3.53	76.67	4.69	0.07
7	Easy to read text on the computer screen	3.64	82.22	0	0.00
8	EMRS decreases the number of laboratory tests	2.55	27.27	1.56	0.01
9	EMRS will make patient care less expensive	2.43	21.59	0	0.00
10	With EMRS, family physicians are better able to bill for each respective patient encounter and associated incentive programs	3.34	67.05	0	0.00
11	EMRS eliminates a lot of paperwork for the administrative staff	2.86	43.18	0	0.00
12	EMRS eliminates a lot of paperwork for our clinicians	2.66	32.95	0	0.00
13	With EMRS, overhead costs are saved	2.43	21.59	0	0.00
14	It is confusing to follow the sequence of screens	1.29	-35.56	0	0.00

continued...

15	EMRS improves the quality of medical care received by the patients	3.43	71.59	100	1.43
16	EMRS use improves continuity of care and patient access which will decrease his need to visit the Emergency Department	2.70	35.23	15.62	0.11
17	EMRS decreases patient waiting time	2.45	22.73	1.56	0.01
18	EMRS reduces the risk of making errors	3.11	55.68	6.25	0.07
19	Patient information is more confidential with EMRS than our paper records	3.05	52.27	6.25	0.07
20	Is this site part of a new primary care model supported by public funding	0.60	-69.79	100	-1.40

CALCULATIONS	**on a 0 to 4 scale**	**on a -100 to +100 scale**	**on a 100% scale**	**on a -2 to +2 scale**
All EMRS impact statements				
mean (per dimension aka column)	2.79	39.46	12.27	0.02
SD (per dimension aka column)	0.80	39.78	30.25	0.46
Only those that evaluate PCPC				
mean (per dimension aka column)	2.77	35.29	14.53	0.04
SD (per dimension aka column)	0.89	45.32	30.33	0.63

APPENDIX 7

Online Canada Health Infoway Survey

EMR Physician Value Study

The research collaborative

MEdbASE Research

McGill DESAUTELS FACULTY OF MANAGEMENT · FACULTÉ DE GESTION

Site Information

Contact:

Clinic name:		*Contact name:*	
		Title:	
Address:		Telephone number:	
		email address:	
		Years at clinic:	
City:			
Province:			
Country:			
Postal code:			
Telephone number:			
web site:			

Description:

Provide brief description of services offered:	

How many **active** patients does this site service:

(a patient is active if he / she has visited the clinic or has been visited at home by a clinic physician in the last 5 years)

How many **registered** patients does this site service:

(a patient is registered or rostered if he / she has declared that the clinic or one of its clinicians is his / hers primary care physician)

What is the *primary* setting of your practice site?

How many family clinicians practice at this site:

(Family clinician means family physician or nurse-practitioner)

Indicate the TOTAL FTE these clinicians represent

(An FTE is defined as 35 to 40 hours per 5 day work week)

(A clinican is defined as a healthcare provider responsible for seeing patients. For the purposes of these questionnaires, a clinician is a Family Physician or a Nurse-practitioner)

How many family clinicians are participating in the study:

What funding arrangement best describes the payment model for clinicians at this site?

Continued...

What other types of complementary funding do family clinicians at this site receive?

Is this site part of a new primary care model supported by public funding?

(e.g. GMF or Cliniques-réseau in Québec, Family Health Teams in Ontario, Primary Care Networks in Alberta, etc.)

EMR: (electronic medical record)

Indicate which EMR product and vendor are in use at this site.

EMR product name and version:	
EMR vendor name:	
When was the EMR implemented at this site (go live date MM/YYYY)?	
When was the EMR last updated (MM/YYYY, N/A if not updated)?	

Do clinicians at your site use any of the following technologies?

Electronic ordering of laboratory tests

Electronic receipt of laboratory results integrated into the EMR (not scanned)

Electronic alerts or prompts about a potential problem with drug dose or drug interaction

Electronic referring to specialists

Electronic prescribing of medication (selection of Rx from EMR and printing script)

Are you able to electronically transfer prescriptions to a pharmacy?

Can you electronically exchange the following with any doctors outside your

(Do not include fax)

Patient clinical summaries

Laboratory and diagnostic tests

With the patient medical records system you *currently* have, how easy would it (or staff in your practice) to generate the following information about your

Is this process integrated to y

List of patients by diagnosis (e.g., diabetes or cancer)

List of patients by laboratory result *(e.g. HbA1C>9.0)*

List of patients who are due or overdue for tests or preventive care *(e.g. flu vaccine due)*

List of all medications taken by an individual patient

Does this list include medication prescribed by practitioners outside this clinic?

List of all patients taking a particular medication

List of all laboratory results for an individual patient

Does this list include results ordered by practitioners outside this clinic?

Provide patients with clinical summaries for each visit

Are the following tasks *routinely* performed by clinicians at

Patients are sent reminder notices when it is time for regular preventive or follow-up care

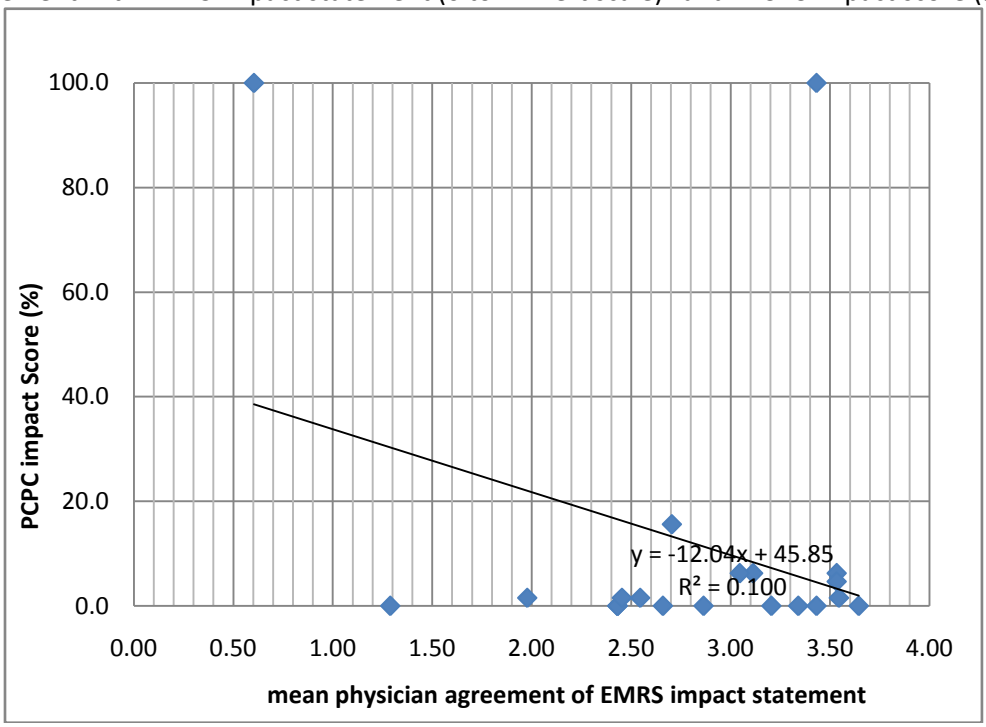
(e.g. flu vaccine or HbA1C for diabetic patients)

APPENDIX 8

Mean physician agreement of each EMRS impact statement versus their respective PCPC impact score

Mean physician agreement of each of the 20 Electronic Medical Record Systems (EMRS) impact statements versus their respective Patient-Centered Primary Care (PCPC) impact score

*EMRS impact statement number can be discerned from Appendix 6 using columns: “mean frequency of physician agreement with EMRS impact statement (0 to 4 Likert scale)” and “PCPC impact score (%)” .



Mean physician agreement of each Patient-Centered Primary Care (PCPC) Positive Electronic Medical Record System (EMRS) impact statement versus their respective PCPC impact score

*EMRS impact statement number can be discerned from Appendix 6 using columns: “mean frequency of physician agreement with EMRS impact statement (0 to 4 Likert scale)” and “PCPC impact score (%)” .