PREDICTORS OF UP-TO-DATE COLORECTAL CANCER SCREENING AND PATIENT-CENTRED CARE IN FAMILY HEALTH TEAM PRIMARY CARE PRACTICES

by

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Abstract

Introduction: The Family Health Team (FHT) is an Ontario-based initiative that aims to provide primary care through multidisciplinary teams of healthcare professionals. Little is known about variability between and within teams, and whether certain organizational characteristics are associated with quality of patient care. **Objectives:** (1) To describe FHT-level organizational characteristics for seven FHTs in Southeastern Ontario. (2) To examine the role of physician-level organizational characteristics in predicting: (a) Up-to-date colorectal cancer screening and (b) episodic patient-centredness for patients within seven FHTs in Southeastern Ontario. **Methods:** This study employed linked datasets obtained from surveys of seven FHTs, 115 health care providers (including 41 family physicians) and 998 patients, as well as a chart abstraction. Statistical analyses included performing subject-specific multilevel multivariate modeling. **Results:** (1) FHTs varied on characteristics including length of time of practice operation, number of patients, existence of personnel policies, team makeup and team climate. (2) (a) Patient uptake of colorectal cancer screening was associated with average duration of regular routine visit OR=0.88 per minute (95% CI 0.83-0.94), patient gender male OR=2.00 (95% CI 1.22-3.28), general checkup in past 2 years OR=9.03 (95% CI 5.18-15.73), travel time less than or equal to 20 minutes OR=1.53 (95% CI 0.94-2.48), and usually see regular provider OR=0.40 (95% CI 0.19–0.87). Patient uptake or physician recommendation of colorectal cancer screening demonstrated similar associations, with the absence of travel time and the addition of team climate (family physician and nurses) OR=5.88 (95% CI 0.98-35.24), patient occupational status employed vs. retired OR=0.49 (95% CI 0.23–1.02), patient occupational status not employed vs. retired OR=0.42 (95% CI 0.16–1.13), and patient smoking status never vs. ever OR=0.59 (95% CI 0.37–0.96). (b) Episodic patient-centredness was associated with patient born in Canada 0.1119 (95% CI -0.0040-0.2278), seeing regular healthcare provider today 0.1449 (95% CI 0.0426-0.2472), physician-patient gender concordance 0.1019 (95% CI 0.0128-0.1910), and

appointment length 0.006929 (95% CI 0.003554-0.010304). **Discussion:** Further research is needed to examine predictors of the quality of patient care at the practice, physician and patient levels.

Co-Authorship

Michelle Dimitris completed this thesis under the supervision of Dr. Michael Green and Dr. Linda Levesque. Michelle Dimitris designed this thesis project under the guidance of Dr. Michael Green and Dr. Linda Levesque. Michelle Dimitris sought ethics approval, linked the datasets, cleaned the data and performed statistical analyses with input from Dr. Michael Green and Dr. Linda Levesque. Michelle Dimitris wrote this thesis with input from Dr. Michael Green and Dr. Linda Levesque.

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Chapter 1

Introduction

Primary care is defined as a person's first point of contact with the healthcare system, and is often synonymous with care provided by a family physician[1]. This type of care has been touted as an important tenant of Ontario's healthcare system by government[2] and researchers[3] alike. In 2005, Ontario introduced a type of primary care delivery model termed "Family Health Team" (FHT)[4]. This delivery model is unique because it promotes the delivery of primary care through multidisciplinary teams, rather than through the family physician alone. Team-based primary care has been praised as an initiative that might increase quality of care[5], but little research has been performed to confirm this assumption. Additionally, little is known about variability in the organization of Family Health Teams. Moreover, little is known about the quality of primary care in Ontario.

Currently, research efforts in primary care in Canada are focused on developing quality indicators in order to measure the quality of primary care[6]. This thesis has selected two indicators that represent one of either the preventive care or the patient experience of care. Colorectal cancer screening represents preventive care, in that it is an activity that is recommended for a specific population at specific intervals of time for the purpose of secondary prevention of colorectal cancer[7]. Colorectal cancer is the third most diagnosed and second most fatal cancer in Ontario[8]. Evidence indicates that screening for colorectal cancer reduces mortality[9] and is cost-effective[10]. Conversely, patient-centredness represents the patient experience of care and is applicable to all patients. While this term encompasses patient satisfaction, it also includes the patient's feeling of being involved in his or her own care[11]. Both types of quality indicators are highly relevant in the primary care setting. The impact of organizational aspects of primary care on both colorectal cancer screening and patient centred care is unknown.

The purpose of this thesis project was twofold. Firstly, this thesis set out to describe organizational characteristics of Family Health Teams in order to investigate variability between teams. Secondly, this thesis examined predictors of the quality of care, as represented by up-to-date colorectal cancer screening and episodic patient-centredness, within Family Health Teams. The goal of this thesis was to inform future research about the quality of care in primary care, particularly within Family Health Teams.

The organization of this thesis is as follows: First, a literature review is presented that details the study setting, known predictors of the study outcomes (namely colorectal cancer screening and patient-centred care), and prior research examining the relationship between organizational characteristics and patient outcomes in primary care. Second, methods of this thesis are detailed, including study design, conceptualization of variables and statistical analysis. Third, results addressing the study objectives are presented and interpreted. Fourth, the implications of the results and strengths and limitations of this thesis are discussed.

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Chapter 2

Literature Review

2.1 Study Setting

Primary is defined as "the level of care at which people initially come into contact with physicians and, in most cases, the health care system"[1]. This type of care is seen as an important tenant in the healthcare system, with evidence that it is associated with decreased morbidity, mortality, ER utilization, hospitalization, and costs as well as increased patient satisfaction, vision, dental care, rates of immunization and blood pressure control[2]. In Canada, the general practitioner (or family physician) is the only primary care medical specialty, and is expected to account for 50% of the physician population. However, only 24% of Ontario medical graduates were expected to choose general practice as their specialty in 1998, raising questions about physician interest in working in this setting[3]. There has been experimentation in general practitioner reimbursement (i.e. the introduction of schemes differing from the traditional fee-for service method), with the result being higher levels of work satisfaction among general practitioners[4]. Alongside this payment reform, there has been a movement to have primary care delivered in teams instead of by an individual physician[1,5].

Ontario's response to this call was to introduce Family Health Teams, which are comprised of family physicians, nurse practitioners, registered nurses, social workers, dieticians and other allied health professionals in a combination such that the team addresses the unique needs of its service population[6]. This program was introduced in 2005, with 200 teams created to date, and with expansions to the program made as recently as August 2010[6]. Because of their unique funding and delivery structures, it is hypothesized that Family Health Teams improve both patient care and physician satisfaction, and an evaluation of this program is expected from the Ministry of Health and Long Term Care in 1-2 years[7].

A recent case study of Family Health Teams that conducted interviews with staff speculated that factors internal to each FHT (i.e. communication through electronic medical records, communication through team meetings, team vision, professional culture, practice style, etc.) might be related to the quality of the team's collaboration[8]. The study also postulated that physicians might have different levels of commitment to the team-based model (described as "differential buy-in"). Indeed, even the MOHLTC has suggested that there will be variability among FHTs, indicating that, "no two teams will function exactly alike. Each, over time, will develop its own character, working relationships and culture"[9]. Despite the acknowledgement of variability, Family Health Teams are often discussed in a homogeneous manner. Although the Family Health Team initiative is expanding, little is known about the variability of characteristics between teams and within teams, and whether or not certain characteristics are associated with quality of patient care.

2.2 Quality Indicators (Outcome)

2.2.1 Quality of Care

The quality of primary care in Ontario is neither systematically measured nor publically reported. It has been suggested that primary care is unfairly precluded from being central to public debate because it is so understudied[10]. Currently, Canadian research efforts are focused on building data capacity and identifying measureable quality indicators. The Canadian Primary Care Sentinel Surveillance Network (CPSNN) is currently gathering chronic disease data from patient electronic medical records[11]. Simultaneously, The Canadian Institute for Healthcare Information (CIHI) Primary Health Care Indicator initiative has identified 105 primary healthcare quality indicators through stakeholder consensus[12].

This thesis chose to investigate two process-level primary care indicators that reflect both preventive care and patient experience in primary care. Avedis Donabedian, an important proponent of the measurement of the quality of care, indicated that quality measurement could be

focused on one or more of the structure, process and/or outcomes of care[13]. He suggested that, since many factors outside of the provision of care may affect health outcomes, processes might be more favorable indicators of quality of care in that they are more proximal to the care delivered. Furthermore, he suggested that preventive care and the patient-physician relationship are important components of quality, but are often overlooked in definitions of quality. However, this thesis suggests that these dimensions are of relevance in primary care.

Colorectal cancer screening was selected as an indicator of interest because of its slow uptake in Ontario. At the time that the parent study was conducted, only 31% of the population that met the criteria for Ontario's colorectal cancer screening guidelines had been screened in the past two years[14]. Although there has been much research conducted on the determinants of colorectal cancer screening, most of this research has focused on patient-level factors, psychosocial determinants and specific interventions aimed at increasing the uptake of colorectal cancer screening[15, 16]. There has been little research examining organizational attributes at the family physician-level as predictors of colorectal cancer screening.

Conversely, patient-centredness is an indicator that details patient experience rather than preventive care. Patient-centredness is similar to patient satisfaction, but the terms are not synonymous. The Ontario Medical Association indicates that "a patient-centred care system is one where patients can move freely along a care pathway without regard to which physician, other health-care provider, institution or community resource they need at that moment in time. The system is one that considers the individual needs of the patient and treats them with respect and dignity"[17]. Organizations such as The World Health Organization, The Ministry of Health and Long Term Care and The Commonwealth Fund have identified patient-centredness as important[18,19,20]. Ontario's Minister of Health has stated that "Family health care should be the hub of patient-centred care", indicating that primary care is a venue of upmost importance for this

outcome[19]. However, while patient-level determinants of colorectal cancer screening have been widely studied, the determinants of patient-centredness are virtually unknown.

It has been suggested that technical care and patient experience might be in conflict with one another[21]. More specifically, the involvement of the patient in his or her care may impede the provision of evidence-based medicine. Other researchers have concluded that patient-centredness may be associated with better patient outcomes[22]. This thesis has chosen to examine the predictors of both preventive and patient experience quality indicators by electing to examine both colorectal cancer screening and patient-centredness as outcomes.

2.2.2 Colorectal Cancer Screening

At the time during which this parent study was conducted, Cancer Care Ontario recommended colorectal cancer screening for all males and females aged 50+ [23]. Screening rates were chronically low, and much research has sought to investigate the predictors of colorectal cancer screening. Factors that have been found to be associated with colorectal cancer screening include patient demographics (age[15, 16], sex[15,16], household income[15], employment[15, 16], education[16], country of birth[15], ethnicity[15, 16]), patient health and health behaviors (self-perceived health status[16], physical activity[15], consumption of fruits and vegetables[15], self-perceived stress[15], smoking status[15], having a chronic condition[15], receiving flu shot[15]) and patient relationship to primary care practice (having a regular physician, contact with family physician[15, 16]). Research conducted in the United States has suggested that physician age, years at practice, sex, and practice type are also associated with physician compliance with colorectal cancer screening guidelines[24]. While many patient-level predictors of colorectal cancer screening have been identified, little research examining physician-level organizational predictors has been performed. Thus, despite being identified as an indicator of the quality of primary care in Canada, colorectal cancer screening has primarily been studied as a function of the patient, and not as a function of the primary care environment.

2.2.3 Patient-Centred Care

While colorectal cancer screening is a preventive output with a specific target population and recommended screening intervals, patient-centredness is a somewhat subjective output that is applicable to all patients at all times. Research in this field usually examines the effect of patient-centredness on system-level[25,26] and patient-level outcomes[27,28] (i.e. patient-centredness as an exposure). Although literature examining the predictors of patient-centredness is surprisingly sparse, a qualitative study that was based in the United States concluded that many factors, including those at the community, practice, physician and patient-levels, might contribute to patient-centred care[29]. Other research conducted in locations outside of Ontario identified some predictors of patient-centredness at the patient-level (physicial health status, education level, smoking status[30]) as well as the physician-level (quantity and quality of time spent with provider[31], gender[32]). One Ontario-based study concluded that team-based care was associated with higher patient perceptions of patient-centredness[33]. Although these few studies have painted a clearer picture of the predictors of patient-centredness, there are still gaps in knowledge, especially in Ontario. The predictors of patient-centred care have not been studied in Family Health Teams.

Colorectal cancer screening and patient-centredness are quality indicators that are both relevant in the primary care setting. Although they differ in nature and in previous research, they have both been understudied as outputs of their organizational environment.

2.3 Organizational Factors and Quality of Primary Care (Previous Research)

Few studies have been done to address the relationship between team organizational factors, team climate and patient outcomes within primary care. Many of the studies that address these factors have been performed outside of Canada, and thus the conclusions may not be generalizable to Family Health Teams. Six relevant studies are described and critiqued below, only two of which

were conducted in Ontario, and only one of which uses Ontario's Family Health Teams as the study setting.

2.3.1 Study Performed in Ontario

(1) Darouge. et. al.

Of the studies critically appraised in this literature review, the one that is most conceptually relevant to this thesis was conducted by *Darouge et. al.*[34] and was published in April 2011. This was a cross-sectional study that examined the association between remuneration and organizational characteristics within primary care practices in Ontario, and the completion of recommended preventive care manoeuvres among patients within the practices. This study was unique in that it was a multilevel study that examined broad practice-based characteristics alongside individual physician and patient-level characteristics. It was found that the presence of a female physician within the practice (OR=8.0 95% CI 4.2-11.8), a panel size of less than 1600 patients (OR=6.8 95% CI 3.1-10.6) and the presence of an electronic reminder or electronic health record system (OR=4.6 95% CI 0.4-8.7) were all statistically significantly positively associated with the completion of recommended preventive care manoeuvres. Moreover, when all patient, physician and organizational factors were included in the model, there was no statistically significant association between funding structure and the completion of preventive manoeuvres. This supports the hypothesis that practice and physician-level organizational factors play a role in the quality of primary care.

Although conceptually similar to this thesis, *Darouge et. al*.'s study contains many methodological issues that garner improvement. Most notably, Family Health Teams were not included in this study, despite being a primary care delivery system that is growing in importance in Ontario. Additionally, physician-level characteristics were aggregated to the practice-level since, in contrast to this thesis, physician-patient linkage was not possible in this study. This may have resulted in misclassification of patients regarding physician-level characteristics and the

inability to examine the interaction of physician and patient-level characteristics (i.e. gender concordance).

The outcome measure used in this study (the completion of recommended preventive manoeuvres) was a composite variable of the activities of screening for colorectal, cervical and breast cancers, screening for visual and auditory impairment and providing influenza immunization. A preventive score was calculated for each patient based on the number of activities performed divided by the number of activities recommended (based on the sex of the patient, age of the patient and recommended screening/provision interval). It may have been inappropriate to aggregate these activities into one variable, as they may have different patient-level predictors. Additionally, this variable was treated as continuous, when in reality it can only take on a discrete number of values and, in some patients for whom only one preventive manouvre is recommended, may be dichotomous. This study suggests that analysis was repeated for each preventive manouevre by using multilevel binary logistic regression in order to examine whether a specific manouevre was responsible for the association between organizational factors and the completion of recommended preventive manoeuvres. However, it is unclear as to whether some of these binary logistic regression models would have had enough power to detect an association if one existed. It is suspected that power for some of these models would have been too low, given that patient charts were randomly selected and that some preventive manouevres in this study are recommended only for those aged 65 and above.

Darouge et. al.'s study supports the hypothesis that physician and practice-level characteristics may be important predictors of the quality of patient care (as measured by the provision of preventive manouevres). This thesis built upon this work by examining similar associations in the Family Health Team setting and by improving on some methodological concerns, including physician-patient linkage and appropriate outcome conceptualization.

(2) Howard et. al

A study by *Howard et. al.*[35] examined the relationship between self-reported teamwork as measured by the Team Climate Inventory (TCI) and FHT-specific organizational factors, such as leadership scale score, organizational culture, months operational as a FHT, electronic medical record (EMR) capabilities/perceptions, number of staff, the existence of monthly team meetings, number of patients per physician and number of sites (i.e. single vs. multiple). Performing multiple variable regression analysis with the team average TCI score as the outcome demonstrated a positive association between leadership scale score, EMR capabilities, an organizational culture type (group) and team climate, while a negative association between months operational as a FHT, another organizational culture type (hierarchical) and team climate was found. Although these associations were found to be statistically significant at the p=0.05 level, it is unclear if these findings are practically (or clinically) significant. The multiple variable regression coefficients representing the increase in team climate resulting from a one-unit increase in the each independent variable were low, ranging in value from -0.003 (months operational as a FHT and team climate) to 0.48 (leadership scale score and team climate). It is unclear if, for example, a 0.003 decrease in the 5-point team climate score per one-month increase in FHT operation is practically significant. The same uncertainty is present for all reported multivariate regression coefficients, as practical significance was not addressed in this study. Additionally, response rates appear to be problematic at both the team-level (21/144 of approached eligible teams consented) and the health professional-level (overall response rate of 65.8%). Response rates were also differential among physicians (45.3%), allied health professionals (84.3%) and administrative/executive staff (61.2%). All of these response rate concerns call into question the internal validity of this study's findings. Apart from these methodological issues, it should be noted that this study addressed factors that are conceptually upstream from this thesis, in that it did not examine patient outcomes.

2.3.2 Studies Performed Internationally

(3) Bosch et. al.

Bosch et. al.[36] examined the relationship between teamwork, organizational culture and diabetes care within small office-based practices in the Netherlands. Using five separate multilevel regression models, with one for practice-level team climate and one for each type of organizational culture, this study found no statistically significant relationship between any of these factors and indicators of diabetes care (including HbAlc, systolic blood pressure, total cholesterol or clinical performance). Although this study addressed patient outcomes, it was plagued by a low response rate among practices (11.4%) and among staff within participating practices (63%). The sample size was acknowledged to be small, and thus this study's null results may not be a result of lack of association, but rather lack of power to detect statistically significant relationships. Additionally, the mean team climate score within the participants studied was 1.94, which seems lower than the average found in the aforementioned FHT study (3.8). This indicates that the primary care practices in the Netherlands may be too different from the Family Health Teams in Ontario to generalize these findings to the latter population.

(4) Hann et. al.

The study by *Hann et. al.*[37] investigated associations between organizational culture and team climate, as well as organizational culture, team climate and quality of patient care within primary care practices in England. This study found an association between one type of organizational culture (clan) and some of the subscales of the team climate inventory (participation and team-working). Quality of patient care was ascertained by abstracting information relating to the treatment of coronary heart disease, asthma and diabetes from patient medical records. Subsequent analysis found no association between some subscales of team climate inventory (clarity of objectives and task orientation) and quality of care, nor was there an association between overall team climate and diabetes care. Patient perceptions of care, measured by the General Practice Assessment Survey as well as some items from the General Practice Assessment

Questionnaire, were not found to be associated with organizational culture. There was some evidence of an association between a subscale of the team climate inventory (participation) and patient perceptions of continuity of care (regression coefficient of 3.72, 95% CI of 0.56-6.87). Although this study was ambitious in its comprehensive measurement of quality of care, the wide 95% confidence intervals reported around the regression coefficients and the author's acknowledgement of the small sample size indicate that this study may also have been underpowered. Like the previous studies, the patient response rate for the General Practice Assessment Survey/Questionnaire was low (47%) and varied among the practices. Additionally, it is unclear whether this study controlled for individual patient factors such as gender and age that may have affected quality of care.

(5) Campbell et. al.

The study by *Campbell et. al.*[38] investigated organizational factors of primary care practices (such as practice size, routine booking interval, socioeconomic deprivation and team climate) in England and how these related to quality of chronic disease care, preventive care, access to care, continuity of care and interpersonal care among patients. Many statistically significant associations were found, including those between team climate and diabetes care, satisfaction, continuity of care and access to care. Large practices were associated with better diabetes care and practices in socioeconomically deprived areas were found to have lower rates of uptake for preventive cervical cytology. It is notable that cervical cytology as well as measures relating to immunizations and vaccinations were the only measures addressing preventive care (ie. breast cancer and colorectal cancer screening were not included). Another limitation of this study was that practices where less than 30% of staff completed questionnaires were excluded from analysis, raising questions about whether these practices were different from the practices that were included. In terms of team climate and quality of care, it is hypothesized that practices with

a poor team climate and quality of care would be less likely to respond, which could bias the effect estimates towards or away from the null hypothesis.

(6) Bower et. al.

The study by *Bower et. al*.[39] examined the association between practice structure and team processes, as well as practice structure, team processes and team outcomes in England. Although only one aspect of practice structure (singlehanded status) was found to be associated with team climate, it was also reported that team climate was statistically significantly associated with higher quality of diabetes management, higher self-reported innovation and healthcare team effectiveness. However, it may be concerning that this study made some modifications to its statistical analyses, such as an elimination of outliers to improve model fit (i.e. not as a result of miscoded data) to account for small sample size. Like many of the previous studies, response rates were low among staff (59%) and patients (38%), and rates were differential among practices. In addition this study did not control for individual patient factors in the analyses. Common problematic themes among these international studies of organizational factors, team climate and patient outcomes include low response rates, lack of power to detect associations and statistical analyses that do not properly account for individual patient factors. These are recurring issues that this thesis attempted to address in Ontario's Family Health Team setting.

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Chapter 3

Methods

3.1 Study Objectives

The objectives of this study were:

(1) To describe organizational characteristics at the team-level for seven FHTs in Southeastern Ontario.

(2) To examine the role of physician-level organizational characteristics in predicting:

(a) The provision of up-to-date colorectal cancer screening for patients within seven FHTs in Southeastern Ontario.

(b) Episodic patient-centredness for patients within seven FHTs in Southeastern Ontario.

3.2 Study Design

This was a cross-sectional study that utilized secondary analysis of previously collected data[1]. The purpose of the parent study was to evaluate and compare the quality of data collected from a variety of sources. Primary data collection was completed during nine months in 2008.

3.3 Data Sources

A practice survey (administered to each participating Family Health Team), a provider survey (administered to participating family physicians and all associated staff), a patient survey (administered to each participating patient) and chart abstraction (completed for each participating patient) were the four sources from which data for this study were obtained. Survey questions created by The Comparison of Models of Primary Care in Ontario (COMP-PC) study team[2], with many selected or modified from the following previously validated surveys: Primary Care Assessment Tool (PCAT-Adult)[3], Patient Perceptions of Patient-Centredness (PPPC)[4,5,6], Team Climate Inventory (TCI)[7], Canadian Community Health Survey (CCHS)[8], National Physician Survey (NPS)[9] and Primary Care Assessment Survey (PCAS)[10]. Questions

were also derived from the Accessibility and Continuity of Care: A study of Primary Healthcare in Quebec study[11]. The Patient Perceptions of Patient-Centredness (PPPC) index was found to be statistically significantly associated (p=0.01) with scores of patient-physician communication, which were derived by analysis of audiotaped observation of office visits[6].

3.4 Study Population

The study population can be defined as staff and patients of MOHLTC-designated Family Health Teams in Southeastern Ontario. A convenience sample of 7 FHTs in Southeastern Ontario was obtained, with all FHTs in two unnamed cities being eligible for selection. All approached teams consented to be studied. Within each team, 5-7 physicians were selected for the study based on location of their office space (i.e. if a team was located over multiple sites, the physician sample was taken from one site so as to depict one site as a functional unit). All allied health professionals associated with the team were also considered eligible for data collection. Finally, 20-30 patients per physician were sequentially approached and recruited during regular clinic days. If the patient was a child (i.e. under 18 years of age), their parent or guardian was recruited on the patient's behalf. Although the ratio of number of patients recruited to number of patients approached was usually not recorded, communication with practices indicated that participation rates were high, with one practice reporting a 90% participation rate. Data was collected from participating teams, providers/staff and patients through the aforementioned surveys and chart abstractions.

3.5 Data Linkage

This study population is hierarchical in nature, such that each patient is linked to a physician and each physician is linked to a FHT. Numerical participant identifiers were recorded during primary data collection in order for this hierarchical data linkage to occur. Numerical patient identifiers were also recorded in order to link a patient's chart abstraction with their survey data. All allied health professionals that completed a provider survey were linked to the FHT for which

they worked. Linkage of allied health professionals to specific physicians or patients was not possible in this study. Data linkage and sample size for FHTs, physicians and patients is summarized below in Figure 1.

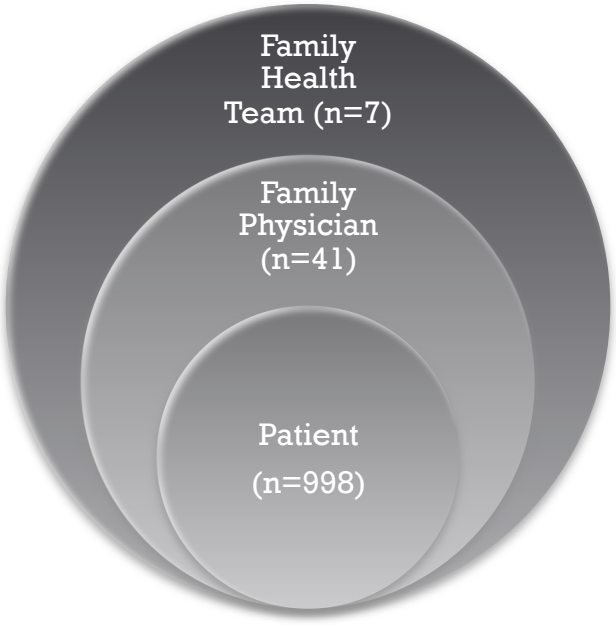

Figure 1. Data Linkage and Sample Size for FHTs, Physicians and Patients

3.6 Data Quality

Response rates were generally high across teams, types of participants and data sources, as demonstrated in Table 1. It should also be noted that survey response rates of physicians and associated staff were both high (93% and 83% respectively).

Table 1. Response Rates Across Teams and Data Sources

	Team 1	Team 2	Team 3	Team 4	Team 5	Team 6	Team 7	Overall
Practice Survey	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
Provider Survey	76.92	100.00	92.86	78.95	100.00	100.00	64.00	85.19
Patient Survey	72.85	76.67	85.33	85.71	88.68	85.14	78.08	81.46
Chart Abstraction	100.00	100.00	99.33	100.00	100.00	100.00	100.00	99.90

3.7 Objective 1

3.7.1 Exposure Measurement

The organizational characteristics measured at the level of the FHT are listed in Table 2.

Information regarding variable source and conceptualization is included.

Table 2. Exposure Measurement (Objective 1)

Variable	Study Source	Conceptualization
Model/Length of Practice/ Length of Operation		
Length of time of operation of practice	Practice Survey	Continuous
Length of time practice has been a FHT	Practice Survey	Continuous
Previous Model of Practice	Practice Survey	Categorical
Governance Structure	Practice Survey	Categorical
Practice Operations		
Number of Patients	Practice Survey	Continuous
Number of Patients Rostered	Practice Survey	Continuous
Comprehensiveness		
Work Setting	Practice Survey	Categorical
Does anyone at practice provide Sigmoidoscopy?		
Medication List in Patient's Records?	Practice Survey	Dichotomous
Chart Organized by Provider?	Practice Survey	Dichotomous
Chart Organized by Thematic Area?	Practice Survey	Dichotomous
Chart Organized by Both?	Practice Survey	Dichotomous
Personnel		
Policy on Human Resources Management	Practice Survey	Dichotomous
Policy on Staff Training	Practice Survey	Dichotomous
Policy on Job Descriptions	Practice Survey	Dichotomous
Policy on Performance Appraisals	Practice Survey	Dichotomous
Policy on Feedback on Staff Performance	Practice Survey	Dichotomous
Policy on Staff Development	Practice Survey	Dichotomous
Policy on Recognition of Merit/Excellence	Practice Survey	Dichotomous
Policy on Service Delivery?	Practice Survey	Dichotomous
Policy on Medical Errors	Practice Survey	Dichotomous
Policy on Referral/liaison/follow-up care	Practice Survey	Dichotomous
Policy on Knowledge	Practice Survey	Dichotomous

development		
Policy on Continuous Quality Improvement	Practice Survey	Dichotomous
Policy on Conduct of Patient/Client Satisfaction Surveys	Practice Survey	Dichotomous
Information Technology		
Access to Internet	Practice Survey	Categorical
Email	Practice Survey	Categorical
Practice Website	Practice Survey	Categorical
Online Access to Journals/ Clinical Practice Guidelines/ Medical Databases	Practice Survey	Categorical
Remote (off-site) Access to Patient Records	Practice Survey	Categorical
Electronic Billing	Practice Survey	Categorical
Electronic Patient Health Records	Practice Survey	Categorical
Electronic Patient Appointment Scheduling System	Practice Survey	Categorical
Electronic Reminder Systems for Recommended Patient Care	Practice Survey	Categorical
Electronic Interface to Pharmacies/Pharmacists	Practice Survey	Categorical
Electronic Interface to External laboratory/ Diagnostic Imaging	Practice Survey	Categorical
Electronic Warning System for Adverse Prescribing and/or Drug Interactions	Practice Survey	Categorical
Electronic Decision Aids	Practice Survey	Categorical
Telemedicine/ Webcasting/ Videoconferencing	Practice Survey	Categorical
Have Patient Management Information Systems/ Software	Practice Survey	Categorical
Use Patient Management Information Systems Software	Practice Survey	Categorical
Have Clinical Audit Systems/ Software	Practice Survey	Categorical
Use Clinical Audit Systems/ Software	Practice Survey	Categorical
Quality Assurance		
Medical Record Audit in Past Two Years?	Practice Survey	Categorical
Team Structure/Functioning		
Case Management Standards	Practice Survey	Categorical

in Place?		
Case Management Standards in Use?	Practice Survey	Categorical
Case Management Forms Integrated into Medical Records in Place?	Practice Survey	Categorical
Case Management Forms Integrated into Medical Records in Use?	Practice Survey	Categorical
Standardized Forms for Treatment/Service Plans in Place?	Practice Survey	Categorical
Standardized Forms for Treatment/Service Plans in Use?	Practice Survey	Categorical
Standardized Referral Forms in Place?	Practice Survey	Categorical
Standardized Referral Forms in Use?	Practice Survey	Categorical
Care Pathways or Standards for Referral in Place?	Practice Survey	Categorical
Care Pathways or Standards for Referral in Use?	Practice Survey	Categorical
Standardized Protocols for Holding Case Conferences in Place?	Practice Survey	Categorical
Standardized Protocols for Holding Case Conferences in Use?	Practice Survey	Categorical
Protocols for Recording Minutes of Case Conferences in Place?	Practice Survey	Categorical
Protocols for Recording Minutes of Case Conferences in Use?	Practice Survey	Categorical
Protocols in Place to Share Information Between All Team Members in Place?	Practice Survey	Categorical
Protocols in Place to Share Information Between All Team Members in Use?	Practice Survey	Categorical
Standardized Forms for Patient/Client Assessment in Place?	Practice Survey	Categorical
Standardized Forms for Patient/Client Assessment in Use?	Practice Survey	Categorical
Accessibility		
Is Anyone in Practice Accepting New Patients?	Practice Survey	Dichotomous

Does Practice Have Criteria for Accepting New Patients?	Practice Survey	Dichotomous
Economics		
Multi-Site Practice?	Practice Survey	Dichotomous
Team Makeup	Practice Survey	Each Response Expressed as Percent of Total (i.e. Pie Chart)
Access		
Days to Next Available Appointment with Any FP or NP	Practice Survey	Continuous
Days to 3rd Next Available Appointment with Any FP or NP	Practice Survey	
Team Climate		
Team Climate (All Healthcare Professionals)	Provider Survey	Continuous (Score)
Interdisciplinary Team Satisfaction (Physicians)	Provider Survey	Continuous (Score)
Interdisciplinary Team Satisfaction (Nurses)	Provider Survey	Continuous (Score)
Interdisciplinary Team Satisfaction (Allied Health Professionals)	Provider Survey	Continuous (Score)

3.7.2 Analysis Strategy

Descriptive analysis was performed for each organizational characteristic listed in Table 2. For variables that were continuous in nature (i.e. length of time of operation of practice), the value of the variable was reported for each team. For variables that were categorical in nature, the frequency of teams that were captured in each applicable category was reported for each variable. Aggregate reporting of categorical variables was performed in order to maintain the anonymity of the studied FHTs (see ethics).

Team climate was a score variable that was obtained by calculating the arithmetic mean of the 14-item Team Climate Inventory (TCI). A score, of which possible values could range from 1-5, was calculated for each physician and allied health professional that filled out the TCI as part of the provider survey. Any provider that failed to complete more than 33% of the questions in the index was excluded from this analysis. Aggregate team climate for each team was then obtained

by calculating the average of the scores of all applicable team members. Team climate was reported for per team for all employees, physicians only, nurses only and allied health professionals only. Analysis of Variance (ANOVA) was used to examine differences in team climate means between the teams. If an ANOVA test detected difference in means at the p=0.05 level, all pairwise comparisons between teams were statistically investigated. The Bonferroni correction factor was used to adjust for increased type I error caused by conducting multiple comparisons. If an ANOVA test did not detect a difference in variance at the p=0.05 level, or if cell-sizes were too small (i.e. less than 5 allied health professionals per team responded), a pooled mean team climate was reported in lieu of team-specific values.

Organizational variables at the level of the FHT were descriptively analyzed and reported solely as a hypothesis-generating exercise in order to examine the variability (or lack thereof) between FHTs. Some organizational variables (policy on continuous quality improvement, policy on the conduct of patient/client satisfaction surveys, electronic reminder systems for recommended patient care, medical record audit in past 2 years and team climate all healthcare professionals) were investigated as predictors of outcomes in an exploratory manner. However, the majority of the variables listed in Table 2 were not examined as potential predictors of up-to-date colorectal cancer screening or patient-centredness, and none of the variables listed in Table 2 were included in the model-building process that was used to model and report the predictors of both colorectal cancer screening and patient-centred care.

All analysis was conducted in SAS version 9.2[12].

3.8 Objective 2

3.8.1 Exposure Measurement

All exposure variables measured at the level of the physician and the level of the patient are listed in Table 3. Information regarding variable source and conceptualization is included. Physician-level variables depict non-modifiable (demographic) and modifiable (organizational)

characteristics, the latter of which is the primary interest of this study. Patient-level variables depict non-modifiable (demographic), health characteristics and relationship to practice and visit-specific characteristics.

Indices used for the calculation of score variables include a 15-item information technology index, a 14-item team climate index and an 18-item work satisfaction index. Questions that were worded negatively (i.e. such that the lowest category represented the most positive response) were reversed prior to score calculation. Missing data within score variables was calculated per score per physician. Any physician that failed to complete more than 33% of any given index was denoted as "missing" for the particular score variable.

Table 3. Exposure Measurement (Objective 2)

Variable	Study Source	Original Conceptualization	New Conceptualization (If Applicable)
Provider			
Non-Modifiable (Demographic)			
Age	Provider Survey	Continuous (years)	N/A
Gender	Provider Survey	Male Female	N/A
FTE	Provider Survey	Continuous (0-1.0)	Full Time Part Time
Years Working at Practice	Provider Survey	Continuous (years)	<4 years >=4 years
Type of Position	Provider Survey	Contract Permanent	N/A
Annual Income	Provider Survey	Continuous (dollars)	Income (Normalized by FTE) = Annual Income/FTE
Year of Graduation	Provider Survey	Continuous (year)	Years Since Graduation=2008-Year of Graduation
Country of Medical Education	Provider Survey	Canada Other	
CFPC Degree	Provider Survey	Yes No	
Modifiable (Organizational)			
Number of Active Patients	Provider Survey	Continuous (patients)	Panel Size = Number of Active Patients/FTE
Percent of Patients	Provider Survey	Continuous (percent)	Rostered Panel Size =

Rostered			(Percent of Patients Rostered) x (Number of Active Patients)/FTE
Hours Spent on Direct Patient Care per Week	Provider Survey	Continuous (hours)	Hours Spent on Direct Patient Care per Week per Patient= Hours Spent on Direct Patient Care/ Number of Active Patients
Hours Spent on Indirect Patient Care per Week	Provider Survey	Continuous (hours)	Hours Spent on Indirect Patient Care per Week per Patient= Hours Spent on Direct Patient Care/ Number of Active Patients
Duration of Regular Routine Visit	Provider Survey	Continuous (minutes)	N/A
Percent Double Bookings Needed	Provider Survey	Continuous (Percent)	N/A
Perceptions of Information Technology	Provider Survey	Continuous (score /4)	N/A
Interdisciplinary Team Satisfaction (Physician)	Provider Survey	Continuous (score /5)	N/A
Interdisciplinary Team Satisfaction (Physician and Nurse)	Provider Survey	Continuous (score /5)	N/A
Work Satisfaction (Physician)	Provider Survey	Continuous (score /6	N/A
Patient			
Demographic			
Age (Colorectal Cancer Screening Outcome)	Patient Chart Abstraction	Continuous (years)	50-59 60-69 70+
Age (Patient-centredness)	Patient Chart Abstraction	Continuous (years)	<18 18-50 50+
Gender	Patient Chart Abstraction	Male Female	N/A
Born in Canada	Patient Survey	Yes No	N/A
Living With Partner	Patient Survey	Yes No	N/A
Race	Patient Survey	White Non-White	
Highest Level of Education	Patient Survey	None Some elementary Some high school	High school or less Some post-secondary Completed post-

		Completed high school Some college or university Completed college Completed university	secondary
Current Occupational Status	Patient Survey	Employed Unemployed Housewife or househusband Student Other Retired	Job No job (includes unemployed, housewife/ househusband, student, disability) Retired
Total Household Income	Patient Survey	<5000 5000-9999 10000-14999 15000-24999 25000-34999 35000-49999 50000-64999 65000-79999 80000+	<35000 35000-49999 50000-64999 65000-79999 80000+
Health			
Ever Smokers	Patient Survey	Yes No	N/A
Current Smokers	Patient Survey	Yes No	N/A
Chronic Condition	Chart Abstraction	Yes No	N/A
Self-Perceived Health	Patient Survey	Excellent Very Good Good Fair Poor	Excellent or Very Good Good Fair or Poor
Relationship to Practice			
Travel Time	Patient Survey	Continuous (minutes)	<=20 minutes >20 minutes
Number of Office Consults	Chart Abstraction	Continuous (consults)	1-2 3-4 >4
Total Number of Consults	Chart Abstraction	Continuous (consults)	1-2 3-4 >4
Number of Types of Healthcare Workers	Chart Abstraction	Continuous (healthcare workers)	1 2 3+
General Checkup in Past 2 Years	Chart Abstraction	Yes Recommended and Refused No	Yes No (Includes recommended and refused)

Usually See Regular Healthcare Provider?	Patient Survey	Always Almost always A lot of the time Almost never Never	Usually (Includes always, almost always, alot of the time) Not Usually (Includes almost never, never)
Main Reason for Today's Visit	Patient Survey	General Checkup Chronic Problem Recent Problem Other	General Checkup Chronic Problem Other (including recent problems)
Length of Time as Patient of Practice	Patient Survey	<6mths 6mths-1year 1-2 yrs 3-4 yrs >5 yrs	<=2yrs 3-4yrs >5yrs
Physician-Patient Gender Concordance	Provider Survey and Chart Abstraction	Yes (i.e. Male/Male or Female/Female) No (i.e. Male/Female or Female/Male)	N/A
Visit-Specific			
Seeing Regular Healthcare Provider Today?	Patient Survey	Yes No	N/A
Who is Regular Healthcare Provider?	Patient Survey	None Physician Nurse Practitioner	Physician Not a Physician
Wait Time	Patient Survey	Continuous (minutes)	N/A
Length of Visit	Patient Survey	Continuous (minutes)	N/A

3.8.2 Outcome Measurement (Up-to-Date Colorectal Cancer Screening)

At the time of the parent study, it was recommended that men and women aged 50 years or older at average risk for colorectal cancer be screened every two years. The chart abstraction item "S3-Q7b Past 2 yrs.-screened for colorectal cancer (>50 yrs.)?" was used to investigate the fulfillment of these guidelines for every study patient that was aged 50 years or older. This item had the following response categories: (1) Yes, (2) Ordered No Result, (3) Recommended and Refused, (4) No, (5) N/A. Up-to-date colorectal cancer screening was recoded into a dichotomous yes/no outcome variable using the following guidelines:

- (1) Yes: The patient had been screened in the past 2 years.

- (2) Ordered No Result: This category was used to signify that there was an indication, but no evidence, that colorectal cancer screening had been performed. In this thesis, this category was considered to indicate that the patient had been screened in the past 2 years. The following could be true for a patient that appeared in this category:
    - (a) The patient had provided a hemmoccult stool sample, and a test had been ordered for the sample. Since the chart abstraction was conducted during a discrete period of time, the patient's test results may simply not have been available at the time of the abstraction.
    - (b) The patient had been referred to either a colonoscopy or sigmoidoscopy, but a report detailing the outcome of this test was not in the patient's files. As with the previous option, this report may not have been available at the time of the abstraction since it was conducted during a discrete period of time. However, this could also indicate that a patient had not attended a colonoscopy or sigmoidoscopy appointment.
    - (c) The patient had ben provided with a hemoccult stool test kit, and had not yet provided a sample. Communication with the chart abstractor indicated that this may not be a likely option, given that the administration of a test kit may not be indicated within patient charts.
- (3) Recommended and Refused: For the primary analysis, this response indicated that the patient had not been screened in the past 2 years, since it is the patient uptake of screening that reported as a quality indicator of primary care. For the sensitivity analysis, this response indicated that the patient had received a recommendation to be screened in the past 2 years. Thus, this response category was coded two different ways in order to compare patient uptake vs. physician recommendation of up-to-date colorectal cancer screening.

- (4) No: The patient had not been screened in the past two years.
- (5) N/A: Colorectal cancer screening was not applicable for this particular patient. This patient was excluded from analysis.

More specific guidelines indicate that a colonoscopy in the previous 10 years or a sigmoidoscopy in the previous 5 years is sufficiently up-to-date, even in the absence of a hemoccult stool test in the previous two years[13]. Communication with the Primary Investigator of the parent study indicated that patients whose charts indicated the fulfillment of these specific guidelines (either within summary or scanned document sections) might have been classified as having received up-to-date colorectal cancer screening. However, detailed information about the receipt of a colonoscopy in the previous 10 years or sigmoidoscopy in the previous 5 years may not have been available for some patients, as charts were examined only two years retrograde. This may have resulted in outcome misclassification for some patients.

3.8.3 Predictors of Up-to-Date Colorectal Cancer Screening

Predictors of up-to-date colorectal cancer screening were investigated using a mixed-effects multivariate logistic regression model. A mixed-effects model was used in order to account for the hierarchical nature of the data while a logistic regression model was appropriate given the dichotomous nature of the outcome variable.

A bivariate analysis examining the association between each predictor variable and up-to-date colorectal cancer screening was performed as a data-sparing step in order to avoid overwhelming the multivariate model. Only variables that demonstrated an association with up-to-date colorectal cancer screening that was statistically significant at the p=0.2 level were considered for the final model.

The multivariate (final) analysis was performed by examining the association between all of the exposure variables that were found to be significant predictors at the p=0.2 level and up-to-date colorectal cancer screening. Backward selection was performed manually by removing predictor

variables from the model one-by-one. The exposure variable demonstrating the highest p-value (i.e. the highest probability that its association with up-to-date colorectal cancer screening occurred by chance) was removed from the model first. This process continued until only variables that were statistically significant at the p=0.1 level were retained.

All analyses were conducted in SAS version 9.2 using PROC GLIMMIX. "Random" statements for both FHT and physician were included in order to account for clustering of outcomes at both of these levels. Given the dichotomous nature of the outcome, a binomial distribution was used to fit the model. All results were reported on a subject-specific basis, as opposed to generalized estimating equations (GEE) that report population averages.

3.8.4 Outcome Measurement (Patient-Centredness)

Patient-centredness was a score variable that was obtained by calculating the arithmetic mean of the 9-question patient perceptions of patient-centredness (PPPC) index. One score, of which possible values ranged from 1-4, was calculated per patient that filled out the PPPC as part of the patient survey. Items that were deemed by the patient as "not applicable" were not included in the calculation of their score. Any patient that had missing data for greater than 30% of the PPPC was denoted as "missing" for this particular variable. Criteria for missing data were more stringent for this variable than for exposure score variables because of the limited number of questions on the PPPC index. The score obtained from the PPPC index is considered to measure episodic patient-centredness, since the patient completed the index about the appointment attended the day on which they were recruited. Thus, this index measured patient-centredness during an episode of care, rather than along the full continuum of care.

3.8.5 Predictors of Episodic Patient-Centredness

Predictors of episodic patient-centredness were investigated using a mixed-effects multivariate linear regression model. A mixed-effects model was used in order to account for the hierarchical

nature of the data while a linear regression model was appropriate given the continuous nature of the outcome variable.

A bivariate analysis examining the association between each predictor variable and episodic patient-centredness was performed as a data-sparing step in order to avoid overwhelming the multivariate model. Only variables that demonstrated an association with episodic patient-centredness that was statistically significant at the p=0.2 level were considered for the final model.

The multivariate (final) analysis was performed by examining the association between all of the exposure variables that were found to be significant predictors at the p=0.2 level and episodic patient-centredness. Backward selection was performed manually by removing predictor variables from the model one-by-one. The exposure variable demonstrating the highest p-value (i.e. the highest probability that its association with episodic patient-centredness occurred by chance) was removed from the model first. This process continued until only variables that were statistically significant at the p=0.1 level were retained.

All analyses were conducted in SAS version 9.2 using PROC MIXED. "Random" statements for both FHT and physician were included in order to account for clustering of outcomes at both of these levels. Given the linear nature of the outcome, the default normal distribution was used to fit the model.

3.8.6 Organizational Predictors

Although it was presumed that there would be insufficient power to investigate team-level organizational characteristics, five variables at the team-level were examined as potential predictors of colorectal cancer screening (both patient uptake and patient uptake or physician recommendation), as well as patient-centredness. These five variables were policy on continuous quality improvement, policy on the conduct of patient/client satisfaction surveys and electronic reminder systems for recommended patient care, medical record audit in past two years and team

climate (all healthcare professionals). These exploratory team-level variables were chosen on the basis of both interest and demonstrated variability between teams. An exploratory model-building process, similar to those described for objectives 2a and 2b, was attempted for each of the five organizational variables. Results from and statistical issues with the model-building processes were reported. Final statistical models addressing objectives 2a and 2b (i.e. the predictors of up-to-date colorectal cancer screening and patient-centred care) were not adjusted for any of the five team-level organizational variables.

3.9 Ethics

Ethics approval for this thesis was sought and obtained from Queen's University Research Ethics Board (REB). All unencrypted datasets were kept on a computer that was never connected to the internet within a locked research office. The cities within Southeastern Ontario in which the FHTs resided were not identified. Practice-level categorical variables were reported as frequencies per category, as opposed to per team, in order to maintain anonymity of the FHTs. Similarly, aggregated data detailing patient outcomes were not reported alongside team characteristics.

3.10 References

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Chapter 4

Results

4.1 Objective 1

Characteristics at the level of the FHT were described for seven FHTs in Southeastern Ontario. These results are displayed in Tables 4-14, as well as Figures 2-6.

4.1.1 Objective 1: Model/Length of Practice/Length of Operation

Information about the model, length of practice and length of operation of the seven FHTs studied is presented in Table 4. Each of the teams had established themselves as a FHT at roughly the same time (i.e. 2-3 years prior to the year that the parent study was conducted). However, there was a wide range in the overall amount of time that the teams had been practicing as either a FHT or in another primary healthcare delivery model. Some teams had been established for up to 33 years prior to the year that the parent study was completed, and had been practicing as a Family Health Network (FHN) prior to FHT designation. Other teams had only begun practicing at the time of designation as a FHT, and had not practiced under a different primary healthcare delivery model. The FHTs studied also had differed with respect to their governance structures with some teams being physician-governed and others having mixed partnerships with universities, physician groups and/or hospitals.

Table 4. Model/Length of Practice/Length of Operation

Model/Length of Practice/Length of Operation							
	Team1	Team2	Team3	Team4	Team5	Team6	Team7
Length of time of operation of practice (years)	33	8	24	3	25	2	20
Length of time practice has been a FHT (years)	2	1.5	3	3	2	2	3
	FHN	FFS	FHG	FHO	CHC	Other	Missing
Previous Model of	5	0	0	0	0	2	0

Practice						
	Community		Physician		Other	Missing
Governance Structure	0		3		4	0

4.1.2 Objective 1: Practice Operations

Information about practice operations is available in Table 5. The seven FHTs studied ranged in practice size from 3800-20000 patients as well as with regards to the number of rostered patients (3306-19000).

Table 5. Practice Operations

Practice Operations							
	Team1	Team2	Team3	Team4	Team5	Team6	Team7
Number of Patients	11600	20000	10000	13700	9300	3800	8000
Number of Patients Rostered	10440	19000	9000	9864	5673	3306	6400

4.1.3 Objective 1: Comprehensiveness

Information about the comprehensiveness of the seven FHTs studied is presented in Table 6. When asked to identify their work setting (with multiple definitions per team being acceptable), three teams identified themselves as private offices or clinics, four teams as academic health sciences centres, two teams as administrative offices, one team identified itself as a research unit and another as a family health centre. Although all teams indicated that they included a medication list in patient charts, there was variability in the way that patient charts were organized. Two teams organized patient charts by provider, and one of these teams also organized charts by thematic area.

Table 6. Comprehensiveness

Comprehensiveness						
	Private office or clinic	Community clinic or community health centre	Free standing walk-in clinic	Academic health sciences centre	Community hospital	Emergency department
Work Setting	3	0	0	4	0	0
	Nursing home	Administrative office	Research unit	Free-standing laboratory or diagnostic clinic	Other	
Work Setting (Continued)	0	2	1	0	1	
	Yes	No	Not Sure/Don't Know	Missing		
Does anyone at practice provide Sigmoidoscopy?	0	6	1	0		
	Yes	No	Missing			
Medication List in Patient's Records?	7	0	0			
Chart Organized by Provider?	2	5	0			
Chart Organized by Thematic Area?	1	6	0			
Chart Organized by Both?	1	6	0			

4.1.4 Objective 1: Personnel Policies

Information on the existence of written personnel policies is depicted in Table 7. There appeared to be variability in the existence of the personnel policies across the seven FHTs. Only two personnel policies (namely those regarding job descriptions and performance appraisals) existed for all seven teams. All other policies, such as those regarding medical errors and continuous quality improvement, existed for some teams but not for others.

Table 7. Personnel Policies

Section 5: Personnel			
	Yes	No	Missing
Policy on Human Resources Management	6	1	0
Policy on Staff Training	5	2	0
Policy on Job Descriptions	7	0	0
Policy on Performance Appraisals	7	0	0
Policy on Feedback on Staff Performance	5	2	0
Policy on Staff Development	3	4	0
Policy on Recognition of Merit/Excellence	3	4	0
Policy on Service Delivery?	0	1	6
Policy on Medical Errors	4	3	0
Policy on Referral/liaison/follow-up care	2	5	0
Policy on Knowledge development	3	4	0
Policy on Continuous Quality Improvement	3	4	0
Policy on Conduct of Patient/Client Satisfaction Surveys	2	5	0

4.1.5 Objective 1: Information Technology

Information regarding information technology capabilities of the seven FHTs is available in Table 8. There appeared to be some variability in IT capabilities across the seven FHTs, but less variability than that observed for the existence of written personnel policies. For instance, all

seven FHTs indicated having the following capabilities: access to the internet, email, practice website, online access to journals/clinical practice guidelines/medical databases, electronic billing, electronic patient health records, electronic patient scheduling appointment system, and electronic warning system for adverse prescribing and/or drug interactions. On the other hand, most FHTs also had remote access to patient records and an electronic interface to external laboratory/diagnostic imaging. Most FHTs did not have an electronic interface with pharmacies/pharmacists.

Table 8. Information Technology Capabilities

Section 6: Information Technology				
	Yes	No	Not Sure/ Don't Know	Missing
Access to Internet	7	0	0	0
Email	7	0	0	0
Practice Website	7	0	0	0
Online Access to Journals/Clinical Practice Guidelines/Medical Databases	7	0	0	0
Remote (off-site) Access to Patient Records	6	1	0	0
Electronic Billing	7	0	0	0
Electronic Patient Health Records	7	0	0	0
Electronic Patient Appointment Scheduling System	7	0	0	0
Electronic Reminder Systems for Recommended Patient Care	5	2	0	0
Electronic Interface to Pharmacies/Pharmacists	1	6	0	0
Electronic Interface to External Laboratory/Diagnostic Imaging	6	0	0	1
Electronic Warning System for Adverse Prescribing and/or Drug Interactions	7	0	0	0

Electronic Decision Aids	1	4	2	0		
Telemedicine/Webcasting/Video Conferencing	3	4	0	0		
	Have?					
	Yes	No	Not Sure/ Don't Know	Missing		
Patient Management Information Systems/Software	5	1	0	1		
Clinical Audit Systems/Software	1	5	0	1		
	How Well Does It Meet Needs?					
	Very Well	Well	Poorly	Very Poorly	N/A	Missing
Patient Management Information Systems/Software	4	0	0	1	1	1
Clinical Audit Systems/Software	1	0	0	0	5	1
	How Much is It Used?					
	Very Much	Much	Little	Very Little	N/A	Missing
Patient Management Information Systems/Software	4	0	0	1	1	1
Clinical Audit Systems/Software	1	0	0	0	5	1

4.1.6 Objective 1: Quality Assurance

Information regarding quality assurance activities is available in Table 9. Four teams had completed a medical record audit in the past two years while three teams had not.

Table 9. Quality Assurance

Section 7: Quality Assurance			
	Yes	No	Missing
Medical Record Audit in Past Two Years?	4	3	0

4.1.7 Objective 1: Team Structure/Functioning

Information regarding team structure and functioning is available in Table 10. Similar to what was observed with IT capabilities, there were many standards and protocols that were either in place for all seven FHTs or were not in place for any of the seven FHTs. For example, standardized treatment forms for treatment/service plans, referrals and patient client assessment were in place for all seven FHTs, while protocols for holding and recording minutes in case conferences were not in place for any of the FHTs. Most of the standards and protocols reported by teams as being in place were also reported as being at least partially in use at the time of parent study completion.

Table 10. Team Structure/Functioning

Team Structure/Functioning								
	In Place?			In Use?				
	Yes	No	Missing	Yes	Partially	No	N/A	Missing
Case Management Standards	2	4	1	1	1	0	4	1
Case Management Forms Integrated into Medical Records	5	2	0	3	2	0	2	0
Standardized Forms for Treatment/Service Plans	7	0	0	4	3	0	0	0
Standardized Referral Forms	7	0	0	5	1	0	0	1
Care Pathways or Standards for Referral	5	2	0	2	2	0	2	1
Standardized Protocols for Holding Case Conferences	0	7	0	0	1	0	6	0
Protocols for Recording Minutes in Case Conferences	0	7	0	0	1	0	6	0
Protocols in Place to Share Information Between All Team Members	4	3	0	1	3	0	2	1
Standardized Forms for Patient/Client Assessment	7	0	0	5	2	0	0	0

4.1.8 Objective 1: Accessibility

Information detailing the accessibility of the seven FHTs studied is available in Table 11. Three of the seven teams were accepting new patients at the time of parent study completion and all three had established criteria for accepting new patients.

Table 11. Accessibility

Accessibility				
	Yes	No	Missing	
Is Anyone in Practice Accepting New Patients?	3	4	0	
	Yes	No	N/A	Missing
Does Practice Have Criteria for Accepting New Patients?	3	0	4	0

4.1.9 Objective 1: Economics

Information regarding economics is available in Table 12, as well as in Figures 2-6. All seven teams are multisite practices. Team makeup is shown for five of the seven FHTs as two teams were excluded from this analysis because of missing data. There appears to be variability in the staff composition of the FHTs. For instance, Team 2 is comprised of 50% physicians and 26% nurses, while Team 6 is comprised of 26% physicians and 33% nurses. All FHTs have a prominent administration contingent within their teams, while most FHTs also employ a psychiatrist. There are varying proportions of allied health professionals across FHTs.

Table 12. Economics

Economics			
	Yes	No	Missing
Multi-Site Practice?	7	0	0
Team Makeup	(Pie Charts)		

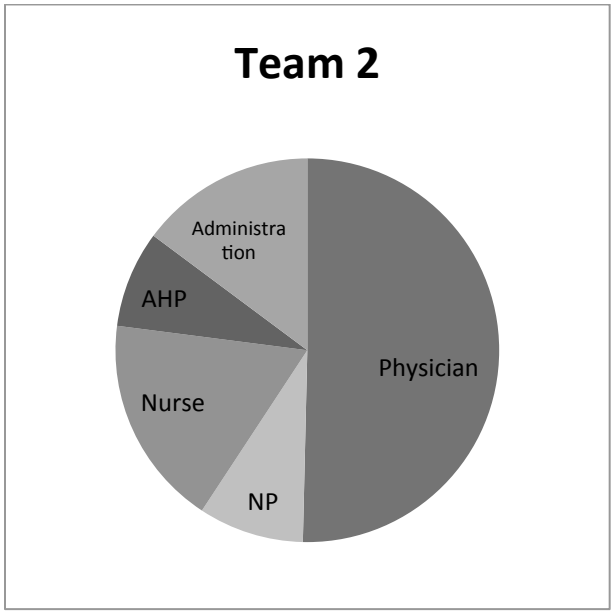

Figure 2. Team Makeup (Team 2)

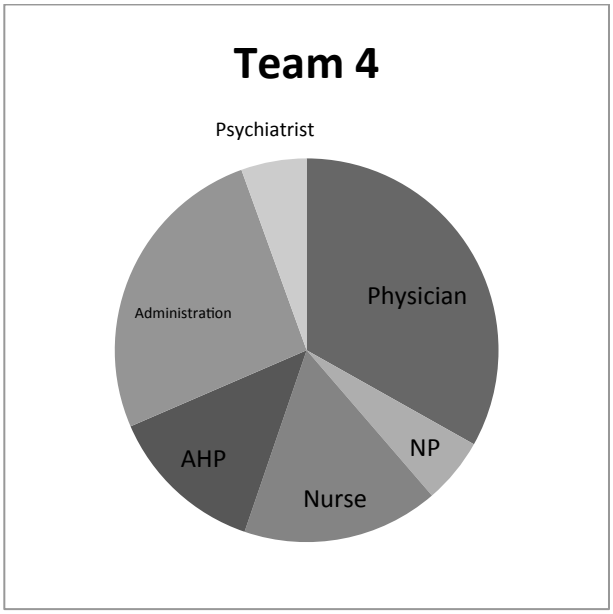

Figure 3. Team Makeup (Team 4)

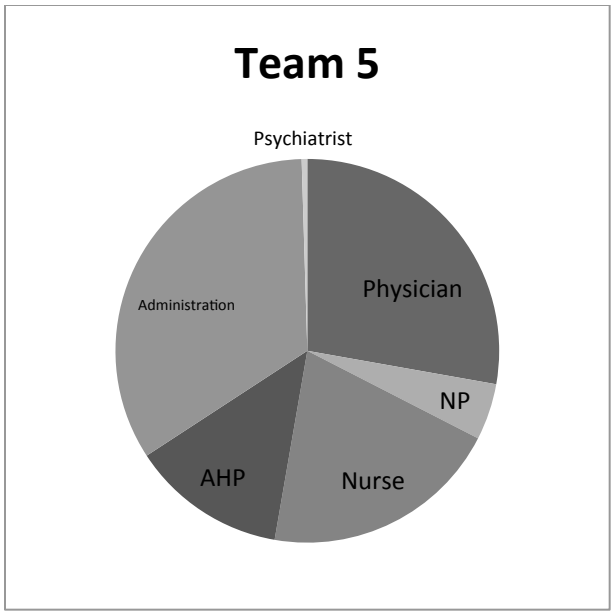

Figure 4. Team Makeup (Team 5)

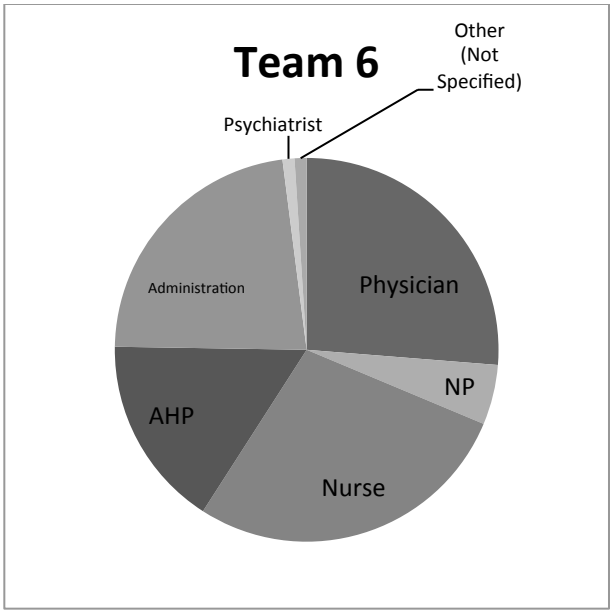

Figure 5. Team Makeup (Team 6)

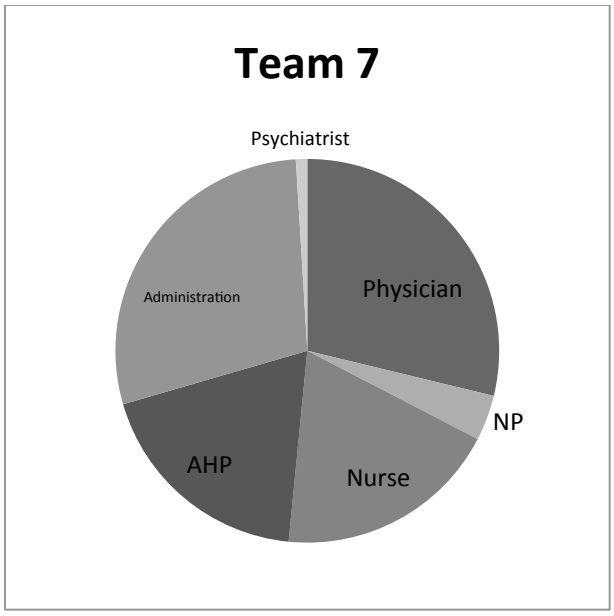

Figure 6. Team Makeup (Team 7)

4.1.10 Objective 1: Access

Information detailing access within the seven FHTs is available in Table 13. Days to next available appointment ranged from 0 (i.e. same-day appointment) to 3 across FHTs. Days to third next available appointment ranged from 0 (i.e. same-day appointment) to 7 across FHTs.

Table 13. Access

Access							
	Team1	Team2	Team3	Team4	Team5	Team6	Team7
Days to Next Available Appointment with Any FP or NP	0	0	1	3	1	0	1
Days to 3rd Next Available Appointment with Any FP or NP	4	0	3	6	7	0	1

4.1.11 Objective 1: Team Climate

Team climate scores for all responding healthcare professionals, physicians, nurses and allied health professionals were calculated per team (Table 14). Statistically significant differences at the $\alpha=0.05$ level were detected across teams for team climate among all healthcare professionals,

physicians and allied health professionals. However, a statistically significant difference in team climate among nurses was not detected across teams. Thus, team climate scores among nurses were reported by pooling the seven team-specific scores. Team climate among allied health professionals was also reported as a pooled value because of small cell size (i.e. less than 5 eligible allied health professional scores for a given team).

Table 14. Team Climate

Team Climate								
	Team1	Team2	Team3	Team4	Team5	Team6	Team7	
Team Climate (All Healthcare Professionals)	3.33 (0.73)	3.54 (0.54)	3.82 (0.66)	3.87 (0.53)	3.70 (0.59)	3.84 (0.64)	3.26 (0.60)	ANOVA (p=0.0236)
Interdisciplinary Team Satisfaction (Physicians)	3.65 (0.36)	3.71 (0.43)	3.90* (0.24)	3.97 ** (0.50)	3.44 (0.23)	3.73 (0.66)	2.94*, ** (0.64)	ANOVA (p=0.0265) , *3-7 (p=0.0406) , **4-7 (p=0.0307)
Interdisciplinary Team Satisfaction (Nurses)	3.56 (0.66)							Pooled (p=0.9515)
Interdisciplinary Team Satisfaction (Allied Health Professionals)	3.61 (0.77)							Small Cell Size - Pooled (p=0.0214)

Although some statistically significant differences were detected in team climate across FHTs, it is unclear whether these differences are practically (or clinically) significant. For example, team 3 and team 4 were found to have statistically significantly higher team climates among physicians than team 7. However, the magnitudes of the differences were 0.955 (team 3 vs. team 7) and 1.028 (team 4 vs. team 7) on a 5-point Likert scale. It is unclear whether this represents a practically detectable difference in the climate of the physicians across these teams.

4.2 Objective 2

Predictors of both patient uptake and physician recommendation of colorectal cancer screening, as well as predictors of episodic patient-centredness were examined. Modifiable organizational characteristics were of primary interest. The results of objective 2 are detailed in Tables 15-20.

4.2.1 Objective 2: Physician-Level Predictors

Possible predictors of the outcomes of interest were measured at both the physician and patient-levels. Physician-level factors, including non-modifiable demographic variables and modifiable organizational characteristics, are presented in Table 15; this table presents descriptive statistics by team as well as overall for all studied physicians.

The physician study population consisted mostly of males (59.5%) and had an average age of approximately 48 years (SD=8.17). The average annual physician income was $230 924 (standardized by full-time-equivalent). On average, physicians in this study had a panel size of 1237 active patients, of which the majority was rostered (n=1072), and they spent over twice as much time on direct patient care as on indirect patient care. The average duration of a regular routine visit administered by physicians in this study population was 16.4 minutes, and physicians indicated that they would need to double-book an average of 15.1% of appointments in order to fulfill patient needs. On average, physicians rated their perception of information technology capabilities as 2.79/4, their team climate as 3.56/5, and their work satisfaction as 4.87/7. When nurses were included as part of a physician's team climate calculation, average team climate remained the same at 3.56/5.

The data were fairly complete for responding physicians with less than 10% of data missing for each physician-level variable. The exception to this was the variable income, for which 26.3% of the data were missing.

Table 15. Descriptive Analysis of Physician-Level Predictors

Variable	Categories/ Units	Team 1	Team 2	Team 3	Team 4	Team 5	Team 6	Team 7	Total	# Missing	% Missing
Non-Modifiable (Demographic)											
Age	Years	49.2 (4.76)	51.33 (8.50)	46.83 (8.93)	45.00 (7.68)	49.50 (10.54)	45.17 (9.47)	50.00 (9.49)	48.03 (8.17)	2	5.3%
Gender	Male	40.0% (2)	66.7% (4)	66.7% (4)	40.0% (2)	100.0% (4)	50.0% (3)	60.0% (3)	59.5% (22)	1	2.6%
	Female	60.0% (3)	33.3% (2)	33.3% (2)	60.0% (3)	0.0% (0)	50.0% (3)	40.0% (2)	40.5% (15)		
Full or Part Time	Part time	40.0% (2)	0.0% (0)	33.3% (2)	60.0% (3)	25.0% (1)	83.3% (5)	40.0% (2)	40.5% (15)	1	2.6%
	Full time	60.0% (3)	100.0% (6)	66.7% (4)	40.0% (2)	75.0% (3)	16.7% (1)	60.0% (3)	59.5% (22)		
Years Working at Practice	<4 years	0.0% (0)	33.3% (2)	0.0% (0)	100.0% (5)	60.0% (3)	100.0% (6)	50.0% (2)	48.7% (18)	1	2.6%
	>=4 years	100.0% (5)	66.7% (4)	100.0% (6)	0.0% (0)	40.0% (2)	0.0% (0)	50.0% (2)	51.4% (19)		
Position	Contract	40.0% (2)	0.0% (0)	0.0% (0)	20.0 % (1)	0.0% (0)	16.7% (1)	20.0% (1)	13.9% (5)	2	5.3%
	Permanent	60.0% (3)	100.0% (5)	100.0% (5)	80.0% (4)	100.0% (5)	83.3% (5)	80.0% (4)	86.1% (31)		
Income	$/FTE	235917 (95673)	226009 (55155)	238500 (86955)	202593 (26207)	190000 (10000)	270806 (185841)	218889 (45501)	230524 (92308)	10	26.3%
Years Since Grad	Years	25.8 (5.26)	24.50 (8.83)	20.67 (8.41)	17.80 (6.76)	24.25 (11.09)	19.33 (11.29)	27.20 (9.04)	22.65 (8.76)	1	2.6%
Med Degree	Canada	100.0% (5)	83.3% (5)	100.0% (6)	100.0% (5)	80.0% (4)	66.7% (4)	80.0% (4)	86.8% (33)	0	0.0%

	International	0.0% (0)	16.7% (1)	0.0% (0)	0.0% (0)	20.0% (1)	33.3% (2)	20.0% (1)	13.2% (5)		
CFPC Degree	Yes	100.0% (5)	60.0% (3)	100.0% (5)	100.0% (5)	100.0% (5)	100.0% (6)	100.0% (5)	94.4% (34)	2	5.3%
	No	0.0% (0)	40.0% (2)	0.0% (0)	0.0% (0)	0.0% (0)	0.0% (0)	0.0% (0)	5.6% (2)		
Modifiable (Organizational)											
Panel Size	#Patients/ FTE	837 (393)	1608 (361)	1766 (348)	932 (311)	1150 (480)	1055 (489)	1148 (376)	1237 (493)	1	2.6%
Rostered Panel Size	%Rostered*# Patients/FTE	703 (308)	1538 (361)	1577 (369)	785 (277)	898 (597)	933 (467)	871 (368)	1072 (502)	1	2.6%
Direct Patient Care	Hrs/#Patients	0.0247 (0.0065)	0.0196 (0.0057)	0.0159 (0.0034)	0.0286 (0.0105)	0.0260 (0.0099)	0.0306 (0.0168)	0.0293 (0.0143)	0.0246 (0.0110)	1	2.6%
Indirect Patient Care	Hrs/#Patients	0.0127 (0.0100)	0.0076 (0.0031)	0.0090 (0.0038)	0.0081 (0.0080)	0.0051 (0.0048)	0.0147 (0.0101)	0.0130 (0.0140)	0.0102 (0.0084)	1	2.6%
Duration of Routine Visit	Minutes	23 (6.71)	15.00 (0)	13.33 (2.58)	15.00 (0.00)	15.00 (4.08)	15.00 (0.00)	19.00 (2.24)	16.35 (4.19)	1	2.6%
Percentage Double Book	%	21 (9.62)	14.00 (6.52)	33.75 (22.01)	9.00 (7.42)	16.25 (11.09)	5.42 (4.01)	5.00 (3.54)	15.14 (14.35)	2	5.3%
Perception of IT	Score (/4)	2.56 (0.32)	3.17 (0.46)	2.70 (0.16)	2.34 (0.48)	3.04 (0.36)	3.09 (0.27)	2.51 (0.40)	2.79 (0.46)	2	5.3%
Team Climate (Physician)	Score (/5)	3.61 (0.39)	3.71 (0.43)	3.90 (0.27)	3.97 (0.50)	3.44 (0.23)	3.73 (0.66)	2.94 (0.64)	3.63 (0.54)	0	0.0%
Team Climate (Physician and Nurse)	Score (/5)	3.52 (0.048)	3.46 (0.054)	3.60 (0.039)	3.65 (0.125)	3.68 (0.023)	3.80 (0.132)	3.37 (0.071)	3.59 (0.156)	0	0.0%
Work Satisfaction	Score (/7)	4.71 (0.51)	5.87 (0.53)	5.06 (0.88)	4.40 (0.64)	4.92 (0.45)	4.77 (0.68)	4.18 (1.46)	4.87 (0.89)	0	0.0%

n=38 physicians

4.2.2 Objective 2: Patient-Level Predictors

Patient-level factors, including demographics, health, relationship to practice and visit-specific characteristics, were measured. Descriptive statistics of both the patient-centredness study population (all patients) and the colorectal cancer screening study population (patients aged 50 and over) are reported in Table 16. The majority of patients were female (62.0%) and aged 50 years or over (57.9%). This appeared to be an affluent population, in that 41.97% of patients reported having an annual household income of $80 000 or more. The majority of patients were white (93.1%) and many had a history of one of coronary artery disease, diabetes or hypertension (42.6%). Most patients in the study population had had a general checkup in the past two years (68.8%). The average wait time as reported by the studied patients was 13.49 minutes, and the average appointment time was 21.33 minutes. The frequencies and means of most factors did not appear to change in magnitude when the study population was restricted to patients aged 50 years and older. However, the proportion of patients that had at least one of coronary artery disease, diabetes or hypertension increased to 61.0% when restricting the study population to the older segment of patients.

Similar to that observed with the physician-level factors, the data for patient-level factors were fairly complete. There were less than 10% of data missing per variable, with the exception of income and appointment time, for which there were 19.4% and 16.6% missing data respectively.

4.2.2 Objective 2a: Outcome Measurement (Colorectal Cancer Screening)

Of those who were targeted for routine colorectal cancer screening (i.e. men and women aged 50+), 58.02% had been screened in the past two years. Within this population, 60.1% had either

been screened or had received a physician recommendation for screening in the past two years. Data for the colorectal cancer screening outcome were missing for 3.2% of the target population.

Table 16. Descriptive Analysis of Patient-Level Predictors

		All Patients (PC)†			Patients 50+ yrs (CCS) ††		
Variable	Categories/ Units	Total	# Missing	% Missing	Total	# Missing	% Missing
Demographics							
Age (PC)	<18 years	5.0% (38)	0	0.0%	N/A	N/A	N/A
	18-49 years	37.1% (281)			N/A		
	50+ years	57.9% (438)			N/A		
Age (CCS)	50-59 years	N/A	N/A	N/A	32.7% (143)	0	0.0%
	60-69 years	N/A			33.3% (146)		
	70+ years	N/A			34.0% (149)		
Gender	Male	38.0% (288)	0	0.0%	42.9% (188)	0	0.0%
	Female	62.0% (469)			57.1% (250)		
Born in Canada	Yes	82.0% (615)	7	0.9%	78.4% (338)	7	1.6%
	No	18.0% (135)			21.6% (93)		
Living with Partner	Yes	70.5% (531)	4	0.5%	69.0% (300)	3	0.7%
	No	29.5% (222)			31.0% (135)		
Race	White	93.0% (694)	11	1.5%	96.3% (415)	7	1.6%
	Non-white	7.0% (52)			3.7% (16)		
Travel Time	<=20 min	65.2% (486)	11	1.5%	63.4% (272)	9	2.1%
	> 20 min	34.9% (260)			36.6% (157)		

Highest Level of Education	Completed high school or less	20.9% (156)	10	1.3%	24.5% (105)	9	2.1%
	Some postsecondary	15.1% (113)			16.1% (69)		
	Completed postsecondary	64.0% (478)			59.4% (255)		
Current Occupational Status	Employed	52.4% (384)	24	3.2%	32.1% (136)	14	3.2%
	Not employed	12.4% (91)			7.8% (33)		
	Retired	35.2% (258)			60.1% (255)		
Total Income	<$35000	17.9% (109)	147	19.4%	19.6% (66)	101	23.1%
	$35000-$49999	14.6% (89)			17.2% (58)		
	$50000-$64999	12.6% (77)			14.8% (50)		
	$65000-$79999	13.0% (79)			13.0% (44)		
	$80000+	42.0% (256)			35.3% (119)		
Health							
Ever Smokers	No	51.0% (363)	45	5.9%	45.2% (195)	7	1.6%
	Yes	49.0% (349)			54.8% (236)		
Smokers Currently Smoking	Yes	11.3% (80)	49	6.5%	9.8% (42)	10	2.3%
	No	88.7% (628)			90.2% (386)		
Any Chronic Condition Ever	Yes	42.6% (306)	38	5.0%	61.0% (267)	0	0.0%
	No	57.4% (413)			39.0% (171)		
Self-Perceived Health	Excellent or very good	43.0% (323)	6	0.8%	38.6% (167)	5	1.1%
	Good	39.7% (298)			39.0% (169)		
	Fair or poor	17.3% (130)			22.4% (97)		
Relationship to Practice							
Number of Office Consults (12 mo)	1-2	16.7% (126)	4	0.5%	13.3% (58)	1	0.2%

	3-4	25.6% (193)			24.9% (109)		
	>4	57.6% (434)			61.8% (270)		
Number of Total Consults (12 mo)	1-2	15.7% (118)	4	0.5%	12.4% (54)	1	0.2%
	3-4	22.6% (170)			20.1% (88)		
	>4	61.8% (465)			67.5% (295)		
Number of Types of Healthcare Workers	1	16.1% (122)	0	0.0%	16.7% (73)	0	0.0%
	2	60.8% (460)			60.1% (263)		
	>2	23.1% (175)			23.3% (102)		
Past 2 Years General Checkup	Yes	68.8% (519)	3	0.4%	71.4% (312)	1	0.2%
	No	31.2% (235)			28.6% (125)		
Usually See Regular Healthcare Provider?	Usually	84.0% (626)	12	1.6%	88.1% (376)	11	2.5%
	Not usually	16.0% (119)			11.9% (51)		
Who is Regular Healthcare Provider?	Not physician	7.1% (52)	28	3.7%	6.5% (27)	25	5.7%
	Physician	92.9% (677)			93.5% (386)		
Length of Time as Patient of Practice	<=2 years	20.4% (150)	20	2.6%	13.0% (55)	13	3.0%
	3-4 years	14.8% (109)			12.9% (55)		
	5+ years	64.9% (478)			74.1% (315)		
Gender Concordance	Yes	59.8% (442)	18	2.4%	59.9% (255)	12	2.7%
	No	40.1% (297)			40.1% (171)		
Visit-Specific							
Seeing Regular Healthcare	Yes	72.8% (547)	6	0.8%	77.7% (338)	3	0.7%

Provider Today?	No	27.2% (204)			22.3% (97)		
Main Reason for Today's Visit?	General checkup	30.3% (226)	10	1.3%	29.7% (128)	7	1.6%
	Chronic problem	20.6% (154)			25.3% (109)		
	Other	49.1% (367)			45.0% (194)		
Wait Time	Minutes	13.49 (11.97)	67	8.9%	13.65 (11.29)	49	11.2%
Appointment Time	Minutes	21.33 (13.57)	126	16.6%	21.59 (12.02)	87	19.9%
Outcomes							
Colorectal Cancer Screening (Patient Uptake)	Yes	N/A	N/A	N/A	58.0% (246)	14	3.2%
	No	N/A			42.0% (178)		
Colorectal Cancer Screening (Physician Recommend)	Yes	N/A	N/A	N/A	60.1% (255)	14	3.2%
	No	N/A			39.9% (169)		
Patient-centredness	Score (/4)	3.33 (0.56)	44	5.8%	3.31 (0.56)	33	7.5%

† PC=Patient-centredness population, n=757
††CCS=Colorectal cancer screening study population, n=438

4.2.3 Objective 2a: Bivariate Analysis (Colorectal Cancer Screening)

The association between each potential predictor and the outcome of patient uptake of colorectal cancer screening was examined through bivariate analysis. A cut-off p-value of 0.2 was used as criteria to select potential predictor that would be included in the final model. Table 17 lists each factor and its corresponding p-value for the bivariate model. Factors that were selected for inclusion in multivariate analysis of the predictors of patient uptake of colorectal cancer screening included: physician age (p=0.0065), position (p=0.1135), years since graduation (p=0.0133), average duration of a regular routine visit (p=0.0059) and interdisciplinary team satisfaction of physician and nurses (p=0.0001) as well as patient gender (p=0.0694), living with partner

(p=0.0749), total household income (p=0.0585), self-perceived health (p=0.0372), travel time (p=0.1716), general checkup in past 2 years (p<0.0001), usually see healthcare provider (0.0541), physician-patient gender concordance (0.0253), seeing regular healthcare provider today (0.0861) and main reason for today's checkup (p=0.0476).

Table 17. Variables Included in Final Model by p-value Cutoff for Colorectal Cancer Screening (Patient Uptake), Colorectal Cancer Screening (Physician Recommendation) and Patient-centredness

Variable	p-value (CCS)	p-value (CCS sensitivity)	p-value (PC)
Team			
Organizational (Select)			
Team Climate (All employees)	0.0014	0.0128	0.4449
Policy on Continuous Quality Improvement	0.5307	0.2211	0.6193
Policy on Conduct of Client/Patient Satisfaction Surveys	0.0579	0.0308	0.5360
Electronic Reminder Systems for Recommended Patient Care	0.9588	0.8136	0.0543
Medical Record Audit in Past 2 Years	0.0715	0.0028	0.9112
Provider			
Non-Modifiable (Demographic)			
Age	0.0065	0.0030	0.7051
Gender	0.3219	0.0912	0.1181
Full or Part Time	0.9496	0.8798	0.8627
Years at Practice	0.2915	0.3434	0.6012
Position	0.1135	0.0903	0.3728
Income	0.5059	0.1743	0.9692
Years Since Graduation	0.0133	0.0063	0.4780
Country of Medical Education	0.4924	0.7554	0.8797
CFPC Degree	0.5415	0.3830	0.7844

Modifiable (Organizational)			
Panel Size	0.4678	0.3245	0.2267
Rostered Panel Size	0.3741	0.3014	0.2449
Hours Spent on Direct Patient Care per Week per Patient	0.3403	0.4883	0.5782
Hours Spent on Indirect Patient Care per Week per Patient	0.6330	0.8553	0.1428
Average Duratinon of Regular Routine Visit	0.0059	0.0084	0.6750
Percent of Double Bookings Needed	0.6343	0.7979	0.5656
Perception of Information Technology	0.8337	0.5331	0.6778
Interdisciplinary Team Satisfaction (Physician)	0.2787	0.0689	0.7442
Interdisciplinary Team Satisfaction (Physician and Nurse)	0.0001	<.0001	0.3582
Work Satisfaction (Physician)	0.3095	0.5381	0.2471
Patient			
Demographic			
Age	0.3502	0.3655	0.7066
Gender	0.0694	0.0529	0.4767
Born in Canada	0.4171	0.6897	0.1426
Living with Partner	0.0749	0.0350	0.0960
Race	0.8189	0.9200	0.2168
Highest Level of Education	0.3541	0.3223	0.0667
Current Occupational Status	0.2277	0.1582	0.3033
Total Household Income	0.0585	0.1193	0.0110
Health			
Ever Smokers	0.3352	0.1794	0.9421
Current Smokers	0.2877	0.2998	0.8520
Chronic Condition	0.5161	0.6758	0.8520
Self-Perceived Health	0.0372	0.0403	0.0055

Relationship to Practice			
Travel Time	0.1716	0.1494	0.8821
Number of Office Consults	0.5854	0.7173	0.2098
Number of Total Consults	0.4965	0.6585	0.2803
Number of Types of Healthcare Workers	0.6065	0.8073	0.4934
General Checkup in Past 2 Years	<.0001	<.0001	0.4450
Usually See Regular Healthcare Provider?	0.0541	0.0650	0.0152
Who is Regular Healthcare Provider?	0.8049	0.6624	0.3323
Length of Time as Patient of Practice	0.9205	0.6514	0.3506
Physician-Patient Gender Concordance	0.0253	0.0112	0.0063
Visit-Specific			
Seeing Regular Healthcare Provider Today?	0.0861	0.0914	0.0009
Main Reason for Today's Visit	0.0476	0.0622	0.1664
Wait Time	0.6184	0.6576	0.1518
Length of Visit	0.9169	0.9250	<0.0001
Patient-Centredness	0.8527	0.9438	N/A

4.2.4 Objective 2a: Multivariate Analysis (Colorectal Cancer Screening)

The association between predictor variables selected through bivariate analysis and patient uptake of colorectal cancer screening was examined through multivariate analysis. Table 18 lists variables that were retained in the final model (i.e. p<=0.10), including average duration of a regular routine visit (p=0.0002), patient age (p=0.7600 – forced into model), patient gender (p=0.0061), general checkup in past 2 years (p<0.0001), travel time (p=0.086) and usually see regular provider (p=0.0215).

The full model (i.e. prior to manual backward selection) was unable to fit a random intercept for physician, either because of lack of power or because clustering at the level of the physician was

negligible. In order to maintain consistency, all bivariate and multivariate analyses for this outcome modeled correlation at the team-level only. In the final model (i.e. post manual backward selection) variance of the random intercept for team was 0.02350 (standard error=0.08416), indicating a weak correlation.

Interpretation of parameter estimates obtained from subject-specific hierarchical models is different than interpretation of parameter estimates obtained from multivariate logistic regression models, despite the fact that both model dichotomous outcomes. In subject specific hierarchical models, one must interpret regression coefficients in relation to the subject. For example, from these results, the odds of a male patient receiving colorectal cancer screening are 2.00 (95% CI 1.22 – 3.28) times more than the odds of the same patient receiving colorectal cancer screening if he was female. Similarly, the odds of a patient who had a general checkup in the past 2 years receiving colorectal cancer screening are 9.03 (95% CI 5.18 – 15.73) times more than the odds of the same patient receiving colorectal cancer screening if the same patient had not received a general checkup in the past 2 years. The odds of a patient whose travel time was 20 minutes or less receiving colorectal cancer screening are 1.53 (95% CI 0.94-2.48) times the odds of the same patient receiving colorectal cancer screening if the same patient's travel time was greater than 20 minutes. The odds of a patient who indicated that they usually see their regular provider receiving colorectal cancer screening are 0.40 (95% CI 0.19 – 0.87) times the odds of the same patient receiving colorectal cancer screening if the same patient indicated that he/she did not usually see his/her regular healthcare provider. In this model, regression coefficients for continuous exposure variables represented a one-unit change in the mean of the predictor variable. It follows that the odds of a patient whose physician indicated that they spent an average of 16.126 minutes per patient receiving colorectal cancer screening are 0.88 (95% CI

0.83 – 0.94) times the odds of the same patient receiving colorectal cancer screening if their physician indicated that they spent an average of 17.126 minutes per patient.

Table 18. Multivariate Results (Colorectal Cancer Screening Patient Uptake)†

Variable	Categories/ Units	n (CCS)	n (no CCS)	Adjusted OR	95% CI (Lower)	95% CI (Upper)	p-value
Average Duration of a Regular Routine Visit	Minutes			0.88	0.83	0.94	0.0002
Patient Age	70+	73	65	1.00 (ref)			
	60-69	81	48	1.10	0.62	1.95	0.7456
	50-59	71	52	0.88	0.49	1.57	0.6649
Patient Gender	Female	116	105	1.00 (ref)			
	Male	109	60	2.00	1.22	3.28	0.0061
General Checkup in Past 2 Years	No	25	80	1.00 (ref)			
	Yes	200	85	9.03	5.18	15.73	<.0001
Travel Time	>20 minutes	79	68	1.00 (ref)			
	<=20 minutes	146	97	1.53	0.94	2.48	0.086
Usually See Regular Provider	Not Usually	35	13	1.00 (ref)			
	Usually	190	152	0.40	0.19	0.87	0.0215

†n=390, odds ratios adjusted for all other variables in the model

4.2.5 Objective 2a: Sensitivity Analysis (Colorectal Cancer Screening)

The analyses described in sections 4.2.3 – 4.2.4 were repeated for a different conceptualization of the colorectal cancer screening outcome variable. In the conceptualization of the variable subject to sensitivity analysis, a physician recommendation for colorectal cancer screening was included as the receipt of screening, in order to account for patient noncompliance.

All predicting variables that were bivariately associated with patient uptake of colorectal cancer screening at the p=0.2-level were also bivariately associated with physician recommendation of colorectal cancer screening. Additional variables that were associated with physician recommendation are highlighted in Table 19 and include physician gender (p=0.0912), physician income (p=0.1743) and interdisciplinary team satisfaction (p=0.0689) as well as patient current occupational status (p=0.1582) and ever smoker (p=0.1794).

The multivariate results of this sensitivity analysis were similar to those seen with the original conceptualization of the variable, although there were some differences. Results from this analysis are available in Table 19. Although a random intercept for team was fit for the duration of the model-building process, the final model was not able to fit a random intercept for team. This may indicate that there is no variation at the level of the team, or that there is not enough power to detect variation. Similar associations and directions of effect were observed for the exposure variables average duration of a routine visit, patient gender, general checkup in past 2 years and usually see regular healthcare provider. A statistically significant association between travel time and this outcome was not observed at the p=0.10-level. Additional associations were observed for the variables team climate (physician and nurses), patient occupational status and ever smoker. Specifically, the odds of a patient whose physician and team nurses rated their team climate as 3.57 on average receiving colorectal cancer screening are 5.88 (95% CI 0.98 – 35.24) times the odds of the same patient receiving colorectal cancer screening if their physician and team nurses rated their team climate as 4.57 on average (i.e. one unit higher than the mean). The odds of a patient being employed and receiving either colorectal cancer screening or a physician recommendation are 0.49 (95% 0.23-1.02) times the odds of the same patient being retired and receiving either colorectal cancer screening or a physician recommendation. Similarly, the odds

of a patient not being employed and receiving either colorectal cancer screening or a physician recommendation are 0.42 (95% 0.16-1.13) times the odds of the same patient being retired and receiving either colorectal cancer screening or a physician recommendation. Finally, the odds of a patient never smoking and receiving either colorectal cancer screening or a physician recommendation are 0.59 (95% CI 0.37 – 0.96) times the odds of the same patient ever smoking and receiving either colorectal cancer screening or a physician recommendation.

Table 19. Multivariate Results (Colorectal Cancer Screening Patient Uptake or Physician Recommendation) †

Variable	Categories/ Units	n (CCS)	n (no CCS)	Adjusted OR	95% CI (Lower)	95% CI (Upper)	p-value
Average Duration of a Regular Routine Visit	Minutes			0.92	0.86	0.97	0.0038
Team Climate (Family Physician and Nurse)	Points (1-5)			5.88	0.98	35.24	0.0534
Patient Age	70+	78	59	1.00 (ref)			
	60-69	85	44	1.18	0.64	2.20	0.5925
	50-59	69	46	1.42	0.62	3.22	0.4034
Patient Gender	Female	121	96	1.00 (ref)			
	Male	111	53	1.98	1.18	3.33	0.0099
Patient Occupational Status	Retired	151	89	1.00 (ref)			
	Not Employed	14	14	0.42	0.16	1.13	0.0879
	Employed	67	46	0.49	0.23	1.02	0.0587
Ever Smoker	Yes	133	69	1.00 (ref)			
	No	99	80	0.59	0.37	0.96	0.0355

General Checkup in Past 2 Years	No	28	73	1.00 (ref)			
	Yes	204	76	8.22	4.68	14.46	<.0001
Usually See Regular Provider	Not Usually	35	12	1.00 (ref)			
	Usually	197	137	0.37	0.17	0.84	0.0176

† n=381, odds ratios adjusted for all other variables in the model

4.2.6 Objective 2b: Outcome Measurement (Patient-Centredness)

In contrast to the dichotomous colorectal cancer screening outcome, patient-centredness is a continuous score variable. On average, patients in this study population rated their patient-centredness as 3.33/4. A patient-centredness score was missing for 5.8% of patients in this study population (including patients for whom the patient-perceptions of patient-centredness index was more than 30% incomplete).

4.2.7 Bivariate Analysis (Patient-Centredness)

A data-sparing process similar to that for the colorectal cancer screening outcome was conducted for the patient-centredness outcome. Bivariate relationships between patient-centredness and each predictor variable listed in Table 17 were separately investigated. Variables that met the p=0.2 criteria included physician gender (p=0.1181), hours spent on indirect patient care per week per patient (p=0.1428), as well as patient born in Canada (p=0.1426), living with partner (p=0.0960), highest level of education (p=0.0667), total household income (p=0.0175), self-perceived health (p=0.0055), usually see regular healthcare provider (p=0.0152), physician-patient gender concordance (p=0.0063), seeing regular healthcare provider today (p=0.0009), main reason for today's visit (p=0.1664), wait time (p=0.1518) and length of visit (p<0.0001).

4.2.8 Multivariate Analysis (Patient-Centredness)

The association between exposure variables selected through bivariate analysis and patient-centredness was examined through multivariate analysis. Variables that were retained (i.e. $p<=0.10$) in the final model are detailed in Table 4.17 and include patient born in Canada ($p=0.059$), seeing regular healthcare provider today ($p=0.057$), and appointment length ($p<0.0001$) as well as physician-patient gender concordance ($p=0.0254$).

Clustering at both the team and physician-levels were modeled for this outcome. Variance for the random intercept for team was 0.01555 ($p=0.0926$), while variance for the random intercept for physician was 0.005050 ($p=0.2045$). This indicates that there was weak clustering at both the team and physician-levels, with physician-level clustering being weaker than team-level clustering.

Interpretation of subject-specific hierarchical models for continuous outcomes is similar to interpretation of generalized linear models. For instance, on average, a patient that was born in Canada rated their patient-centredness as being 0.1119 (95% CI -0.0040-0.2278) points higher than a patient not born in Canada. On average, patients who saw their regular healthcare provider on the day of study recruitment rated their patient-centredness as 0.1449 (95% CI 0.0426-0.2472) points higher than patients who did not see their regular healthcare provider. On average, patients who were the same gender as their physician (i.e. male-male or female-female gender concordance) rated their patient-centredness as 0.1019 (95% CI 0.0128-0.1910) points higher than patients who were not the same gender as their physician. On average, patients rated their patient-centredness as 0.006929 (95% CI 0.003554-0.010304) points higher for every minute that they spent with the healthcare provider during their appointment. When considering these interpretations, it is important to remember that clustering at both the team and physician-levels have been taken into account.

A practically significant change for the patient perceptions of patient-centredness has not been defined. However, since the index contains 9 questions and each question has 4 response categories, the smallest possible increment of change on the index per person is 1/36 or 0.028. Each regression coefficients can be compared to this value in order to hypothesize about its practical significance. For example, regression coefficients for the variables born in Canada seeing regular healthcare provider today and physician-patient gender concordance represent 4-5 increment changes of the patient-centredness index per patient. In practical terms, this is equivalent to saying that a patient that is the same gender as their physician may answer 4-5 questions on the PPPC one category higher on a 4-point Likert scale than a patient that is not the same gender as their patient. Conversely, an average patient's appointment length must change by approximately 20 minutes before a similar increment change in the PPPC is observed.

Table 20. Multivariate Results (Patient-centredness)†

Variable	Categories/ Units	Adjusted Estimate	Error	95% CI (Lower)	95% CI (Upper)	p-value
Born in Canada	No	0 (ref)				
	Yes	0.1119	0.0591	-0.0040	0.2278	0.059
Seeing Regular Healthcare Provider Today?	No	0 (ref)				
	Yes	0.1449	0.0522	0.0426	0.2472	0.0057
Physician Patient Gender Concordance	No	0 (ref)				
	Yes	0.1019	0.0455	0.0128	0.1910	0.0254
Appointment Length	Minutes	0.006929	0.001722	0.003554	0.010304	<.0001

† n=590, parameter estimates adjusted for all other variables in the model

4.2.9 Organizational Characteristics

Five team-level organizational characteristics were examined as potential predictors of colorectal cancer screening (both patient uptake and patient uptake or physician recommendation), as well as patient-centredness. Table 17 demonstrates that the organizational variables team climate (all healthcare professionals), policy on conduct of patient/client satisfaction surveys and medical record audit in past two years were bivariately associated with both patient uptake and patient uptake/physician recommendation of colorectal cancer screening. Similarly, the existence of electronic reminder systems for recommended patient care was associated with patient-centredness. When these variables were individually included into the model-building process, team climate of all healthcare professionals (OR=3.18 per point increase, 95% CI 0.95-10.67) and medical record audit in past two years (OR=1.71, 95% CI 1.05-2.77) were associated with patient uptake of colorectal cancer screening at the p<=0.1-level, while only medical record audit in past two years (OR=2.13, 95% CI 1.31-3.44) was associated with patient uptake or physician recommendation of colorectal cancer screening at the p<=0.1-level. Similarly, the existence of electronic reminder systems for patient care was associated with patient-centredness (-0.1960, 95% CI -0.3833- -0.0087) at the p<=0.1-level, although it should be noted that this was an inverse relationship (i.e. lower patient-centredness scores on average among patients of a team with electronic reminder systems).

These results are difficult to interpret for a number of statistical reasons. First of all, clustering at the team-level could not be properly modeled both during the model-building process and in some of the final models for the colorectal cancer screening outcomes. Secondly, four of the five organizational characteristics were dichotomous in nature, introducing potential confounding. Both of these statistical issues are discussed in the following chapter.

Chapter 5

Discussion

5.1 Interpretation of Results

5.1.1 Objective 1

The purpose of describing characteristics at the level of the FHT was to investigate organizational variability between seven of FHTs in close proximity to each other. Currently, primary care delivery models are often investigated as an 'exposure' in terms of the quality of patient care[1,2]. However, this thesis hypothesized that there may be sufficient variability even within the same practice model, which may introduce exposure misclassification when FHTs are compared to other practice models. The results of this thesis support that hypothesis.

This study found important variability in the length of time that a practice had been in operation (2-33 years), which may reflect very different cultures and level of cohesiveness among providers working in these FHTs. For example, one may expect a group of physicians that have been working together for 33 years to collaborate differently than a group of physicians that have only been together for 2 years. FHTs also differed in size, with the number of patients served ranging from 8000 – 20000. One might expect that a larger team may work differently than a smaller team, although this hypothesis was not explored in this thesis. Additionally, team makeup differed across teams. To a certain extent this is to be expected, since team makeup is intended to reflect the needs of the population[3]. However, team makeup should be considered as a potential source of variability among FHTs that may impact the type of care that patients are receiving.

Variability was found in the existence of personnel policies within FHTs and, to a lesser extent, in the information technology capabilities of FHTs as well as standards and protocols in place at the

various FHTs. One might reasonably expect that the existence of policies, capabilities, standards and protocols may affect the functioning of FHTs, which may impact the quality of patient care. This thesis did not explore the content of personnel policies or the utilization of IT capabilities and corresponding software. These are suggested future avenues of research.

Team climate was also found to vary among teams for all healthcare providers, physicians and allied health professionals. While a physician's score of team climate combined with that of team nurses was found to be a statistically significant predictor of physician recommendation or patient uptake of colorectal cancer, the importance of team climate still warrants further research, as there may have been a lack of power to model team-level clustering alongside this association. This thesis examined team climate in relation to subject-specific patient outcomes, but an ecological association between global team climate and patient outcomes at the patient population level may be hypothesized to exist.

5.1.2 Objective 2a

Variables that were found to be statistically significantly associated with patient uptake of colorectal cancer screening include a provider organizational characteristic (average duration of a regular routine visit), a patient demographic variable (gender) and three variables describing patient relationship to practice (general checkup in past 2 years, travel time and usually see regular provider).

The predictor variable most strongly associated with patient uptake of colorectal cancer screening was the receipt of a general checkup in past 2 years (OR=9.03, 95% CI 5.18-15.73). This finding is consistent with previous literature, which has shown that various measures of access (contact with a family physician[4], more than 5 doctor visits per year[5], a health maintenance visit[6]) predict colorectal cancer screening. The most interesting contribution of this finding is that the patient

study population was derived from physicians' waiting rooms. Thus, all study patients can be assumed to have at least some access with the primary care system. In fact, chart abstraction showed that all 757 patients had interacted with a primary care physician at least once within the past 12 months (except for one patient, who had a missing value for this variable). Despite some access among all studied patients, a general checkup within the past two years demonstrated a strong association with colorectal cancer screening. These results support the idea that it is not only access in general that determines a patient's receipt of colorectal cancer screening, but more specifically the type of contact that is made with the primary healthcare system. This is supported by literature that indicates that colorectal cancer screening is most likely to be recommended during a health maintenance visit[7].

Average duration of a regular routine visit, as reported by the physician, was also found to be associated with patient uptake of colorectal cancer screening. Since an inverse relationship was found (i.e. increasing odds of colorectal cancer screening with decreasing average duration of appointment time), this finding is more difficult to interpret. The explanation suggested by this thesis is ecological in nature. More specifically, it is postulated that a physician that spends less time per patient is able to see more patients within their practice. It follows that the likelihood of any one patient within that physician's practice having received colorectal cancer screening may increase, since more patients are able to book appointments. However, this association must be investigated in future research before any decisive conclusions can be drawn.

A positive association was found between travel time less than or equal to 20 minutes and patient uptake of colorectal cancer screening. Travel time may represent an access-level barrier to colorectal cancer screening. More specifically, a patient that must travel more than 20 minutes to visit their primary health care provider may be more burdened by, and therefore less likely to

attend, appointments that address preventive care. However, it should be noted that this study population was derived from an accessing population (i.e. patients in waiting rooms). Thus, the idea of travel time as an access-level barrier to preventive care (i.e. colorectal cancer screening) should be investigated further before any conclusions are made.

A negative association was also found between the variable 'usually seeing regular healthcare provider' and patient uptake of colorectal cancer screening. This is also not intuitive or easily interpreted; however, this thesis provides two hypotheses to explain this association. Within a FHT, not usually seeing one's regular healthcare provider may indicate that the patient usually sees (1) a nurse practitioner or other allied health professional, (2) a resident, (3) another physician within the practice or (4) any combination of the above. If the patient usually sees a nurse practitioner or other allied health professional, this could be associated with an increase in uptake of colorectal cancer screening, since preventive counseling with nurses has been found to increase colorectal cancer screening rates[8]. If the patient usually sees a resident, the resident may possess more current knowledge and awareness about screening guidelines, and thus may be more diligent in screening his or her patients. However, this association should be investigated further in future research in order to shed light on its reasoning.

Patient gender was also found to be associated with patient uptake of colorectal cancer screening. This association was consistent with the current literature[9,10] in that odds of colorectal cancer screening were higher if the patient was male than if the patient was female (OR=2.00, 95% CI 1.22 – 3.28). It should be noted that, while previous studies are population-based (i.e. using data from the Canadian Community Health Survey), this thesis examined predictors of colorectal cancer screening within an in-office population. This thesis supports the idea that gender

inequality in colorectal cancer screening might be a phenomenon that occurs in the population accessing the primary healthcare system, and not solely at the population level.

Additional variables that were found to be statistically significantly associated with either physician recommendation or patient uptake of colorectal cancer screening include one provider organizational characteristic (team climate of physician and nurses), one patient demographic variable (occupational status) and one patient health variable (ever smoker).

The sensitivity analysis found that the odds of either patient uptake or physician recommendation of colorectal cancer screening were higher for a patient whose physician and team nurses reported a higher team climate, a retired patient and a patient who had ever smoked. The positive association between team climate (a composite score of the patient's physician, and all of the nurses in the patient's team) and either physician recommendation or patient uptake of colorectal cancer screening is logically coherent. More specifically, it is reasonable to hypothesize that physicians and nurses that report a better team climate may be more effective in either recommending or providing evidence-based care to their patients. Although this association was large in magnitude (OR=5.88), it also had a very wide 95% confidence interval (0.98-35.24). This suggests that there may have been a lack of power to properly examine the association between physician and nurse team climate with colorectal cancer screening. Additionally, the model was unable to account for team-level clustering in the final model of the predictors of either physician recommendation or patient uptake of colorectal cancer screening, which corroborates the speculation of lack of power. Associations between team climate and patient outcomes should be examined in future research where there is appropriate power to examine associations while accounting for clustering.

The association between a patient being retired and receiving either colorectal cancer screening or a recommendation is not straightforward. This may be a function of a greater amount of spare time during the day among retired patients, which can readily be used to schedule and attend preventive medical appointments. The association between ever smoking and patient uptake or physician recommendation of colorectal cancer screening is also conflicting with previous research. A previous study has found that the odds of colorectal cancer screening among females were higher for never or former smokers than for current smokers[5]. Since this study categorized smoking differently than did this thesis, the discrepancy in results may lie in the variable conceptualization. In this thesis, former and current smokers would have been grouped together as "ever smokers" (although it should be noted that this thesis also examined current smoking status, and did not find it to be a predictor of either physician recommendation or patient uptake of colorectal cancer screening). Additionally, the published study had also examined patient uptake of colorectal cancer screening, rather than physician recommendation. In actuality, patients who exhibit unhealthy behaviors such as smoking may be offered more preventive care because they are perceived to be at higher risk for negative health outcomes. This should be explored in future research before any decisive conclusions are drawn.

5.1.3 Objective 2b

Variables that were found to be statistically significantly associated with patient-centredness include one patient demographic variable (born in Canada), a relationship to practice variable (physician-patient gender concordance) and two visit-specific variables (seeing regular healthcare provider today and appointment length).

The fact that visit-specific variables comprised some of the predictors of patient-centredness is not surprising, considering the patient-centredness index was also completed in relation to the

visit. Length of appointment time was positively associated with patient-centredness, which is consistent with previous literature that examined predictors of patient satisfaction in primary care[11]. It is conceptually coherent that a longer appointment time would positively contribute to patient satisfaction. It is also important to note that the association between appointment time and patient-centredness was quite small in magnitude (0.006929-increase per minute in patient-centredness).

A positive association between seeing your regular healthcare provider on the day of study recruitment and patient-centredness was also observed. Since the physician-patient relationship is central to the idea of patient-centredness[12], this finding is also consistent with conventional thought. It is not unreasonable to think that perceptions of patient-centredness may decrease when seeing an unfamiliar provider. However, this is an important implication for team-based care, where a patient may see a variety of healthcare professionals that are not their regular provider. Although team-based care is often championed as a solution for patient-centred care[13], the effect of the unique physician-patient relationship on patient-centredness should not be overlooked.

It was observed that patients who were born in Canada scored their patient-centredness 0.1119/4 points higher on average than patients who were not born in Canada. This could be explained by several mechanisms. Patients who have had interactions with a healthcare system outside of Canada may have had different expectations about what kind of care that they expected to receive. If these expectations were not met, they may have scored their patient-centredness lower on average than a patient who has never encountered another healthcare system. Another possible explanation that was not explored in this thesis is that of language concordance. Since physician-patient communication is central to the idea of patient-centredness, any barrier in

verbal communication could be a factor in a decreased patient-centredness score. However, it should be noted that languages spoken by those who were not born in Canada were not examined in this thesis. Additionally, it is unknown if those not born in Canada were born in countries where English was an official language. Furthermore, physicians were not asked about their primary spoken languages, and thus, language concordance could not be examined.

The positive effect of physician-patient gender concordance on patient-centredness was a unique finding of this study. On average, patients who were the same gender as their physician scored their patient-centredness as being 0.1019/4 points higher than those who were not the same gender as their physician. Another study conducted in a primary care setting within the United States found no effect of gender concordance on patient-centredness[14]. However, when the same investigator examined gender concordance separated by gender (i.e. female-female vs. male-male), it was found that only female-female gender concordance was associated with patient-centredness[15]. Since this thesis did not separate physician-patient gender concordance by gender, there are two possible explanations for the discrepancy between the findings of this thesis and the current literature: (1) Both female-female and male-male gender concordance are predictors of patient-centredness in the patient population studied in this thesis or (2) Female-female gender concordance could be such a strong predictor of patient-centredness that it drove the relationship between gender concordance and patient-centredness The latter would suggest that including male-male physician-patient pairs in the same category as female-female physician-patient pairs introduced some exposure misclassification. Since this thesis did not separate gender concordance by type, the difference between female-female and male-male concordant pairs is unknown. This could be investigated in future research. Moreover, it would be interesting to

know what aspects of gender concordant physician-patient relationships contribute to increased patient-centredness.

5.2 Strengths and Limitations

5.2.1 Strengths

This thesis has many strengths that warrant recognition. The setting of this study, namely Ontario's primary health care system, is unique in that it is of interest to policymakers but is largely understudied. Currently, little is known about the quality of primary healthcare in Ontario, so any study that sheds light on this topic is of value. Family Health Teams are especially relevant, as they are the newest and most widely discussed primary healthcare delivery model. This thesis was able to link physician data with patient data, which is very unique in primary care studies. Data linkage enabled this thesis to examine patient and physician gender concordance as a potential predictor of the quality of care received by the patient. Patient-physician gender concordance had been discussed as a recommended avenue of primary care research in at least one other study[2].

The data that were collected in the parent study and were used in this thesis were both thorough and complete. Lengthy practice, physician and patient surveys that captured a variety of useful information were utilized. Additionally, patient chart abstractions captured detailed information about patients' healthcare utilization. In addition to being thorough, data collection for the parent study was also quite complete. Response rates were high across teams, types of respondents (i.e. teams, physicians, other healthcare professionals and patients) and data sources. This thorough and complete collection of data reflects well on this study's internal validity.

Unique and complex statistical procedures were used to control for clustering of outcomes at both the physician and team level. Hierarchical subject-specific modeling accounts for the fact that a

given physician's patients may be more similar to each other than to other patients, and that patients within a team may be more similar to each other than to patients in other teams. Statistical procedures that properly account for correlation introduced by this clustering also contribute to the study's internal validity.

Although this thesis was only able to examine two primary health care indicators, it is thought that these two indicators are highly relevant and representative of Donabedian's quality framework[16]. Colorectal cancer screening is particularly relevant given its sluggish uptake in Ontario, and its applicability to a large segment of the population (men and women aged 50+ years). Conversely, patient-centredness is applicable to all patients and is frequently discussed by policy makers and other prominent voices in healthcare. Donabedian has also emphasized that quality of care includes both preventive care and the experience of the patient. The two indicators that were chosen in this thesis represent each of these dimensions of quality of care.

5.2.2 Limitations

Despite its many strengths, this thesis also had many limitations that should be addressed in future work.

5.2.2.1 Objective 1

Since there were only seven FHTs in the study, team-level predictors of colorectal cancer screening and patient-centred care could not be thoroughly examined. However, this thesis did produce hypotheses about characteristics that may differ among teams. These seven FHTs are relatively close in geography, and are likely not representative of all FHTs in Ontario. Given that variability was seen even among seven teams that were relatively close in proximity, it is hypothesized that there may be even more variability observed when examining FHTs across Ontario.

5.2.2.2 Objective 2

Although data linkage of patients to physicians was a strength of this study, this thesis was not able to link nurses or allied health professionals to physicians or patients. Thus, the care administered by these professionals and its association with the quality of patient care could not be examined. All team nurses were included in each physician's team climate calculation for the creation of the variable "Team Climate (Physicians and Nurses)". This may introduce some exposure misclassification, as all team nurses may not work frequently and/or directly with all team physicians. It is thought that this assumption introduced non-differential exposure misclassification (i.e. misclassification of nurse team climate exposures to patients that did not depend on a patient's colorectal cancer screening status or patient-centredness score), which would be likely to bias point estimates towards the null hypothesis.

Since the patient population was derived from waiting rooms, access to care could not be thoroughly examined, as patients are assumed to have at least some access if they are in the office for an appointment. However, in-office organizational characteristics may be of the most relevance to the patient population that is visiting the office. The impact of organizational characteristics on a patient's ability to access the primary healthcare system is outside the scope of this thesis, but should be examined in future research.

In terms of the statistical analysis plan employed by this study, the bivariate analysis with a p-value cutoff of 0.2 for inclusion in multivariate analysis had its strengths and weaknesses. This strategy enabled this thesis to examine many potential predictors, but it did not consider the magnitude of regression coefficients during data sparing. Bivariate analysis that demonstrated a large regression coefficient, but a p-value greater than 0.2 for a given exposure variable may have indicated that the study was underpowered to detect a statistically significant association between

that particular predictor variable and the outcome of interest. Future research should consider the magnitude of regression coefficients when building the most parsimonious model.

The parent study endeavored to collect a great deal of data from many different sources that detailed characteristics of a very small and specific study population. Although this thesis benefitted from the comprehensiveness and completeness of data collection, it must be acknowledged that external validity of the results reported in this thesis is unclear. For instance, the similarities and differences between studied FHTs and all of Ontario's FHTs, studied physicians and all of Ontario's physicians working in FHTs, as well as studied patients and all of Ontario's patients under the care of FHTs are unknown. However, the conclusions drawn from this thesis seem to be potentially conceptually relevant to other FHTs, and garner future investigation in wider populations of FHTs, physicians and patients.

5.2.2.3 Objective 2a: Colorectal Cancer Screening

Due to small sample size, clustering at the level of the physician could not be properly modeled in the initial full multivariate model (i.e. prior to manual backwards selection). In order to maintain consistency, all bivariate and multivariate analyses modeled clustering only at the level of the FHT. Clustering at the level of the physician was added to the final multivariate model in order to examine effects on the regression coefficients. Regression coefficients did not seem to change in magnitude or significance, and clustering at the level of the physician was very low. However, this is a weakness of this thesis that should be improved upon in future work by increasing sample size. Clustering at the level of the team could not be modeled in the final model for the sensitivity analysis for up-to-date colorectal cancer screening, although team-level clustering was modeled for the duration of the model-building process. Future studies should be sufficiently

powered to model correlation while examining organizational characteristics that may impact up-to-date colorectal cancer screening.

The chart abstraction item used to measure up-to-date colorectal cancer screening examined the act of being screened, either by hemoccult stool test, colonoscopy or sigmoidoscopy in the previous two years. However, more specific guidelines indicate that a colonoscopy in the previous 10 years or a sigmoidoscopy in the previous 5 years is sufficiently up-to-date, even in the absence of a hemoccult stool test in the previous two years[17]. Although communication with the Primary Investigator indicated that some patients might have been classified according to the more specific guidelines, other patients whose care adhered to the more specific guidelines may have been misclassified as not up-to-date. For example, a patient that had received a colonoscopy three years prior to the date of chart abstraction (and no additional screens since the colonoscopy) may have been classified as "not screened", even though specific guidelines suggest that the patient would in fact be up-to-date in regard to colorectal cancer screening. This misclassification is expected to be minimal and non-differential (i.e. not related to any of the exposure variables) and may bias effect estimates toward the null hypothesis.

Additionally, physician and patient perceptions of colorectal cancer screening were not collected during the data collection process for the parent study. Comparing patient uptake and physician recommendation of colorectal cancer screening in separate multivariate models may have appropriately assessed patient perceptions of colorectal cancer screening. More specifically, it is thought that a negative perception of colorectal cancer screening would have resulted in the patient refusing screening when it was recommended. Conversely, physician perceptions of colorectal cancer screening were not examined or accounted for statistically in any multivariate models. However, it is thought that physician perceptions of colorectal cancer screening would

not have confounded the relationship between any of the exposure variables of interest and the outcome. For example, there is no reasonable explanation as to why physician perceptions of colorectal cancer screening may be related to organizational characteristics (such as team climate, work satisfaction or perceptions of information technology capabilities). Moreover, it is even less probable that physician perceptions of colorectal cancer screening would have confounded the relationship between any of the exposure variables found to predict colorectal cancer screening (i.e. provider gender, average duration of regular routine visit, patient gender, general checkup in past two years, patient occupational status, patient ever smoker and usually see healthcare provider) and the outcome.

5.2.2.4 Objective 2b: Patient-Centredness

Residual confounding may have been present by the absence of variables that have been found to be associated with patient-centredness, but were hypothesized to be outcomes rather than predictors or patient-centredness. For example, patient-centredness was associated with mental health in the context that mental health was hypothesized to be a positive health outcome of a patient-centred appointment[18]. However, the inverse relationship may be postulated in that a person that rates their mental health as being better may be more able to communicate and address their needs with a healthcare provider. Although self-rated mental health was available in this database, its association with patient-centredness was not investigated, and this may be explored in future research.

This measure of patient-centredness was episodic, in that it measured visit-specific patient-centredness. As such, many of the predictors of this outcome were also visit specific (i.e. seeing regular healthcare provider today, wait time and appointment length). Although episodic patient-centredness sheds light on what aspects of an appointment may help a patient feel involved in

their own care, this measure and its predictors do not provide information about patient-centredness across the continuum of care. Future research should endeavor to develop global measures of patient-centredness (i.e. patient-centredness over time, across healthcare providers and perhaps even across aspects of the healthcare system).

5.2.2.5 Organizational Characteristics as Potential Predictors of Outcomes

Although some exploratory associations between team-level organizational characteristics and patient outcomes were examined, by no means should these be interpreted as fact. Since models including team-level organizational characteristics were generally unable to model team-level correlation, it is suspected that there is insufficient power to examine team-level variabless while accounting for team-level clustering. Additionally, four of the five organizational characteristics were dichotomous in nature (i.e. only two possible values). For example, five teams had electronic reminder systems, while two teams did not. The subsequent association found between this variable and patient-centredness could be confounded by anything that the same five teams did have, and the same two teams did not have. Given the number of policies, standards and capabilities that were examined in this study, this type of confounding is quite possible. Thus, the association between electronic reminder systems (a dichotomous variable) and patient-centredness cannot be interpreted with any degree of certainty. This should be seen as exploratory analysis only, and may demonstrate that future studies examining team-level characteristics should be appropriately powered.

5.3 Contribution to Field and Future Research

Since this thesis utilized data that was collected from the unique understudied setting of Family Health Team primary care practices, all reported results are contributions to the understanding of this setting. Most notably, the descriptive analysis of organizational characteristics at the level of

the FHT provided insight into potential variability between FHTs. While the association of some exposure variables with patient uptake or physician recommendation of colorectal cancer screening has been previously observed in the literature (i.e. patient gender, general checkup in past two years), others demonstrated new or contradictory associations (i.e. average duration of regular routine visit, patient occupational status, usually see healthcare provider). While predictors of patient satisfaction have been examined, predictors of patient-centredness identified by this thesis (born in Canada, seeing regular healthcare provider today, physician patient gender concordance, and appointment time) were unique in the Canadian setting. Future research should continue to examine modifiable predictors of quality of patient care in relevant primary healthcare delivery systems.

5.4 Conclusion

The intention of this thesis was to provide insight into the organization of Family Health Teams, as well as to examine the modifiable characteristics within FHTs that may predict quality of care among their patients. The first objective, which entailed a descriptive analysis of a wide range of organization characteristics at the level of the FHT, demonstrated variability in this primary healthcare delivery model. Hypotheses about characteristics that may impact the quality of patient care were postulated. The second objective, which examined predictors of two dimensions of quality of care, found associations between many modifiable and non-modifiable characteristics with either colorectal cancer screening or patient-centredness. Modifiable predictors of colorectal cancer screening include average duration of a routine visit, checkup in past 2 years, and whether or not the patient usually sees their regular healthcare provider. Team climate among the patient's physician and team nurses may predict physician recommendation or patient uptake of colorectal cancer screening. Modifiable predictors of patient-centredness

include physician-patient gender concordance, whether or not the patient saw their regular healthcare provider on the date of study recruitment, and appointment length. The results of this thesis should be considered when designing future research examining the quality of primary health care, especially within Family Health Teams.

5.5 References

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Appendix A

Ethics Approval

QUEEN'S UNIVERSITY HEALTH SCIENCES & AFFILIATED TEACHING HOSPITALS RESEARCH ETHICS BOARD-DELEGATED REVIEW
March 16, 2012

Miss Michelle Dimitris
Department of Community Health and Epidemiology
Queen's University

Dear Miss Dimitris
Study Title: EPID-378-12 Predictors of Colorectal Cancer Screening and Patient-Centred Care in Family Health Team Primary Care Practices.
File # 6006690
Co-Investigators: Dr. L. Levesque, Dr. M. Green, Ms. C. Savage

I am writing to acknowledge receipt of your recent ethics submission. We have examined the protocol for your project (as stated above) and consider it to be ethically acceptable. This approval is valid for one year from the date of the Chair's signature below. This approval will be reported to the Research Ethics Board. Please attend carefully to the following listing of ethics requirements you must fulfill over the course of your study:

Reporting of Amendments: If there are any changes to your study (e.g. consent, protocol, study procedures, etc.), you must submit an amendment to the Research Ethics Board for approval. Please use event form: HSREB Multi-Use Amendment/Full Board Renewal Form associated with your post review file # 6006690 in your Researcher Portal (https://eservices.queensu.ca/romeo_researcher/)

Reporting of Serious Adverse Events: Any unexpected serious adverse event occurring locally must be reported within 2 working days or earlier if required by the study sponsor. All other serious adverse events must be reported within 15 days after becoming aware of the information. Serious Adverse Event forms are located with your post-review file 6006690 in your Researcher Portal (https://eservices.queensu.ca/romeo_researcher/)

Reporting of Complaints: Any complaints made by participants or persons acting on behalf of participants must be reported to the Research Ethics Board within 7 days of becoming aware of the complaint. Note: All documents supplied to participants must have the contact information for the Research Ethics Board.

Annual Renewal: Prior to the expiration of your approval (which is one year from the date of the Chair's signature below), you will be reminded to submit your renewal form along with any new changes or amendments you wish to make to your study. If there have been no major changes to your protocol, your approval may be renewed for another year.

Yours sincerely,

Albert J. Clark.

Chair, Research Ethics Board
March 16, 2012

Investigators please note that if your trial is registered by the sponsor, you must take responsibility to ensure that the registration information is accurate and complete

QUEEN'S UNIVERSITY HEALTH SCIENCES & AFFILIATED TEACHING HOSPITALS RESEARCH ETHICS BOARD

The membership of this Research Ethics Board complies with the membership requirements for Research Ethics Boards and operates in compliance with the Tri-Council Policy Statement; Part C Division 5 of the Food and Drug Regulations, OHRP, and U.S DHHS Code of Federal Regulations Title 45, Part 46 and carries out its functions in a manner consistent with Good Clinical Practices.

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