UNDERSTANDING NURSING AND ORGANIZATIONAL CONTRIBUTIONS TO
CHRONIC DISEASE MANAGEMENT WITHIN PRIMARY CARE

By

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Abstract

Background: Innovative strategies have been implemented within primary care across Canada to improve the quality of care that is delivered. One such strategy has been the utilization of interprofessional teams, of which nurses are an integral component. The overall purpose of this thesis was to understand nursing contributions within primary care, specifically related to chronic disease management.

Objectives: (1) To determine the roles of nurses in chronic disease management and the extent to which chronic disease management strategies have been implemented within primary care in Ontario, (2) to identify data collection tools that describe/measure primary care organizational attributes, (3) to determine the distribution and nature of organizational attributes across primary care practices in eastern Ontario, and (4) to explore relationships between the presence of nurses within Family Health Teams in south eastern Ontario and Type 2 diabetes health outcomes.

Methods: Four studies were performed to address the stated objectives. A provincial nursing survey was conducted to obtain information about the roles of nurses working in primary care in Ontario and the extent to which chronic disease management strategies have been implemented in practices in which nurses work. A systematic search and review was completed to identify data collection tools that collect a broader range of organizational attribute data within primary care. Using the ‘Measuring Organizational Attributes of Primary Health Care Survey’ organizational-level data from practices in eastern Ontario were collected and then linked to diabetic patient outcomes.

Results: The nursing survey and organizational attribute survey identified that nurses engaged in a broad range of chronic disease management activities and that chronic disease management strategy implementation was not uniform across practices. Registered nurses were identified as the most prominent non-physician healthcare provider within practices, and the inclusion of registered nurses in practices was associated with improved diabetes outcomes.
Conclusions: Nurses are an integral component of primary care and undertake many important activities to support chronic disease management. However, there is an ongoing need to clarify roles between different nursing regulatory designations. This thesis showed positive associations between having at least one registered nurse in a practice and diabetes management indicators.
Co-Authorship

The manuscripts presented in this thesis are the work of Julia Lukewich in collaboration with her supervisor, Dr. Joan Tranmer, and doctoral committee members, Dr. Dana Edge, Dr. Elizabeth VanDenKerkhof, and Dr. Tyler Williamson (co-authors). All of the studies were designed by Julia Lukewich in collaboration with her supervisor and committee members.

Chapter 3, Manuscript 1: Nursing contributions to chronic disease management in primary care.

This manuscript was written by Julia Lukewich with assistance from her supervisor and committee members, including Dr. Joan Tranmer, Dr. Dana Edge, and Dr. Elizabeth VanDenKerkhof. This manuscript is published within the Journal of Nursing Administration. However, modifications were made to the manuscript to meet the thesis submission requirements.

Reference


Chapter 4, Manuscript 2: Identification, summary and comparison of tools used to measure organizational attributes associated with chronic disease management within primary care settings.

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Reference


Chapter 5, Manuscript 3: *Nursing contributions to chronic disease management in relation to organizational attributes within primary care practices in eastern Ontario: An application of the Measuring Organizational Attributes of Primary Health Care Survey.* This manuscript was written by Julia Lukewich with assistance from her supervisor and committee members, including Dr. Joan Tranmer, Dr. Dana Edge, Dr. Elizabeth VanDenKerkhof, and Dr. Tyler Williamson (co-authors). The manuscript has been formatted for submission to the Canadian Medical Association Journal.

Chapter 6, Manuscript 4: *Exploring relationships between the presence of nurse providers within family health teams located in south eastern Ontario and health outcomes of patients with Type 2 diabetes.* This manuscript was written by Julia Lukewich with assistance from her supervisor and committee members, including Dr. Joan Tranmer, Dr. Dana Edge, Dr. Elizabeth VanDenKerkhof, and Dr. Tyler Williamson (co-authors). The manuscript has been formatted for submission to the Canadian Medical Association Journal.
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# Table of Contents

Abstract ........................................................................................................................................ ii  
Co-Authorship ..................................................................................................................... iv
Acknowledgements..................................................................................................................... vi
List of Tables ............................................................................................................................. xii
List of Figures ........................................................................................................................... xiii
List of Abbreviations ................................................................................................................ xiv

Chapter 1 General Introduction ....................................................................................................... 1
  1.1 Background and Study Rationale........................................................................................... 1
  1.2 Thesis Objectives ................................................................................................................... 2
  1.3 Overview of Thesis Organization ......................................................................................... 3
  1.4 References .............................................................................................................................. 5

Chapter 2 Literature Review ............................................................................................................ 7
  2.1 Organization of Literature Review ........................................................................................ 7
  2.2 Primary Healthcare ................................................................................................................ 8
  2.3 Primary Healthcare in Canada ............................................................................................... 8
  2.4 Organization of Primary Healthcare in Ontario, Canada ....................................................... 9
    2.4.1 Family Health Networks ................................................................................................. 9
    2.4.2 Family Health Groups ................................................................................................... 10
    2.4.3 Family Health Organizations ........................................................................................ 10
    2.4.4 Family Health Teams ................................................................................................. 10
    2.4.5 Community Health Centers ......................................................................................... 11
    2.4.6 Nurse Practitioner Led-Clinics ...................................................................................... 11
    2.4.7 Comparison Between Practice Models in Ontario, Canada .......................................... 11
  2.5 Chronic Diseases in Canada ................................................................................................. 12
  2.6 Diabetes Mellitus ................................................................................................................. 13
    2.6.1 Type 2 Diabetes ............................................................................................................ 13
  2.7 Clinical Practice Guidelines for Diabetes Management ...................................................... 14
    2.7.1 Glycated Hemoglobin ................................................................................................... 14
    2.7.2 Fasting Plasma Glucose ................................................................................................ 15
    2.7.3 Blood Pressure .............................................................................................................. 15
    2.7.4 Low-Density Lipoprotein Cholesterol .......................................................................... 15
    2.7.5 Urine Albumin Creatinine Ratio ................................................................................... 15
2.8 Diabetes Management within Primary Care ................................................................. 16
2.9 Primary Care Organizational Attributes for Diabetes Management ...................... 16
2.10 Conceptual Frameworks .................................................................................................. 17
  2.10.1 Chronic Care Model .................................................................................................. 17
  2.10.2 The Framework for Primary Care Organizations .................................................... 19
2.11 The Canadian Primary Care Sentinel Surveillance Network ...................................... 20
2.12 Nursing within Primary Care in Ontario, Canada ....................................................... 21
2.13 Thesis Rationale ............................................................................................................. 25
2.14 Figures ............................................................................................................................ 26
2.15 References ...................................................................................................................... 28

Chapter 3 Manuscript 1 Nursing contributions to chronic disease management in primary care 35
  Abstract ................................................................................................................................. 36
  3.1 Introduction .................................................................................................................... 37
  3.2 Methods ........................................................................................................................ 38
    3.2.1 Purpose and Study Design ..................................................................................... 38
    3.2.2 Sample ................................................................................................................... 39
    3.2.3 Data Collection ...................................................................................................... 39
    3.2.4 Statistical Analyses ............................................................................................... 40
  3.3 Results ........................................................................................................................... 41
  3.4 Discussion ....................................................................................................................... 47
  3.5 Conclusion ..................................................................................................................... 50
  3.6 Conflicts of Interests ...................................................................................................... 51
  3.7 Acknowledgements ........................................................................................................ 51
  3.8 Funding Support ............................................................................................................. 51
  3.9 References ...................................................................................................................... 52

Chapter 4 Manuscript 2 Identification, summary and comparison of tools used to measure organizational attributes associated with chronic disease management within primary care settings .................................................................................................................. 55
  Abstract ................................................................................................................................. 56
  4.1 Introduction .................................................................................................................... 57
  4.2 Methods ........................................................................................................................ 58
    4.2.1 Literature search strategy ..................................................................................... 58
    4.2.2 Study inclusion criteria ....................................................................................... 60
    4.2.3 Data extraction and synthesis ............................................................................ 61
<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>6.2.3 Setting</td>
<td>121</td>
</tr>
<tr>
<td>6.2.4 Data sources</td>
<td>121</td>
</tr>
<tr>
<td>6.2.4 Statistical analyses</td>
<td>123</td>
</tr>
<tr>
<td>6.3 Results</td>
<td>124</td>
</tr>
<tr>
<td>6.4 Interpretation</td>
<td>130</td>
</tr>
<tr>
<td>6.4.1 Strengths</td>
<td>133</td>
</tr>
<tr>
<td>6.4.2 Limitations</td>
<td>134</td>
</tr>
<tr>
<td>6.5 Conclusion</td>
<td>135</td>
</tr>
<tr>
<td>6.6 Competing Interests</td>
<td>136</td>
</tr>
<tr>
<td>6.7 Acknowledgements</td>
<td>136</td>
</tr>
<tr>
<td>6.8 References</td>
<td>137</td>
</tr>
<tr>
<td>Chapter 7 General Discussion</td>
<td>142</td>
</tr>
<tr>
<td>7.1 Summary of Main Findings</td>
<td>142</td>
</tr>
<tr>
<td>7.1.1 Nursing Contributions to Primary Care</td>
<td>142</td>
</tr>
<tr>
<td>7.1.2 Evaluation of Nursing Contributions within Primary Care</td>
<td>143</td>
</tr>
<tr>
<td>7.1.3 Organizational Attributes within Primary Care</td>
<td>145</td>
</tr>
<tr>
<td>7.2 Strengths and Limitations</td>
<td>146</td>
</tr>
<tr>
<td>7.3 Future Research Directions</td>
<td>147</td>
</tr>
<tr>
<td>7.1 Candidate’s Contributions</td>
<td>150</td>
</tr>
<tr>
<td>7.2 Conclusion</td>
<td>151</td>
</tr>
<tr>
<td>7.3 References</td>
<td>152</td>
</tr>
<tr>
<td>Appendix A Operational Definitions for Attributes in the Conceptual Framework for Primary Care Organizations</td>
<td>156</td>
</tr>
<tr>
<td>Appendix B CPCSSN Provider Data Collection Form</td>
<td>163</td>
</tr>
<tr>
<td>Appendix C Defining Nursing Contribution within Primary Care Survey</td>
<td>164</td>
</tr>
<tr>
<td>Appendix D Table S1. Systematic Review Search Terms</td>
<td>188</td>
</tr>
<tr>
<td>Appendix E Table S2. Description of Organizational Attribute Data Collection Tools</td>
<td>194</td>
</tr>
<tr>
<td>Appendix F Measuring Organizational Attributes of Primary Health Care Survey</td>
<td>201</td>
</tr>
</tbody>
</table>
List of Tables

Table 3.1: Description of Survey Participants……………………………………………………42
Table 3.2: Chronic Disease Management Activities by Regulatory Designation………………46
Table 4.1: List of Organizational Attribute Data Collection Tools……………………………..68
Table 4.2: Organizational Attributes Covered in Data Collection Tools………………………70
Table 5.1: Presence of Healthcare Providers within Practices……………………………………99
Table 5.2: Roles of Nurses in Each Regulatory Designation across Different Types of Settings…101
Table 5.3: Availability of Different Primary Care Services and Procedures…………………..103
Table 5.4: Systematic Patient Management and Follow-Up……………………………………104
Table 6.1: Patient Profile across Practice Locations………………………………………………125
Table 6.2: Presence of Physician and Nurse Providers within Practices……………………….126
Table 6.3: Diabetes Management Test Completion………………………………………………127
Table 6.4: Diabetes Management Outcome Indicators On-Target……………………………..128
Table 6.5: Patients That Had Diabetes Management Outcome Indicators On-Target at Practices With or Without the Presence of Nurses………………………………………………………129
Table 6.6: Comparison of On-Target Diabetes Management Outcome Indicators across Quartiles of Diabetic Patients per Registered Nurse…………………………………………………………130
List of Figures

Figure 2.1: Chronic Care Model .................................................................................. 26
Figure 2.2: Framework for Primary Care Organizations ................................................. 27
Figure 3.1: Nurses’ Perceptions on Current Roles and Level of Optimism Concerning Future Nursing Role Development Within Primary Care .......................................................... 44
Figure 3.2: Distribution of Chronic Diseases Screened for Within Practices That Have Screening Programs, Management Clinics and a Method of Flagging Patients with Chronic Diseases ........ 45
Figure 4.1: Flow Chart of Search Results ................................................................. 62
Figure 4.2: Percentage of Organizational Attributes Captured Within Each Data Collection Tool .. 72
**List of Abbreviations**

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Full Form</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACIC</td>
<td>Assessing Chronic Illness Care Survey</td>
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<td>ANOVA</td>
<td>Analysis of Variance</td>
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<td>APN</td>
<td>Advanced Practice Nurse</td>
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<td>BEACH</td>
<td>Bettering the Evaluation and Care of Health</td>
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<td>BP</td>
<td>Blood Pressure</td>
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<td>CCM</td>
<td>Chronic Care Model</td>
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<td>CHC</td>
<td>Community Health Center</td>
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<td>CPCSSN</td>
<td>Canadian Primary Care Sentinel Surveillance Network</td>
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<td>EMR</td>
<td>Electronic Medical Record</td>
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<td>FPG</td>
<td>Fasting Plasma Glucose</td>
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<td>FHG</td>
<td>Family Health Group</td>
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<td>FHN</td>
<td>Family Health Network</td>
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<td>FHO</td>
<td>Family Health Organization</td>
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<td>FHT</td>
<td>Family Health Team</td>
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<td>FTE</td>
<td>Full-Time Equivalent</td>
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<td>GP</td>
<td>General Practitioner</td>
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<tr>
<td>HbA1c</td>
<td>Hemoglobin A1c</td>
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<tr>
<td>HOBIC</td>
<td>Health Outcomes for Better Information and Care</td>
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<tr>
<td>LDL-C</td>
<td>Low-Density Lipoprotein Cholesterol</td>
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<td>LHIN</td>
<td>Local Health Integration Network</td>
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<tr>
<td>LPN</td>
<td>Licensed Practical Nurse</td>
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<tr>
<td>NP</td>
<td>Nurse Practitioner</td>
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<tr>
<td>NPLC</td>
<td>Nurse Practitioner-Led Clinic</td>
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<tr>
<td>OR</td>
<td>Odds Ratio</td>
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<tr>
<td>Acronym</td>
<td>Description</td>
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<tr>
<td>PBRN</td>
<td>Practice-Based Research Network</td>
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<tr>
<td>PCET</td>
<td>Primary Care Evaluation Tool</td>
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<tr>
<td>QUALICOPC</td>
<td>Quality and Costs of Primary Care in Europe</td>
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<tr>
<td>RN</td>
<td>Registered Nurse</td>
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<tr>
<td>RPN</td>
<td>Registered Practical Nurse</td>
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<tr>
<td>SD</td>
<td>Standard Deviation</td>
</tr>
<tr>
<td>TRIAD</td>
<td>Translating Research into Action for Diabetes</td>
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<td>UACR</td>
<td>Urine Albumin Creatinine Ratio</td>
</tr>
<tr>
<td>WHO</td>
<td>World Health Organization</td>
</tr>
</tbody>
</table>
Chapter 1

General Introduction

1.1 Background and Study Rationale

The delivery of high-quality primary healthcare services is a priority for healthcare systems worldwide (1–3). Many new and innovative organizational strategies have been implemented within Canada to improve the quality of care that patients receive (4,5). Given the increasing prevalence and costs associated with chronic diseases in Canada (6), a particular emphasis has been placed on increasing the quality of primary care services delivered to patients affected by chronic conditions. The implementation of these organizational strategies has occurred at a jurisdictional-level, resulting in national, provincial, and regional variability in the organization of primary care practices (4,5). Importantly, this variability can be used to assess which primary care organizational attributes support high-quality care for patients with chronic diseases.

Health outcomes and patient access to primary healthcare services have been greatly improved through the delivery of primary care services using interdisciplinary team structures consisting of general practitioners and other healthcare professionals, such as nurses (7). New practice models, including Family Health Teams, Nurse Practitioner-Led Clinics, and Community Health Centers, utilize interdisciplinary team structures to promote the delivery of comprehensive primary healthcare services (8–10). In particular, nurses form the core of interdisciplinary primary care teams (11,12). However, the specific contributions of nurses within primary care and the overall value of nurses within interdisciplinary teams have yet to be firmly established. Given the current shift toward interdisciplinary team structures within primary care, it is imperative that nurses from all regulatory designations, including Nurse Practitioners (NPs), Registered Nurses (RNs) and Registered Practical Nurses (RPNs), begin to demonstrate their unique contributions to patient care within this setting (12,13) to determine how to best optimize their roles in the delivery
of chronic disease management services to the Canadian population.

Understanding the roles and functions of healthcare professionals within interprofessional teams is important to ensure that each role is being utilized to its full potential and that each team member contributes to the overall comprehensiveness and accessibility of primary care services (14). When roles of individuals within a team are not well defined, improper role implementation and ineffective integration of different types of healthcare professionals within a team may compromise patient care (14–16). Given that nurses are highly skilled professionals at the core of primary care teams, the overall goal of this thesis was to better understand nursing contributions to chronic disease management within the larger organizational context of primary care settings.

1.2 Thesis Objectives

Four inter-related objectives were established to address the overall goal of this thesis:

1. To determine the roles of nurses in chronic disease management and the extent to which chronic disease management strategies have been implemented within primary care settings in Ontario, Canada (Manuscript 1 - Published, Journal of Nursing Administration).

2. To identify, compare, and summarize data collection tools that collect data to describe and measure organizational attributes that relate to chronic disease management within primary care (Manuscript 2 – Published, Journal of Evaluation in Clinical Practice).

3. To determine and explore differences in the distribution and nature of organizational attributes, specifically focusing on team composition, nursing roles and functions, and primary care and chronic disease management services, across primary care practices affiliated with the Eastern Ontario Network of the Canadian Primary Care Sentinel Surveillance Network (CPCSSN) (Manuscript 3 – Unpublished).

4. To explore relationships between the presence of different nursing providers (i.e. NPs, RNs, RPNs) within Family Health Teams located in south eastern Ontario and health outcomes of individuals with Type 2 diabetes (Manuscript 4 - Unpublished).
1.3 Overview of Thesis Organization

This thesis follows the regulations outlined by the Queen’s University School of Graduate Studies and Research “General Forms of Theses” and is formatted as a manuscript-based thesis. The chapter that precedes the manuscripts contains a literature review and provides a general overview of topics covered throughout the thesis as a whole. Importantly, the review identifies the need to study nursing contributions and organizational influences within the primary care setting. In the chapters following the literature review, four manuscripts are included. The first manuscript presents findings from a cross-sectional survey that was conducted to better understand nursing roles and chronic disease management strategies being utilized within primary care settings in Ontario, Canada. This manuscript is published within the Journal of Nursing Administration (17). The second manuscript utilized systematic search and review methodology to identify data collection tools that were developed to be used to describe and/or measure organizational attributes within the primary care setting. The second manuscript is published within the Journal of Evaluation in Clinical Practice (18). A data collection tool identified from the second manuscript, namely the “Measuring Organizational Attributes of Primary Health Care Survey” (19), was administered to primary care practices affiliated with the Eastern Ontario Network of the CPCSSN. Accordingly, the third manuscript presents findings from the administration of this organizational-level survey, specifically focusing on the presence of different healthcare providers, nursing roles and functions, and the availability of primary care services and chronic disease management programs within primary care practices. The fourth manuscript utilizes nurse staffing data from the organizational-level survey and patient-level data from the Eastern Ontario Network of the CPCSSN to explore relationships between the presence of different nursing providers within primary care practices and the quality of diabetic care. Both the third and fourth manuscripts are formatted for submission to the Canadian Medical Association Journal. The final chapter of this thesis is a general discussion of the main findings from each of the four manuscripts and includes
overall conclusions, future research directions, and nursing implications suggested by the thesis as a whole.
1.4 References


Chapter 2

Literature Review

2.1 Organization of Literature Review

The purpose of the following literature review is to integrate the central themes from each of the manuscripts presented in this thesis to provide an overall rationale for the studies that were performed. Given that this thesis focuses on care delivered within the primary care setting, the following literature review will begin with a description of the current landscape of primary care services, focusing specifically on the organization of primary care within Ontario, Canada. This portion of the review also defines and differentiates between the terms ‘primary healthcare’ and ‘primary care’, which are often used interchangeably throughout the literature. As the primary care setting is the most appropriate place to deliver care for patients with chronic diseases, chronic disease management is discussed in detail using Type 2 diabetes as the exemplar. General epidemiology of chronic diseases is outlined. Also, the review includes a description of the epidemiology and pathophysiology of Type 2 diabetes, and a comprehensive summary of the current state of knowledge regarding strategies and organizational attributes that support the management of Type 2 diabetes within the primary care setting. A summary of existing frameworks that have been developed to aid in the planning and implementation of these strategies is also provided. Importantly, literature related to the roles of nurses in primary care settings in general and the specific roles of nurses in Type 2 diabetes management is summarized. Taken together, this literature review identifies gaps in our understanding of primary care organizational attributes that influence chronic disease management, and nursing roles and contributions to chronic disease management within primary care, specifically addressing Type 2 diabetes. This review provides a comprehensive background for the specific studies presented in Chapter 3 to Chapter 6 of this thesis.
2.2 Primary Healthcare

Primary healthcare is a fundamental component of the healthcare system (1–3). Primary healthcare is a holistic structure of healthcare delivery that focuses on the specific needs of communities. Primary healthcare encompasses a broad spectrum of services, including primary care, and population health and community development services that target social determinants of health, such as income, housing, education, and environment (2,4). Accordingly, primary care is an element within primary healthcare that specifically focuses on health promotion and the prevention, diagnosis and treatment of illness and injury of individuals and families. Primary care is defined as the first point of access to comprehensive and patient-centered care that is often delivered by the same team of healthcare professionals over a long period of time. Primary care must be accessible and requires coordination of care when patients need medical assessment or treatment support that is beyond the scope of a primary care practitioner (2,4–6). Primary care services are predominately delivered by physicians and nurses and are especially important for individuals with chronic diseases (7).

2.3 Primary Healthcare in Canada

Primary healthcare is fundamental to the delivery of high-quality care to patients and must therefore be optimized and continuously refined to meet the changing needs of the population (1–3,8). Within Canada, a large emphasis has been placed on renewing and strengthening primary healthcare to enhance the quality of care that is delivered (3,8). Many of these reform initiatives have specifically addressed principles from the Canada Health Act (1984), such as universality, accessibility, portability, comprehensiveness, and public administration (9). Examples of these initiatives include the introduction of new payment models and the creation of interdisciplinary teams consisting of general practitioners and allied healthcare professionals (3,8,10). Nevertheless, Canada’s healthcare system as a whole continues to lag behind that of many other countries. In a recent report published by the Commonwealth Fund (2014) that studied healthcare system performance of 11 different countries, namely Australia, Canada, France, Germany, the
Netherlands, New Zealand, Norway, Sweden, Switzerland, the United Kingdom, and the United States, Canada and the United States were ranked the two worst performing countries overall (11). Primary healthcare delivery within Canada was recently criticized for poor health promotion, inadequate disease prevention programs, lack of continuity of care, poor access to services, and unreasonable workloads placed on healthcare providers (4,12). There is also an increasing number of Canadians who do not have access to adequate primary healthcare services (8). Limited access to primary healthcare services places increased pressure on other parts of the healthcare system, including hospital emergency rooms (13,14). Therefore, appropriate primary healthcare delivery is crucial to the vitality of the Canadian healthcare system as a whole.

A key element moving forward with primary healthcare reform in Canada is ensuring comprehensive performance measurement and evaluation that support quality improvement and demonstrate provider and organizational accountability (8,15,16). Specifically, exploration of the optimal roles of healthcare professionals within primary healthcare, better understanding of primary care organizational attributes, and the evaluation of patient-to-provider ratios and team compositions that result in high-quality care are required (17–20).

### 2.4 Organization of Primary Healthcare in Ontario, Canada

Primary healthcare services are established at a jurisdictional-level in Canada, which has led to variability in the organization of primary care services across provinces and territories (3,8,10,16,21). Within Ontario, primary care is organized into different practice models. Physician-led practice models include Family Health Networks (FHNs), Family Health Groups (FHGs), and Family Health Organizations (FHOs). Team-based practice models have also been introduced in Ontario, including Family Health Teams (FHTs), Community Health Centers (CHCs), and Nurse Practitioner-Led Clinics (NPLCs). In general, all of these practice models differ with respect to the patient populations that they service, the providers that contribute to patient care, the depth of primary healthcare services offered, and the funding strategies employed (10,22,23).

#### 2.4.1 Family Health Networks
FHNs were introduced into the Ontario healthcare system in 2001. Each FHN is composed of a minimum of three family physicians that receive funding based on a blended payment model, including capitation, fee-for-service, premiums, and bonuses. Premiums and bonuses are offered to FHNs that provide preventative services, such as childhood immunizations, mammograms, pap smears, colorectal screening, prenatal care, obstetrics and home visits. FHNs also receive funding for continuing medical education and for building information technology infrastructure within the practice to support patient care (24).

2.4.2 Family Health Groups

FHGs are practices comprised of three or more family physicians working in the same office space or in offices that are within reasonable distance from each other. FHGs were implemented in Ontario in 2003 and offer regular and extended hours for patients. Each physician employed in the FHG is responsible for providing three hours of after-hour service per week. Physicians working within the FHG are paid on a fee-for-service basis and receive additional premiums and bonuses for providing after-hours care and delivering priority services, such as diabetes management and smoking cessation counselling (24).

2.4.3 Family Health Organizations

FHOs were created in 2006 as a result of the harmonization of two original delivery models developed in the in the late 20th century, namely Primary Care Networks and Health Service Organizations. Similar to FHNs and FHGs, FHOs are comprised of at least three family physicians. Physicians working in FHOs are remunerated through blended capitation, and receive additional funding for providing priority care services, including chronic disease management (24).

2.4.4 Family Health Teams

FHTs were first introduced as a primary healthcare model in Ontario in 2005 as a means to improve access to healthcare services. There are currently close to 200 FHTs in Ontario, and approximately half of these serve rural or northern communities. FHTs deliver comprehensive care using an interdisciplinary team structure that often includes physicians and nurses, but may also
include other professionals, such as dieticians, pharmacists, health promoters, and social workers.

FHTs are funded using a variety of remuneration models, including blended capitation, complement-based remuneration plus bonuses and incentives, or blended salary (16,22,25)

2.4.5 Community Health Centers

CHCs are non-profit, community-governed organizations that have been in existence in Canada since the 1920s. CHCs focus on delivering a broad range of primary healthcare services to specific vulnerable and marginalized populations within a given community that often experience barriers to accessing healthcare services based on race, language, physical disabilities, poverty or isolated geographic locations. There are over 70 CHCs across Ontario that deliver care using an interdisciplinary team that includes a wide range of providers, such as physicians, nurses, health promoters, community health workers, and dental staff. All healthcare providers within CHCs, including physicians, are paid by salary (22,26).

2.4.6 Nurse Practitioner-Led Clinics

NPLCs are non-profit organizations that deliver comprehensive primary healthcare, including disease prevention, health promotion, and the diagnosis and treatment of episodic illnesses and chronic diseases, using an interprofessional team, including a consulting physician. NPLCs were first introduced into the Ontario healthcare system in 2007. Currently, there are 25 NPLCs in Ontario that are funded through a salaried remuneration model (23,27).

2.4.7 Comparison Between Practice Models in Ontario, Canada

Many studies have examined whether different types of payment structures, such as fee-for-service, salary based, blended capitation, and capitation (28–34), and different types of practice structures, such as FHTs and CHCs, affect the quality of care delivered to patients (26,30,34–37). For example, a cross-sectional study conducted by Russell et al. (2009) compared chronic disease management performance across four types of practice delivery models in Ontario, including CHCs and FHNs and found that CHCs delivered the most superior care. This finding was particularly evident for diabetic care, as significantly more diabetic foot examinations, eye examinations, and
glycated hemoglobin (HbA1c) tests were reportedly performed within CHC practice models in comparison to other practice models (30). Similarly, in an Institute for Clinical Evaluative Sciences report prepared by Glazier, Zagorski, and Rayner (2012), patients that received care from CHC practice structures had significantly fewer emergency room visits than patients that received care from other practice structures, including FHTs (26). Also, Jaakkimainen et al. (2011) used administrative data in a cross-sectional study to compare diabetes management indicators before and after physicians joined FHNs or FHGs in Ontario. This study found a significant increase in the number of diabetes-related prescriptions given to patients and a significant decrease in the number of eye examinations performed on patients with diabetes once their physicians joined either a FHN or FHG. There was no difference in either of these parameters between practices where physicians joined FHNs compared to FHGs (37). Although these studies have highlighted associations between payment and practice structures and patient care, the quality of patient care, specifically with respect to chronic diseases, has yet to be comprehensively analyzed according to all existing practice structures currently offered within Ontario, including NPLCs. In addition, the contribution of specific organizational attributes, such as team composition, provider roles, and availability of services, to the quality of care delivered to patients with chronic diseases also needs to be addressed.

2.5 Chronic Diseases in Canada

Chronic diseases are the leading cause of death in Canada. Cardiovascular disease, cancer, respiratory diseases, kidney disease and diabetes are the five most prevalent chronic diseases and they collectively account for three quarters of all annual deaths attributable to chronic diseases (3). Patients with chronic diseases place substantial demands on the healthcare system and the management of chronic diseases accounts for approximately 40% to 70% of total healthcare costs within Canada (4,38). Within Ontario, close to 80% of individuals aged 45 years or older have a chronic condition and approximately 70% of those individuals suffer from two or more chronic conditions. Chronic diseases account for approximately 55% of healthcare costs within Ontario.
Overall, the costs associated with chronic diseases are predicted to increase in coming years, as the prevalence of chronic diseases is currently on the rise (7,40). It is therefore important that the effectiveness and efficiency of Canadian healthcare systems be optimized to meet the demands of this growing patient population.

2.6 Diabetes Mellitus

Diabetes mellitus is a chronic metabolic disease that is characterized by inadequate regulation of blood glucose levels. There are three main forms of diabetes mellitus, including Type 1 diabetes, Type 2 diabetes, and gestational diabetes (41,42). In Canada, diabetes affects approximately 2.4 million individuals and this number is expected to increase to 3.7 million by 2020. Similarly, the economic burden of diabetes was $12.2 billion in 2010 and is expected to increase to $16.9 billion by 2020 (43). Amongst all provinces and territories in Canada, Newfoundland and Labrador, Nova Scotia, and Ontario have the highest prevalence of diabetes (13). In Ontario, diabetes affects approximately 10% of the population and this number is expected to increase to 13% by 2024 (44).

2.6.1 Type 2 Diabetes

Type 2 diabetes accounts for over 90% of all diabetes cases within Canada (13,45). Type 2 diabetes occurs when the body is no longer able to use insulin effectively. The risk of developing Type 2 diabetes increases with age and this condition commonly develops in individuals over the age of 40. Other risk factors for developing Type 2 diabetes include physical inactivity, high blood pressure (BP), high body mass index, high serum cholesterol levels, a family history of Type 2 diabetes or gestational diabetes, and belonging to high-risk ethnic groups, such as Aboriginal or Hispanic peoples (13,46).

If left untreated, Type 2 diabetes can have severe consequences on a patient’s health and well-being. This condition commonly causes blindness, sensorimotor polyneuropathy, kidney failure, and amputations in patients that are not managed properly within the healthcare setting (47). In fact, patients with diabetes are ten times more likely to have a lower limb amputation than
patients without this condition (48), and diabetes is currently the leading cause of kidney failure worldwide (49). Patients with Type 2 diabetes also often have comorbidities that can exacerbate the effects of diabetes and promote the development of additional complications. For example, approximately 60% of patients with Type 2 diabetes have hypertension, placing them at an increased risk of developing cardiovascular disease and having a stroke (46). The complications associated with Type 2 diabetes require patients with this condition to use a substantial amount of healthcare resources. Importantly, many of these complications can be reduced through the appropriate management of patients with Type 2 diabetes within the primary care setting. Given that Type 2 diabetes accounts for the majority of diabetes cases in Canada and that the quality of Type 2 diabetes care directly affects patient outcomes, this thesis will focus on Type 2 diabetes.

2.7 Clinical Practice Guidelines for Diabetes Management

The Canadian Diabetes Association (2013) has developed clinical practice guidelines to assist healthcare providers within the primary care setting to successfully manage patients with Type 2 diabetes and to reduce their risk of developing microvascular and macrovascular complications. In general, the risk of developing complications associated with Type 2 diabetes can be reduced by maintaining a healthy body weight through physical activity and eating a healthy diet, avoiding the use of tobacco, and appropriately managing blood sugar levels, BP, and serum cholesterol levels. The provision of support from an interdisciplinary team in achieving health targets is recommended (46,50).

2.7.1 Glycated Hemoglobin

HbA1c is a reliable estimate of a patient’s mean blood glucose levels over the previous three to four months. Patients with diabetes should aim to achieve HbA1c levels ≤ 7.0% to significantly reduce the risk of developing both microvascular and macrovascular complications. A diabetic patient’s HbA1c levels should be measured at least one time each year. In fact, patients with poor glycemic control undergoing treatment adjustments should have their HbA1c measured
every three months, and patients who consistently meet recommended glycemic targets should have their HbA1c levels measured every six months (46).

2.7.2 Fasting Plasma Glucose

Another important variable that should be routinely measured in patients with diabetes is fasting plasma glucose (FPG). A FPG ≥ 7.0 mmol/L increases an individual’s likelihood of developing microvascular complications, such as retinopathies. Patients with diabetes must therefore routinely monitor their FPG levels using a blood glucose meter. In order to ensure the accuracy of blood glucose meter readings, meter results should be compared at least annually with simultaneous laboratory measurements of venous FPG performed within the healthcare setting (46).

2.7.3 Blood Pressure

BP can also affect a diabetic patient’s risk of developing complications. A BP measurement should therefore be conducted at all appropriate healthcare visits (51). As previously mentioned, many individuals with diabetes also have hypertension which can predispose them to additional complications, such as cardiovascular disease and strokes. Patients with both diabetes and hypertension should aim to effectively manage their BP and achieve a BP < 130/80 mmHg (46).

2.7.4 Low-Density Lipoprotein Cholesterol

Low-density lipoprotein cholesterol (LDL-C) levels of ≤ 2.0 mmol/L are significantly associated with a reduction in macrovascular complications. A fasting lipid profile including LDL-C should be conducted at the time of diagnosis of diabetes and the assessment should be repeated annually, or more frequently if results are abnormal (46).

2.7.5 Urine Albumin Creatinine Ratio

Screening for early stages of chronic kidney disease (microalbuminuria) in adults who have Type 2 diabetes should be conducted using the Urine Albumin Creatinine Ratio (UACR) test and screening should commence at time of diagnosis and be repeated annually thereafter. A UACR test result of ≥ 2.0 mg/mmol indicates early stages of chronic kidney disease. Individuals can slow or prevent the progression of chronic kidney disease by maintaining tight glycemic control and
reducing BP. Microalbuminuria is also an independent risk factor for heart failure in patients who have diabetes (46).

2.8 Diabetes Management within Primary Care

Patients with Type 2 diabetes are most effectively managed within the primary care setting by an interdisciplinary team of healthcare professionals (46,50,52–55). When patients with diabetes have limited access to primary care services, increased pressure is placed on other parts of the healthcare system, including hospital emergency rooms. This is particularly important when considering the prevalence of diabetes and the fact that patients with diabetes use a greater amount of healthcare resources compared to patients that do not have this condition. For instance, adults with diabetes have more prescribed medications, longer hospital stays, and an increased need for emergency and long-term care services than adults without this condition (13,14,46). The increased utilization of healthcare resources by patients with Type 2 diabetes is primarily due to the health complications associated with this condition, which can be reduced through the use of effective chronic disease management strategies (13,14,46).

2.9 Primary Care Organizational Attributes for Diabetes Management

Effective diabetes management is a complex process involving multiple healthcare strategies. According to the Canadian Diabetes Association (2013), the degree to which patients effectively manage their diabetes is related to the organizational attributes of the primary care practice in which they receive care (56). Several comprehensive reviews have identified organizational attributes that are associated with improvements in the management of patients with chronic diseases, such as diabetes, within the primary care setting. The addition of allied healthcare professionals to form interdisciplinary primary care teams, changes to electronic medical records (EMRs) to support the use of patient registries, recall, and reminder systems and to provide feedback to healthcare providers, the introduction of new physician payment models, and extended opening hours of primary care practices are all associated with improved diabetes care (54,57–59). Importantly, a Cochrane review completed by Renders et al. (2001) identified that glycemic control
was improved when nurses partly replaced physicians in delivering diabetes care. More specifically, diabetes care was improved when nurses conducted regular contact and follow-up with patients and provided patient education or facilitated adherence to treatment (54). Similarly, another Cochrane review completed by Loveman, Royle, and Waugh (2003) identified that the presence of a diabetes specialist nurse or nurse case manager can improve diabetic care over short time periods. This conclusion was based on findings from six randomized controlled trials and thus identified the need for further study of the relationship between nurses and diabetic care over longer periods of time (60). In Canada and many other countries, the implementation of these organizational attributes has occurred at a jurisdictional-level, resulting in substantial variability in the chronic disease management delivery models and strategies used in primary care practices across different jurisdictions (8,10). Also, there is currently limited information regarding the distribution and nature of primary care organizational attributes, which has made it difficult to study their effects on chronic disease management.

2.10 Conceptual Frameworks

The study of organizational attributes and Type 2 diabetes can be guided by chronic disease management models that identify organizational variables that are hypothesized to improve Type 2 diabetes management within primary care. Many organizational attributes that are believed to improve chronic disease management are conceptualized within existing chronic disease care models, such as the Chronic Care Model (CCM) (Figure 2.1) (53) and the Framework for Primary Care Organizations (Figure 2.2) (61). In fact, the Canadian Diabetes Association (2013) Clinical Practice Guidelines recommend that the organizational strategies identified within the CCM be used to guide the delivery of diabetes care within the primary care setting across Canada, as the CCM has been shown to improve patient outcomes and reduce the use of healthcare services (56).

2.10.1 Chronic Care Model

The CCM (Figure 2.1) was developed in the United States to be used as a guide for creating effective chronic care strategies for the primary care setting (53). The Expanded CCM was
developed in British Columbia, Canada and expanded upon the CCM to integrate specific chronic disease prevention and health promotion elements (62). The Ontario Chronic Disease Prevention and Management (CDPM) framework was adapted from the CCM and the Expanded CCM and was developed to guide the redesign of the healthcare system within Ontario, Canada to focus on the prevention and management of chronic diseases, rather than on acute, episodic care (39).

According to all of these versions of the CCM, certain primary care practice organizational attributes are required to ensure appropriate prevention and management of chronic diseases, such as Type 2 diabetes within the primary care setting (57). These key primary care organizational attributes include: self-management support, delivery system design, decision support, and clinical information systems. Self-management support is an organizational attribute characterized by a patient assuming a lead role in the management of their chronic condition. Effective self-management support is accomplished through patient education and healthcare professionals collaboratively helping patients and their families acquire the necessary skills, resources, and tools for problem-solving and goal-setting. Effective self-management support also involves providing patients with psychosocial support and informing them of the best treatment strategies and targets.

Delivery system design is an organizational attribute that refers to the alteration of a practice structure to facilitate the creation of healthcare teams that incorporate a variety of different professionals with a clear division of labour, and the separation of chronic disease management from the treatment of acute conditions. Important features of delivery system design include case-management of high-risk patients, and planned visits and proactive follow-up for patients with chronic diseases that require ongoing monitoring. For example, with respect to diabetes, delivery system design may involve training allied healthcare professionals to support patient self-management and to perform routine diabetes management activities, such as eye and foot examinations. The provider decision support organizational attribute focuses on the use of evidence-based practice guidelines, such as the Canadian Diabetes Association (2013) Clinical Practice Guidelines, to support the care of individuals with specific chronic conditions in daily
practice. Provider decision support also encompasses the use of routine performance and outcome measurements to assess the effectiveness of care provided, ongoing education opportunities for healthcare professionals employed within the practice, the use of clinical flow sheets, and expert consultation support. The clinical information systems component refers to technologies that are used by practices to manage patients with chronic diseases. Specifically, clinical information systems can be used to generate reminder systems that support healthcare professionals in adhering to clinical practice guidelines, to provide feedback to healthcare professionals enabling them to evaluate their performance on chronic disease management measures, and to organize the care of patients through the use of patient registries (52,57).

These primary care organizational attributes are interdependent, and each of these elements affects clinical outcomes and the efficiency of healthcare delivery (39,52,53,62). This thesis specifically focuses on these organizational attributes because they are intrinsic to the primary care practice and important in the delivery of high-quality care for patients with chronic illnesses, such as Type 2 diabetes.

2.10.2 The Framework for Primary Care Organizations

The Framework for Primary Care Organizations (Figure 2.2) was also used to guide this thesis (61). The Framework for Primary Care Organizations was developed in 2007 to aid researchers in successfully evaluating the implementation of new models of care within Ontario. This model consists of a structural domain that is divided into three main components: (1) the health care system, (2) practice context, and (3) organization of the practice, and a performance domain that is divided into two main components: (1) health care service delivery and (2) technical quality of clinical care. This thesis concentrates on the ‘organization of the practice’ components from the structural domain and the ‘technical quality of clinical care’ components from the performance domain because they are intrinsic to the primary care practice setting and are important in the delivery of high-quality care for patients with chronic illnesses, such as Type 2 diabetes. The organization of the practice is characterized by practice-level attributes, such as health human resources, group composition, office infrastructure, and information technology. The
technical quality of care component is defined as the degree to which care is delivered according to evidence-based guidelines and whether care delivered meets acceptable standards. The technical quality of care component is comprised of four subcomponents: (1) health promotion and prevention, (2) secondary prevention, (3) care of chronic conditions, and (4) care of acute conditions. In addition, elements from the practice context within the structural domain, such as geographical setting factors (e.g. locality of practice) are explored (61). Appendix A includes a table summarizing the operational definitions for attributes in the Conceptual Framework for Primary Care Organizations.

The Framework for Primary Care Organizations has been used to guide a similar study conducted in the past (35). Dahrouge et al. (2009) conducted a cross-sectional mixed-methods study to better understand how different dimensions of primary care practices affect patient experiences and the quality of care they receive. This study utilized the Framework for Primary Care Organizations to identify specific variables related to primary care to study and to help select a data collection tool (i.e. high congruency between the variables captured by the data collection tool and variables identified within the framework) (35).

2.11 The Canadian Primary Care Sentinel Surveillance Network

To facilitate the evaluation of the Canadian primary healthcare system, several organizations that maintain large, population-based databases, including the Canadian Primary Care Sentinel Surveillance Network (CPCSSN), have been established (63,64). This thesis utilizes data available from the CPCSSN. In 2008, the CPCSSN was established as Canada's first chronic disease EMR surveillance system. It is an initiative funded by the Public Health Agency of Canada and the College of Family Physicians of Canada, and collaborates with the Canadian Institutes of Health Research. The main purpose of the CPCSSN is to improve the effectiveness and efficiency of primary healthcare delivery, and to improve patient and system outcomes across the country by creating a platform for research, surveillance and education. It is currently comprised of ten Practice Based Research Networks (PBRNs) spanning nine provinces, including British Columbia,
Alberta, Manitoba, Ontario, Quebec, Nova Scotia, New Brunswick, Prince Edward Island, and Newfoundland and Labrador. The CPCSSN has developed case definitions to identify patients affected by five chronic diseases: diabetes, hypertension, chronic obstructive pulmonary disease, depression, and osteoarthritis, and three neurological conditions: dementia, Parkinson’s disease, and epilepsy (63–65). The CPCSSN currently has a short questionnaire that is administered to primary care practices affiliated with their network to inquire about general demographic information (Appendix B). This questionnaire contains few items inquiring about specific organizational attributes of the primary care practices.

2.12 Nursing within Primary Care in Ontario, Canada

An important primary care organizational attribute that is understudied is the presence of nurses and the contributions that nurses make in the delivery of chronic disease management. Within Canada, there are currently over 400,000 nurses that deliver healthcare services within all sectors of the healthcare system (66). Each province has its own legislation that governs nursing practice, as well as its own governing and licensing bodies for nurses. Within Ontario, all nurses must register with the College of Nurses of Ontario on an annual basis. The College of Nurses of Ontario regulates three groups of nursing providers: Registered Practical Nurses (RPNs), Registered Nurses (RNs), and Nurse Practitioners (NPs) (67). RPNs are regulated healthcare professionals who have obtained a college degree and care for patients with stable and predictable conditions. In provinces other than Ontario, the protected title for RPNs is “licensed practical nurse (LPN)” (68). RNs are regulated healthcare professionals who have obtained either a college diploma or university degree and can care for patients with complex needs in unpredictable situations. RNs also play a key role in preventative health screening, health promotion, and chronic disease management (69). Advanced practice nursing (APN) is an umbrella term used to describe primary healthcare NPs, acute care NPs (including adult and pediatric NPs), clinical nurse specialists, and individuals in the clinical nurse specialist/NP blended role (70,71). In general, NPs are RNs who have acquired advanced knowledge and education, and can autonomously diagnose
patients, order and interpret diagnostic tests, prescribe medications, and perform a wider variety of clinical tasks than RNs and RPNs (70).

Nurses form the core of primary care interdisciplinary teams and are well positioned in primary care to enhance the planning and delivery of healthcare resources (24,72–74). For example, Canadians who have access to a non-physician healthcare provider, such as a nurse in primary care, are more likely to report that they have knowledge about their medical conditions and that they know more about how to prevent future problems related to complications associated with their medical conditions than individuals who do not have access to non-physician healthcare providers (75). In Ontario, there are currently over 30,000 nurses employed across a variety of primary care and community health settings, including FHTs, CHCs, NPLCs, diabetes education centers, and public health departments, making nurses the most prominent non-physician healthcare provider in this setting (76). The number of nurses employed in primary care is likely to increase in coming years, as part of Ontario’s strategy to improve primary healthcare includes increasing the number of highly-qualified, non-physician providers working within this setting (3).

The Health Council of Canada (2005) believes that successful primary healthcare reform requires the better use of highly-qualified health professionals, such as nurses. They also recommend that a greater emphasis be placed on health promotion, disease prevention, and chronic disease management, which are fundamental roles of nurses within each regulatory designation in primary care (3). In order to better utilize nurses within primary care, we must first understand the specific contributions that each nursing regulatory designation makes within this setting and evaluate the impact that they have on patient care. Unfortunately, there is currently a scarcity of evidence demonstrating the value or contributions that nurses within different regulatory designations make within primary care. This is particularly true for RNs and RPNs, as the majority of research has focused on nurses, in general, without making clear distinctions between regulatory designations or has been conducted in the acute, long-term, and home care settings (18,19,28,30,77–79).
A few cross-sectional studies conducted in Ontario explored whether nurses within a primary care practice improve the delivery of health promotion and chronic disease management (28,30,31,79). However, within many of these studies, ‘nurse’ was either not defined or the definition did not align with regulatory designations recognized within the province. In the studies conducted by Russell et al. (2009), Russell et al. (2010), and Hogg et al., (2009) the definition of a nurse included ‘registered nurses, nurses and nursing assistants’ (30,31,79). Similarly, the definition of a nurse varied across the included studies in a systematic review that explored the effectiveness of nurses in primary care (74). The ambiguity in the definition of a nurse within these studies makes it difficult to extrapolate the findings to make recommendations for improving the organization of primary care practices. Thus, future research examining nursing within primary care should make clear distinctions between different types of nurse providers.

The sparse body of literature that has focused on the contributions of RNs and RPNs in primary care settings has mainly been conducted in countries other than Canada, such as the United Kingdom (80–82). In general, the positive relationship between nurse staffing and patient outcomes identified within the acute care setting also seems to be present within the primary care setting. For instance, Griffiths et al. (2010) conducted a cross-sectional study in the United Kingdom using an existing national database to explore the association between the number of RNs within a primary care practice and clinical outcome performance indicators. The findings demonstrated that higher RN staffing levels was significantly associated with improved performance of care related to diabetes, hypertension, chronic obstructive pulmonary disease, and coronary heart disease, and decreased hospital admissions for complications associated with asthma and chronic obstructive pulmonary disease (Griffiths et al., 2010). Furthermore, a study conducted by Vallejo-Torres and Morris (2011) that utilized data available through several existing data sources in England found that patients who have chronic diseases are more likely to see a practice nurse than a general practitioner in the primary care setting (83). Given that RNs are the most
common nursing regulatory designation employed within the primary care setting in Ontario (76), this gap in knowledge must be addressed.

In contrast to RNs and RPNs, a considerable body of evidence demonstrates the effectiveness of NPs in delivering high-quality patient care within the primary care setting (28,30,31,73,74,84). A Cochrane review conducted by Horrocks et al. (2002) demonstrated that patients who received care from NPs reported higher satisfaction with care in comparison to patients who received care from physicians. Although this review did not identify any differences between health outcomes, return consultations, or referral patterns in patients who received care from NPs or physicians, it found that NPs had longer consultations and made more investigations than physicians (73). In a randomized study conducted in the United States that assigned patients to physician or NP-led care, after two years of follow-up, no differences in health outcomes were observed between patients who received care from physicians versus NPs. However, patients that were being cared for by NPs had fewer primary care visits than patients being cared for by physicians (85). In contrast, differences in health outcomes were observed in a cross-sectional study conducted in Ontario that investigated associations between primary care organizational factors, including the presence of NPs, and the quality of chronic disease management. The quality of chronic disease management was measured by a chronic disease management score that incorporated whether evidence-based maneuvers were performed for individuals who had diabetes, coronary artery disease, congestive heart failure, and hypertension. This study found that the presence of NPs was associated with improved chronic disease management, independent of organizational factors (30). Although NPs have demonstrated that they can provide equivalent care to physicians, there remains a need to collect high-quality data to evaluate the effectiveness of the roles of NPs within primary care and demonstrate their ability to contribute to cost-effective care.

In settings outside of primary care, distinctions between regulatory designations are often made within the literature, and as a result important relationships between nurse staffing and patient outcomes have been found. For instance, in a hospital setting, a greater number of RNs was
significantly associated with reduced adverse events, including patient mortality, hospital acquired pneumonia, and shorter lengths of stay (77). Similarly, a higher proportion of hours of nursing care provided by RNs and a greater number of hours of care by RNs per day were associated with better care for hospitalized patients, including shorter lengths of stay, and reduced rates of urinary tract infections and hospital acquired pneumonia (78). Studies with similar rigorous designs should also be conducted within the primary care setting.

### 2.13 Thesis Rationale

This review has identified two important gaps in the literature. There is currently a scarcity of information about the implementation and effectiveness of organizational attributes within the primary care setting. In particular, few studies have assessed the depth and range of organizational attributes across primary care practices in Ontario, Canada. Given that organizational attributes have been implemented at a jurisdictional-level, there is an opportunity to assess which organizational attributes contribute to high-quality patient care. In order to do this, it is important to develop a strategy to acquire comprehensive data on organizational attributes of primary care practices. The roles of nurses in primary care and their contributions to chronic disease management within interdisciplinary teams are also understudied. This thesis therefore addresses these gaps in the literature through the exploration of nursing roles within primary care practices in Ontario, the development of a strategy to generate important information about the distribution of organizational attributes of primary care, and evaluation of the effects of nurses on the outcomes of patients with Type 2 diabetes managed within the primary care setting.
2.14 Figures

The Chronic Care Model

Figure 2.1: Chronic Care Model (53). This thesis focuses on the ‘Organization of Health Care’ component of Chronic Care Model (indicated by red box).
Figure 2.2: Framework for Primary Care Organizations (61). This thesis focuses on the 'Organization of the Practice' components from the Structural Domain and the 'Technical quality of clinical care' components from the Performance Domain of the Framework for Primary Care Organizations.
2.15 References


Chapter 3

Manuscript 1

Nursing contributions to chronic disease management in primary care


Note: modifications were made to the manuscript to meet the thesis submission requirements.
Abstract

**Background:** As the prevalence of chronic diseases continues to increase, emphasis is being placed on the development of primary care strategies that enhance healthcare delivery. Innovations include interprofessional healthcare teams and chronic disease management strategies.

**Objective:** To determine the roles of nurses working in primary care settings in Ontario and the extent to which chronic disease management strategies have been implemented.

**Methods:** We conducted a cross-sectional survey of a random sample of primary care nurses, including registered practical nurses, registered nurses, and nurse practitioners, in Ontario between May and July 2011.

**Results:** Nurses in primary care reported engaging in chronic disease management activities but to different extents depending on their regulatory designation (licensure category). Chronic disease management strategy implementation was not uniform across primary care practices where the nurses worked.

**Conclusions:** There is the potential to optimize and standardize the nursing role within primary care and improve the implementation of chronic disease management strategies.
3.1 Introduction

Chronic diseases are currently the leading cause of preventable death and disability worldwide and the prevalence and costs associated with chronic conditions are increasing globally (1,2). The management of chronic diseases accounts for approximately 40% to 70% of total healthcare costs in Canada (3). In Ontario, approximately 80% of individuals 45 years or older have a chronic condition, 70% of whom suffer from 2 or more chronic illnesses (1). Therefore, the delivery of high-quality care to patients with chronic diseases in the primary care setting is pivotal to the health and well-being of this patient population and is an integral component of the Canadian healthcare system.

Primary healthcare is conceptualized as a holistic structure of healthcare delivery and focuses on the specific needs of communities. Primary healthcare encompasses a broad spectrum of services, including disease prevention, health promotion, population health, and community development, which target social determinants of health, such as income, housing, education, and environment (3,4). Primary care is an element within primary healthcare that focuses on health promotion and the prevention, diagnosis, and treatment of illness and injury of individuals and families. Primary care is defined as the 1st point of access to comprehensive and patient-centered care that is often delivered by the same team of healthcare professionals over a long period. Primary care must be accessible and requires coordination of care when patients need medical assessment or treatment that is beyond the scope of a primary care practitioner (3-5).

In response to the increasing emphasis being placed on the management of patients with chronic diseases in the primary care setting, strategies that enhance the coordination and comprehensiveness of healthcare delivery to these patients have been developed (3,6). The addition of healthcare professionals to form interprofessional primary care teams and changes in physician payment models have recently been implemented in primary care to address the increasing burden that patients with chronic diseases place on the Canadian healthcare system (6-8). Many of these strategies have enabled the delivery of a wide range of services, improved health service
accessibility, and promoted the delivery of coordinated and comprehensive care, leading to better health outcomes for patients with chronic diseases (3,6-13). However, there is limited information available on how to optimize the roles and functions of care providers in interprofessional healthcare teams to ensure that each category of practitioner is utilized to its full potential.

Nurses play an important role in chronic disease management and are well positioned to enhance the planning and delivery of healthcare resources in primary care (14-16). Within Canada, licensed practical nurses (LPNs), registered nurses (RNs), and nurse practitioners (NPs) all contribute to the delivery of primary care services. LPNs are regulated healthcare professionals who have obtained a college diploma and care for patients with stable and predictable conditions. Within Ontario, the protected title for LPNs is “registered practical nurse” (RPN) (17). RNs are regulated healthcare professionals who have obtained either a college diploma or a university degree. However, newly educated RNs are now required to complete a baccalaureate degree in nursing. RNs have a wider scope of practice than RPNs, care for patients with complex needs in unpredictable situations, and play a key role in health promotion and chronic disease prevention and management (18). Primary healthcare NPs are RNs who have acquired advanced knowledge and education and can autonomously diagnose patients, order and interpret diagnostic tests, prescribe medications, and perform a wider variety of clinical tasks than RNs and RPNs (19). Although nurses of each regulatory designation working in primary care play important roles in the management of patients with chronic diseases, the specific roles and activities performed by these nurses are not well defined. This makes it difficult to determine how to best utilize their role to contribute to high-quality care for patients who have chronic diseases.

3.2 Methods

3.2.1 Purpose and Study Design

We conducted a cross-sectional survey to determine the current roles and activities of nurses working in primary care in relation to chronic disease management and to determine the
extent to which chronic disease management strategies have been implemented in primary care in Ontario, Canada, from the nurses’ perspective. The following research objectives were addressed: (1) to describe nurses’ (ie, RPNs, RNs, NPs) perceptions on their current roles within primary care practices; (2) to determine activities currently being conducted in primary care practices to address the prevention and management of chronic diseases; and (3) to determine current clinical activities of nurses in primary care practices in Ontario, Canada, that specifically relate to chronic disease management. Queen’s University Health Science Research Ethics Boards provided ethics approval prior to study commencement.

3.2.2 Sample

Study participants included nurses in all licensure designations (ie, RPNs, RNs, NPs) in Ontario, Canada, who were registered with the College of Nurses of Ontario and had agreed in their registration renewal for the year of 2010 to release their mailing address information for the purpose of research. Only nurses who had indicated that their place of employment was a primary care facility, including community health centers, physician’s offices, and family practices, were included. Sixty-five percent (6011/9201) of primary care nurses registered with the College of Nurses of Ontario agreed to release their contact information for the purpose of research. Twenty-nine addresses were incomplete and as result needed to be excluded. All 411 nurses living in southeastern Ontario were sampled, and a random sample of 1500 from the remaining 5571 nurses from all other regions in Ontario was generated. Overall, the questionnaire was delivered to a total of 1911 nurses. The sample size was based on feasibility and resource availability.

3.2.3 Data Collection

The questionnaire used in this study was developed by the authors based on a national questionnaire that was used to examine the roles of practice nurses in Australia (19,20). The questionnaire was mainly descriptive in nature and was composed of 3 sections. Section A of the questionnaire inquired about the participant’s demographic information, professional education, nursing experience, current employment in primary care, and practice characteristics. Section B
focused on the participant’s role as a primary care nurse (ie, RPN, RN, NP) in their current practice. Section C inquired about specific clinical activities that the participants routinely perform within their primary care practice. A copy of the questionnaire can be found in (Appendix C). This publication focuses on the responses provided for a subset of questions from each section of the questionnaire. Emphasis was placed on questions that addressed nursing roles and activities in primary care. Modifications were made to the questionnaire to make it more appropriate to nurses working in Ontario and to reflect the current organization of primary care in Ontario, Canada (eg, terms used to describe different regulatory designations of nurses were modified to fit within the Canadian context). Modifications were made based on information obtained from a comprehensive search of Canadian healthcare-related Web sites and the literature. Further minor modifications were made based on findings from a scoping review that was conducted to provide a comprehensive understanding of the current roles and activities of nurses in primary care worldwide and feedback from pre-testing of the questionnaire that was conducted with a group of nurses from a primary care practice located in southeastern Ontario. The scoping review and feedback from nurses who participated in the pre-testing of the questionnaire identified additional clinical activities to include within section C of the questionnaire.

The questionnaires were distributed between May and July 2011. Two weeks following the initial distribution of the questionnaire, a letter was sent to participants to remind them to complete the questionnaire. The participants had the option of completing the questionnaire by hand or online (StudentVoice) and had the option to be entered into a draw to win an iPod Touch.

3.2.4 Statistical Analyses

Data were analyzed using descriptive and comparative statistics. Differences between responses by nurses from each regulatory designation (ie, RPN, RN, NP) were explored. However, data regarding the activities currently being conducted in primary care practices to address the prevention and management of chronic diseases (objective 2) were not compared according to regulatory designations, because this information pertains to the practice in which nurses work in,
rather than their specific role as a nurse. Continuous data were analyzed using means, standard deviations (SDs), and 1-way analyses of variance followed by Tukey post hoc tests. Categorical data were analyzed using frequencies and \( \chi^2 \) analysis. The analysis for each question was calculated based on the number of participants that provided an answer for the question. Data analysis was conducted using SPSS version 20 (Armonk, NY). Statistical significance was inferred when \( P < 0.05 \).

### 3.3 Results

#### 3.3.1 Description of Participants

Three-hundred fifty-nine of 1911 questionnaires were completed and returned, providing an 18.8% response rate. Five questionnaires were excluded from the analysis, given that the respondents did not meet the study inclusion criteria of working in a primary care practice in Ontario, Canada. The remaining 354 questionnaires were included in the analysis. A description of the survey respondents is displayed in Table 3.1.

Overall, the majority of the respondents were RNs (62%). The mean age of all participants was 50.6 years. The mean number of years of overall nursing experience was 25.4 (SD, 11.8) years, and the mean number of years of nursing experience within primary care was 13.3 (SD, 11.2) years. The majority of respondents were female (98%) and worked in family health teams (35%) and community health centers (23%). NPs were significantly younger \( (P < 0.001) \) and had less experience working in primary care compared with RNs \( (P = 0.03) \).
Table 3.1: Description of Survey Participants

<table>
<thead>
<tr>
<th>Variable</th>
<th>Responses</th>
<th>n(%)&lt;sup&gt;a&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>Regulatory designation (n=349)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nurse practitioner (NP)</td>
<td>73(20.9)</td>
<td></td>
</tr>
<tr>
<td>Registered nurse (RN)</td>
<td>218(62.5)</td>
<td></td>
</tr>
<tr>
<td>Registered practical nurse (RPN)</td>
<td>58(16.6)</td>
<td></td>
</tr>
<tr>
<td>Age&lt;sup&gt;b&lt;/sup&gt; mean,(SD), (n=347)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>NP</td>
<td>46.8(9.9)</td>
<td></td>
</tr>
<tr>
<td>RN</td>
<td>52.3(11.1)</td>
<td></td>
</tr>
<tr>
<td>RPN</td>
<td>49.1(8.8)</td>
<td></td>
</tr>
<tr>
<td>Gender (n=348)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>341(98.0)</td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>7(2.0)</td>
<td></td>
</tr>
<tr>
<td>Employment status (n=349)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Full-time</td>
<td>210(60.1)</td>
<td></td>
</tr>
<tr>
<td>Part-time</td>
<td>104(29.8)</td>
<td></td>
</tr>
<tr>
<td>Casual</td>
<td>21(6.0)</td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td>14(4.0)</td>
<td></td>
</tr>
<tr>
<td>Education completed (n=343)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Masters</td>
<td>20(5.8)</td>
<td></td>
</tr>
<tr>
<td>Masters/NP</td>
<td>16(4.7)</td>
<td></td>
</tr>
<tr>
<td>NP Certificate</td>
<td>41(12.0)</td>
<td></td>
</tr>
<tr>
<td>Baccalaureate</td>
<td>59(17.2)</td>
<td></td>
</tr>
<tr>
<td>Diploma</td>
<td>207(60.3)</td>
<td></td>
</tr>
<tr>
<td>Practice structure (n=342)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Family health team</td>
<td>125(36.5)</td>
<td></td>
</tr>
<tr>
<td>Community health center</td>
<td>80(23.4)</td>
<td></td>
</tr>
<tr>
<td>General practitioner office</td>
<td>37(10.8)</td>
<td></td>
</tr>
<tr>
<td>Family health group</td>
<td>20(5.8)</td>
<td></td>
</tr>
<tr>
<td>FHN/FHO&lt;sup&gt;c&lt;/sup&gt;</td>
<td>8(2.3)</td>
<td></td>
</tr>
<tr>
<td>Nurse practitioner-led clinic</td>
<td>3(0.9)</td>
<td></td>
</tr>
<tr>
<td>Other&lt;sup&gt;d&lt;/sup&gt;</td>
<td>69(20.2)</td>
<td></td>
</tr>
<tr>
<td>Locality of practice (n=345)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Urban</td>
<td>219(63.5)</td>
<td></td>
</tr>
<tr>
<td>Rural/remote</td>
<td>126(36.5)</td>
<td></td>
</tr>
</tbody>
</table>

<sup>a</sup> Due to incomplete questionnaires, numbers do not reflect all respondents in sample (n=354)
<sup>b</sup> NPs were significantly younger than RNs (p<0.001)
<sup>c</sup> FHN/FHO = Family health network/Family health organization
<sup>d</sup> E.g. correctional institution, specialist office/services, community/homecare services
### 3.3.2 Nurses’ Perceptions on Current Roles within Primary Care

The majority of nurses in each regulatory designation reported that they had a clear job description that identified their role, practiced within their scope of practice, and were optimistic about their future nursing role development within primary care (Figure 3.1). Although there were no significant differences in the perspectives of nurses from each regulatory designation on their job descriptions, or perceptions on future nursing role development, a greater number of NPs reported that they felt like they practiced above their scope of practice compared with RNs and RPNs ($P < 0.001$).

### 3.3.3 Chronic Disease Management within Primary Care

With respect to chronic disease management strategies undertaken by primary care practices, 79% of respondents reported that they have routine screening programs in their practice, 64% of respondents reported that they have chronic disease management programs or clinics in place in their practice, and 59% reported that they have a method of flagging patients with chronic diseases in their practice. Of the respondents who reported to have these chronic disease management strategies in their practices, hypertension and diabetes were the most common conditions targeted (Figure 3.2). Furthermore, more than 85% ($n = 302$) of respondents reported that they have access to clinical practice guidelines, and 77% ($n = 245$) of respondents reported that they use clinical practice guidelines to support chronic disease management delivery in their primary care practice.
Figure 3.1: Nurses’ Perceptions on Current Roles and Level of Optimism Concerning Future
Nursing Role Development Within Primary Care

A

Do you have a job description that clearly identifies your role?

Respondents (%)

Yes
Unclear
No

B

Do you feel like you practice above, within or below your scope of practice?

Respondents (%)

Above
Within
Below

C

Level of optimism concerning future nursing role development in primary care

Respondents (%)

Extremely Optimistic
Somewhat Optimistic
Unclear of Future Role
Somewhat Pessimistic
Extremely Pessimistic
3.3.4 Nursing Roles within Primary Care

Table 3.2 depicts the chronic disease management activities that nurses were undertaking in primary care settings in Ontario. A large proportion of nurses in each regulatory designation (licensure category) reported to take vital signs, perform wound care, and provide immunizations and vaccinations. Approximately half of the RNs and RPNs reported to engage in chronic disease
management activities, such as providing education on healthy diets and chronic diseases. For most activities related to chronic disease management, a greater proportion of NPs reported engaging in the activity compared with RNs and RPNs. There was substantial overlap between the proportion of RNs and RPNs who reported to engage in each chronic disease management activity.

### Table 3.2: Chronic Disease Management Activities by Regulatory Designation

<table>
<thead>
<tr>
<th>Variable</th>
<th>NP (n=73)</th>
<th>RN (n=218)</th>
<th>LPN (n=58)</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prescribe medications independently$^a$</td>
<td>90.4</td>
<td>5.5</td>
<td>1.7</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Order laboratory and diagnostic tests$^a$</td>
<td>94.5</td>
<td>34.4</td>
<td>27.6</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Titrate medication</td>
<td>61.6</td>
<td>21.1</td>
<td>10.3</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Initiate referrals to healthcare providers</td>
<td>87.7</td>
<td>48.2</td>
<td>43.1</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Use respiratory peak flow meter</td>
<td>95.9</td>
<td>71.1</td>
<td>60.3</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Provide chronic disease education</td>
<td>82.2</td>
<td>55.0</td>
<td>44.8</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Obesity screening</td>
<td>78.1</td>
<td>34.4</td>
<td>24.1</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Chronic disease clinics</td>
<td>58.9</td>
<td>31.7</td>
<td>22.4</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Smoking cessation program</td>
<td>60.3</td>
<td>24.3</td>
<td>19.0</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Provide immunizations/vaccinations</td>
<td>89.0</td>
<td>71.1</td>
<td>77.6</td>
<td>0.01</td>
</tr>
<tr>
<td>Wound care</td>
<td>84.9</td>
<td>74.3</td>
<td>82.8</td>
<td>0.10</td>
</tr>
<tr>
<td>Take vital signs</td>
<td>93.2</td>
<td>87.6</td>
<td>91.4</td>
<td>0.36</td>
</tr>
<tr>
<td>Obtain smoking history</td>
<td>98.6</td>
<td>76.1</td>
<td>65.5</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Encourage exercise</td>
<td>94.5</td>
<td>74.8</td>
<td>55.2</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Education on healthy diets</td>
<td>87.7</td>
<td>62.4</td>
<td>50.0</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Lifestyle counselling</td>
<td>95.9</td>
<td>57.8</td>
<td>31.0</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Venipuncture</td>
<td>53.4</td>
<td>38.5</td>
<td>41.1</td>
<td>0.08</td>
</tr>
</tbody>
</table>

NP=Nurse practitioner, RN=Registered nurse, LPN=Licensed practical nurse

$^a$Activity unique to the role of a NP

### 3.4 Discussion

In 2010, approximately 9200 nurses worked in primary care practices within Ontario (21). Although nurses have consistently played an important role in the delivery of primary care worldwide, few studies have explored the specific roles and activities performed by nurses of different regulatory designations within this setting. This is particularly true for RNs and RPNs, as the majority of studies that have explored this topic have focused on the role of NPs in primary care (20,22-30). This is comparable in Canada, where most of the studies have focused on the roles of...
NPs (31-34). The present study addressed this gap in knowledge and explored the roles of nurses across all regulatory designations with respect to chronic disease management in primary care in Ontario, Canada.

The results from the present study suggest that there is an opportunity for the optimization of the nursing role in primary care practices in Ontario, as approximately 40% (129 of 344 respondents) of nurses working in primary care reported that they did not have a clear job description, approximately 24% (82 of 344 respondents) reported that they did not practice in their scope of practice, and approximately 20% (66 of 341 respondents) reported that they were uncertain or pessimistic about their future role in primary care. Previous studies have shown that when the roles of individuals in a healthcare team are not well defined, improper role implementation and ineffective integration of different types of healthcare professionals may compromise patient care (35-37). As the primary healthcare system evolves to meet the increasing needs that patients with chronic diseases are placing on the Canadian healthcare system, it becomes increasingly important to define the roles and functions of healthcare professionals to ensure that each category of care provider is being utilized to full potential. Therefore, the study results suggest that the roles of nurses need to be better defined in primary care to improve the quality of patient care.

Many individuals with chronic conditions who receive care in the primary care setting are not receiving care in accordance with clinical practice guidelines (38). Chronic disease management strategies are currently being implemented in the primary care setting to address this gap in patient care. However, strategy implementation has not been uniform throughout the Canadian healthcare system, and many individuals with chronic diseases continue to use emergency room services for conditions that could be treated by a family physician (38). The heterogeneity in chronic disease management strategy implementation was apparent in the present study. Although the majority of nurses reported to work in practices that have access to clinical practice guidelines and that have chronic disease management strategies in place, several chronic conditions, such as
asthma, heart failure, mental illness and arthritis, were poorly represented. Given the increasing prevalence and cost of chronic conditions, it is essential that primary care practices implement appropriate strategies to ensure that patients are receiving appropriate care.

In general, the survey identified that nurses engage in a wide variety of activities related to chronic disease management. However, the proportion of nurses performing each activity varied depending on regulatory designation. For most of the chronic disease management activities, a greater percentage of NPs reported to engage in these activities than RNs and RPNs. Similar to previous reports, NPs were found to perform several independent activities, such as ordering laboratory tests, prescribing medications, and making referrals (20,22,23,25,29,31). This finding is not surprising, given the expanded scope of practice and increased independence that are characteristic of the NP role (19). The relatively recent integration of NPs into healthcare teams in the primary care setting was evident in the present study, as NPs reported to have significantly less experience within primary care compared with RNs. Also, since the completion of this survey, legislation regarding NPs’ scope of practice in Ontario has expanded to support a more independent role in the primary care setting. Given this legislative change, contrary to our findings, NPs who completed the questionnaire may now be less likely to report practicing outside their scope of practice.

There is limited information about the roles and activities of RNs and RPNs in primary care practices in Canada. For example, findings from a cross-sectional survey suggest that RNs in primary care practices in Nova Scotia, Canada, engage in activities related to chronic disease management, such as wound care, immunizations, venipuncture, and the initiation of referrals to healthcare providers. However, this study was limited by a small sample size (n = 41) (32). In the present report, several important chronic disease management activities were found to be performed by approximately only 50% of RNs and RPNs. This suggests that the role of RNs and RPNs in chronic disease management in the primary care setting is not being optimized. Potential barriers to RN and RPN role optimization include lack of sufficient clinical space and appropriate equipment,
government reimbursement initiatives that make practitioners focus on specific aspects of care, and the predominant roles played by general practitioners in primary care.

The generalizability of the study findings is limited by a low response rate (18.8%) and the inability to sample all primary care nurses in Ontario. Although the low response rate could have been a consequence of a labor disruption in the postal service that occurred during the survey distribution process, it is similar to that found in other survey research (32,39). There was also inadequate information to compare survey respondents to non-responders, and therefore it is unknown whether this generated bias in our study results. Given that the study sample was composed of nurses registered with the College of Nurses of Ontario who agreed to release their address for the purpose of research, it is possible that these nurses may have been more motivated to discuss their current nursing role. While the focus of this study was on describing nursing activities and chronic disease management strategies, further evaluation with psychometrically sound tools would provide a more evaluative measure.

3.5 Conclusion

As team-based primary care structures are becoming more prominent, it is important to clearly understand the nursing contribution to chronic disease management in primary care. The present study identified a wide range of nurse characteristics and captured detailed information on the variation in clinical activities performed by nurses within all regulatory designations in primary care in Ontario. Importantly, this study identified that nursing role descriptions and scopes of practice require further clarification. It also highlighted the fact that screening, management, and flagging programs for patients with certain chronic conditions, such as asthma and depression, are not being uniformly implemented within Ontario, which may result in a gap in patient care. In the future, it will be important to consider a national perspective that would allow comparisons across provinces and to explore relationships between nursing roles and activities, primary care
organizational attributes, different chronic disease management strategies, and outcomes in patients who have chronic diseases.

3.6 Conflicts of Interests

The authors declare no conflicts of interest.

3.7 Acknowledgements

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3.8 Funding Support

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Chapter 4

Manuscript 2

Identification, summary and comparison of tools used to measure organizational attributes associated with chronic disease management within primary care settings

Abstract

Rationale, aims and objectives: Given the increasing emphasis being placed on managing patients with chronic diseases within primary care, there is a need to better understand which primary care organizational attributes affect the quality of care that patients with chronic diseases receive. This study aimed to identify, summarize and compare data collection tools that describe and measure organizational attributes used within the primary care setting worldwide.

Methods: Systematic search and review methodology consisting of a comprehensive and exhaustive search that is based on a broad question to identify the best available evidence was employed.

Results: A total of 30 organizational attribute data collection tools that have been used within the primary care setting were identified. The tools varied with respect to overall focus and level of organizational detail captured, theoretical foundations, administration and completion methods, types of questions asked, and the extent to which psychometric property testing had been performed. The tools utilized within the Quality and Costs of Primary Care in Europe study and the Canadian Primary Health Care Practice-Based Surveys were the most recently developed tools. Furthermore, of the 30 tools reviewed, the Canadian Primary Health Care Practice-Based Surveys collected the most information on organizational attributes.

Conclusions: There is a need to collect primary care organizational attribute information at a national level to better understand factors affecting the quality of chronic disease prevention and management across a given country. The data collection tools identified in this review can be used to establish data collection strategies to collect this important information.

Keywords: chronic diseases, data collection tools, disease management, organizational attributes, primary care, systematic search and review
4.1 Introduction

Chronic diseases are currently the highest cause of preventable death worldwide, accounting for approximately 36 million deaths annually (1). Within Canada, 3 out of 5 individuals currently have a chronic disease and the management of chronic diseases accounts for approximately 40–70% of total health care costs (2,3). As the population ages and the rates of obesity continue to rise, the prevalence and costs associated with chronic diseases will continue to increase. The appropriate management of patients with chronic diseases within the primary care setting can reduce the utilization of health care resources and improve patient outcomes (4). The delivery of high-quality care to patients with chronic diseases is therefore pivotal to the health and well-being of this patient population, and is an integral component of health care systems worldwide. Given that patients with chronic diseases are primarily managed within the primary care setting (5–8), there is a need to better understand which primary care organizational attributes affect the quality of care that patients with chronic diseases receive.

In general, organizational attributes can be defined as characteristics and structures that are intrinsic to the organization and delivery of care at a practice level. A wide range of innovative organizational attributes, including the addition of allied health care professionals to form multidisciplinary primary care teams, the utilization of electronic medical records (EMRs), changes in physician payment models and extended opening hours, have been implemented within primary care to address the increasing burden that patients with chronic diseases place on the health care system (3,9). Many of these organizational strategies have purportedly increased access to health care services, enhanced the efficiency of resource utilization and improved chronic disease management (3,9–15). In Canada and many other countries, the implementation of these organizational strategies has occurred at a jurisdictional level, resulting in substantial variability in the chronic disease management delivery models and strategies used in primary care practices across different jurisdictions. Importantly, this variability provides an opportunity to determine
which primary care organizational attributes support high-quality care for patients with chronic
diseases.

There is currently limited information regarding the distribution and nature of primary care
organizational attributes, which has made it difficult to study their effects on chronic disease
management. This gap in knowledge may be the result of the variability in tools used to assess a
wide range of organizational attributes, the collection of data at jurisdictional levels rather than
national levels, and inconsistent and incomplete descriptions of organizational attributes within
primary care. The present study aimed to identify, summarize and compare organizational attribute
tools associated with chronic disease management that have been used within the primary care
setting worldwide.

4.2 Methods

4.2.1 Literature search strategy

This study used systematic search and review methodology, as described by Grant and
Booth (16). Systematic search and review methodology consists of a comprehensive and exhaustive
search that is based on a broad question to identify the best available evidence. Unlike systematic
reviews, the topic area in a systematic search and review is not sharply focused, and considers a
wide range of study designs for inclusion, and does not require included articles to undergo critical
appraisal (16). This type of review was necessary to ensure that all existing primary care
organizational attribute data collection tools were captured, regardless of their quality or the quality
of the study in which they were used within. In addition, prior to study commencement, the
Cochrane Database of Systematic Reviews (17) and the Joanna Briggs Institute Library of
Systematic Reviews (18) were searched and no previous systematic reviews on this topic were
identified.

The search strategy aimed to find both published and unpublished studies. An initial search
of MEDLINE, Embase and CINAHL was undertaken to identify optimal search terms by
examining words contained in the title and abstract, and indexing words of relevant articles. Initial search terms were ‘data collection’, ‘chronic disease’, ‘disease management’, ‘delivery of health’, care’, ‘chronic disease management’ and ‘organizational attribute’. A second extensive search was conducted applying all of the identified search terms and syntax as required by each database. A complete outline of the search terms and syntax used within each database can be found in Supporting Information Table S1 (Appendix D). The databases searched included MEDLINE, CINAHL, Embase, HealthStar, Global Health, PsycINFO, Health and Psychosocial Instruments, and Google Scholar. In addition, reference lists of all relevant articles were searched, and full texts of studies deemed relevant were retrieved to determine eligibility to be included in the review. Key author and journal searches were also conducted, and relevant articles were retrieved and assessed for inclusion. Subsequently, grey literature databases, including Grey Matters, Mednar and ProQuest, and health care-related web sites on the worldwide web, including the Association of Ontario Health Centers, Ontario Ministry of Health and Long-Term Care, Canadian Foundation for Healthcare Improvement, Canadian Institute for Health Information, Canadian Nurses Association, the Commonwealth Fund, the Netherlands Institute for Health Services Research and the World Health Organization (WHO), were searched for relevant articles, documents or reports. Additional database searches were conducted once an exhaustive list of organizational attribute data collection tools was developed to ensure that all published articles that used the identified organizational attribute tools were captured. The search terms included in this phase of the study included a combination of the name of the tool, abbreviations used for the tool and alternate names that have been given to the tool (e.g. modified versions). Many organizational attribute tools were not readily available in the published studies and, as a result, the corresponding authors were contacted to request a copy of the tool. This also provided an opportunity to verify with the authors that all relevant articles that used the tool were captured in our search, and in some instances, the corresponding authors provided citations to additional articles that used the tool that had not been previously identified.
4.2.2 Study inclusion criteria

Articles were considered for inclusion if they were specific to the primary care setting and if they identified the name of an organizational attribute tool, even if it was not discussed in detail, if they discussed any aspect of the development of an organizational attribute tool or if they discussed any psychometric properties associated with an organizational attribute tool. Only tools that were intended to be completed by clinic administrative personnel or health care providers were included.

This systematic search and review considered studies that identified tools that collected information on organizational attributes, including those identified within the chronic care model (CCM) (7) and the conceptual framework for primary care organizations (19). Within the CCM, certain primary care practice organizational attributes are required to ensure appropriate prevention and management of chronic diseases within the primary care setting. These key primary care organizational attributes include self-management support, delivery system design, decision support and clinical information systems (7). With respect to the conceptual framework for primary care organizations, only studies that identified tools that specifically focused on the ‘organization of the practice’ components from the structural domain were included as they are intrinsic to the primary care practice setting and are important in the delivery of high-quality care for patients with chronic diseases (19).

The primary outcome was to identify and provide an overall description and comparison of primary care organizational attribute tools. Therefore, this systematic search and review considered studies that included any of the following information related to organizational attribute tools: author(s) and/or developer(s), including contact information for corresponding author to acquire a copy of the tool; location of publication; name of the instrument; country of origin; theoretical foundation; setting in which the tool was used; length (e.g. number of items, time it takes to complete the tool); language translations; administration and completion methods; scoring
instructions; psychometric properties; clinical applicability (e.g. ease of completion, feasibility of administration, ability to be replicated); description of specific organizational attributes the tool captured; and identification of multidisciplinary elements within the tool.

In accordance with systematic search and review methodology (16), this review considered a range of quantitative study designs including quasi-experimental designs, cohort studies, case control studies, cross-sectional studies, case series, case reports, expert opinions and reports. Qualitative studies were excluded. Only articles written in the English language were included due to lack of resources available to translate information; however, articles were not limited by location of publication. Only articles published prior to April 2013 were included. Unpublished articles were considered for inclusion if a copy of the manuscript was accessible from the authors.

Titles and abstracts were reviewed for relevancy by two independent reviewers, and articles that were deemed relevant were retrieved and assessed for inclusion using pre-established selection criteria. Disagreements that arose between the reviewers were resolved through discussion. The methodological quality of each study was not a focus for the inclusion of the article (16), as the overall aim of this study was to identify and provide an overall description and comparison of primary care organizational attribute tools.

4.2.3 Data extraction and synthesis

Data extracted included specific details about the organizational attribute tools. Given the heterogeneity of the studies included with regard to the use of different methodologies, study populations, interventions and outcomes, findings are reported as a narrative summary and include tables and figures to aid in data presentation where appropriate (16).

The organizational attributes measured within each tool were categorized based on a classification system established in a recent scoping review that was conducted on a similar topic (20). Levesque et al. (20) used a comprehensive process to establish and define organizational concepts used to classify specific attributes captured within tools measuring the attributes and
performance of primary health care systems. Specifically, Levesque et al. (20) identified seven organizational concepts including identification of the organization, practice context, organizational vision, organizational resources, organizational structures, service provision and clinical practice, and outputs and outcomes. Within each of these concepts, specific organizational attributes have been defined (20).

4.3 Results

4.3.1 Overview

Overall, 152 articles and reports, including three review articles (20–22), met the inclusion criteria for this systematic search and review. Thirty-four articles that were deemed relevant to be included in this systematic search and review had to be excluded because a copy of the organizational attribute data collection tool could not be located in the peer-reviewed literature, and attempts to contact the corresponding author(s) were unsuccessful. A flow diagram providing a detailed breakdown of the search results is located in Figure 4.1.

A total of 30 organizational attribute data collection tools that have been used within the primary care setting worldwide were identified (Table 4.1). A breakdown of the specific organizational attributes captured within each data collection tool is presented in Table 4.2. Overall, the most common attributes captured by the data collection tools were technical organizational resources (93%), clinical processes (90%) and quality improvement and patient safety mechanisms (90%) (Table 4.2). The percentage of attributes captured by each data collection tool is displayed in Figure 4.2. The remainder of the results section will serve to emphasize details of the most relevant data collection tools identified from each region. The reader is encouraged to look through Supporting Information Table S2 (Appendix E) for a detailed description of each of the tools.
4.3.2 International

Three international primary care organizational attribute tools, including the International Survey of Primary Care Doctors (23–29), the Quality and Costs of Primary Care in Europe (QUALICOPC) study (30,31) and the WHO Primary Care Evaluation Tool (PCET) (32–41) were identified (Table 4.1). The International Survey of Primary Care Doctors was developed by the Commonwealth Fund in the United States and was first used in 2006 to describe primary care
organizational attributes that affect the practice’s capacity to manage patient care and support quality improvement initiatives. It has also been used to address physicians’ views and experiences towards patient access, health information technology capacity, communication across health care sites, feedback related to practice performance, their satisfaction practicing medicine and the overall health care system.

The International Survey of Primary Care Doctors was updated in 2009 and 2012, and the most recent version of this survey was administered to primary care physicians in Australia, Canada, France, Germany, the Netherlands, New Zealand, Norway, Switzerland, Sweden, United Kingdom and the United States to collect information on primary care organizational attributes within these countries (25). The International Survey of Primary Care Doctors provided respondents with several completion options, including mail, online and telephone or in-person interviews with general practitioners (GPs).

The QUALICOPC study was performed by the Netherlands Institute for Health Services Research to describe, compare and analyse how primary health care systems perform in terms of quality, costs and equity across 35 countries, including Australia, Canada, Iceland, Macedonia, New Zealand, Norway, Switzerland, Turkey and 27 countries of the European Union. Four questionnaires were developed as part of the QUALICOPC tool, namely, a practice questionnaire, a GP questionnaire, a patient experiences questionnaire and a patient values questionnaire. The questionnaires were developed through an iterative and comprehensive process involving a literature search, consensus process and pilot survey, and are based on existing validated questionnaires including Starfield’s Primary Care Assessment Tool and surveys developed by the Commonwealth Fund. The QUALICOPC questionnaires were paper based and were developed and administered between 2010 and 2013 (30,31). No studies reporting the findings from these questionnaires were identified in the present systematic search and review.

The development of the WHO PCET was based on the Primary Care Evaluation Framework and a comprehensive literature review. The WHO PCET has been administered in
several countries worldwide including Belarus, Kazakhstan, Moldova, Romania, Russia, Serbia, Slovakia, Turkey and Ukraine. It consists of three instruments to evaluate the complexity of the primary care system: a questionnaire to be administered at a national level concerning the situation of primary care policies, a questionnaire for family doctors and a questionnaire for patients. The questionnaire for family doctors is the component of the WHO PCET that inquires about organizational attributes that are intrinsic to the practice setting. In 2007 and 2008, the WHO PCET was pilot tested in Turkey and Moscow Oblast. Based on results from the pilot test, modifications to the questionnaire for family doctors were made to make it more factual and clear, its length was reduced by removing questions that were considered to be outside of the scope of family doctors and the terminology utilized throughout the questionnaire was changed to make it more consistent. The content within the questionnaires has been validated by international experts in primary care.

Common gaps in organizational attribute data collected across all three of the international tools related to practice location, history and evolution of the clinic, organizational vision, and economic resources (Table 4.2).

4.3.3 Canada

Within Canada, eight primary care organizational attribute data collection tools were identified (Table 4.1). Seven of these tools collected primary care organizational attribute information at a jurisdictional level within the provinces of Alberta (42,43), Ontario (11–13,44–47), Québec (48–54) and Nova Scotia (55).

The Primary Health Care Practice-Based Surveys were the only Canadian tool that was intended to measure primary care characteristics nationally to enable a comprehensive assessment of outcomes, and support the identification of contributing factors. The Primary Health Care Practice-Based Surveys were developed in 2013 based on the framework for primary care organizations, the results-based logic model for primary health care, a scoping review, existing survey tools and feedback from relevant stakeholder groups across Canada (20,56,57). This tool is
available in English and French, and is composed of an organizational-level survey, a provider-level survey and a patient-level survey that can be used separately or together. The organizational-level survey contains questions that provide information on basic practice characteristics, organizational vision, organizational resources, economic resources, technical resources, organizational structures, service provision and clinical practices, and organizational context. It is intended to be completed by an individual who is most familiar with how the primary care practice is organized and operates. The provider-level survey contains questions that provide information on provider demographics, structure and organization of the practice, team functioning, and health care service delivery, and is intended to be completed by all health care providers at the clinic who care for patients. No studies that used the Primary Health Care Practice-Based Surveys were identified in the present systematic search and review, and the psychometric properties of these surveys have yet to be assessed in detail. The Primary Health Care Practice-Based Surveys was the only tool identified in this systematic search and review that collected information on nearly all of the organizational concepts identified in Levesque et al.’s (20) classification system (Figure 4.2; Table 4.2). ‘Demographic characteristics’ of the population or patients served by the practice was the only organizational attribute not captured by this tool (Table 4.2).

4.3.4 United States

Thirteen primary care organizational attribute data collection tools that originated from the United States were identified (Table 4.1). The organizational attribute data collection tool that was cited the most in publications (n = 30) of this systematic search and review was the Assessment of Chronic Illness Care (ACIC) survey developed by the MacColl Institute for Healthcare Innovation, Group Health Cooperative (58–73,79,121–132). The ACIC tool was developed in 2000 to help primary care organizations evaluate strengths and weaknesses of their delivery of care for individuals with chronic diseases. The ACIC tool, which is based on the CCM, includes questions that address six elements of the CCM that purportedly relate to the quality of chronic disease prevention and management care, namely, community linkages, self-management support, decision
support, delivery system design, clinical information systems and organization of care. The ACIC has very clear completion and scoring instructions and consists of Likert-type scales that range from 0, meaning that the practice has limited support for chronic disease management, to 11, meaning that the practice has fully developed chronic disease management care practices. Previous studies have suggested that the ACIC tool is responsive to changes that result from health care quality improvement efforts and may be a useful tool to guide and monitor quality improvement efforts over time. Specifically, the ACIC tool has been associated with clinical outcomes related to diabetes and cardiovascular care (59,60,62,67,69,70,73,121,122,125,127,132). For example, patients who attended primary care clinics who had higher ACIC scores had better managed diabetes as indicated by their haemoglobin A1C values than patients who attended primary care clinics with lower ACIC scores (121,122). However, the ACIC survey only provides a generic assessment of the quality of chronic disease care. The ACIC captured less than 50% of organizational concepts identified by Levesque et al. (20) (Table 4.2; Figure. 4.2).

In addition to the ACIC survey, five American organizational attribute data collection tools were also developed based on the CCM, including the surveys used in the Translating Research into Action for Diabetes (TRIAD) study (82–86), the National Survey of Physician Organizations and the Management of Chronic Illness (87–95), the Prescription for Independent Evaluation Surveys (96,97), Chronic Disease Prevention and Control Healthcare Practice Survey (98), and the Improving Chronic Illness Care Evaluation Survey (66). There were two American data collection tools found that were developed to measure disease-specific primary care organizational attributes, namely, the surveys utilized within the TRIAD study (82–86) and the Primary Care Depression Management Organizational Survey (99).

4.3.5 Europe

Five primary care organizational attribute data collection tools from Europe met the selection criteria for inclusion in this study (Table 4.1). Three of these tools assessed organizational attributes that specifically related to diabetes care, namely, the questionnaires used within the
Improving Quality of Care in Diabetes Study (108,140,141), the National Survey of the Provision of Diabetes Services (109,110) and the Survey of the Provision of Diabetes Services in Galway City and County (75,76). The most commonly collected organizational attributes within the European tools were related to funding mechanisms, governance and administration, clinical processes, quality improvement, and patient safety mechanisms (Table 4.2). The WHO Primary Care Quality Management Tool (74,111) and the Survey of the Provision of Diabetes Services in Galway City and County (75,76) captured less than 40% of important organizational concepts (20) (Fig. 2).

4.3.6 Australia

Within Australia, the General Practice Chronic Care Team Profile (80,81,112,113) was the only organizational attribute data collection tool that was identified (Table 4.1). This structured interview schedule is designed to measure multidisciplinary teamwork structures and functions for chronic disease care in general practice, and takes approximately 15 minutes to complete. The tool is intended to be administered to a principal GP within a primary care setting or a practice manager. It is composed of questions that relate to team functions, non-GP clinical functions and staff management, administrative functions, and practice management structures. It reflects 32% of the organizational attributes identified in the classification system developed by Levesque et al. (20) (Fig. 2). The tool was developed by consulting best-practice guidelines for chronic disease care and performance standards for general practice in Australia and internationally, expert consultations to determine which items were relevant and suitable to be included in the interview schedule, and a pilot test within 11 general practices. Psychometric testing of the General Practice Chronic Care Team Profile identified that it has a Cronbach’s alpha of 0.85.
Table 4.1: List of Organizational Attribute Data Collection Tools

<table>
<thead>
<tr>
<th>Region</th>
<th>Study or Data Collection Tool</th>
<th>Developer and/or Organizational Affiliation/Sponsor</th>
<th>References</th>
</tr>
</thead>
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<td>International</td>
<td>Quality and Costs of Primary Care in Europe (QUALICOPC)</td>
<td>Coordinated by the Netherlands Institute for Health Services Research (NIVEL)</td>
<td>[30,31]</td>
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<td></td>
<td>International Survey of Primary Care Doctors</td>
<td>The Commonwealth Fund, Harris Interactive</td>
<td>[23–29]</td>
</tr>
<tr>
<td></td>
<td>World Health Organization (WHO) Primary Care Evaluation Tool (PCET)</td>
<td>Regional Office for Europe of the World Health Organization; the Netherlands Institute for Health Services Research (NIVEL)</td>
<td>[32–41]</td>
</tr>
<tr>
<td>Canada</td>
<td>Primary Health Care Practice-Based Surveys</td>
<td>Canadian Institutes of Health Information (CIHI)</td>
<td>[20,56,57]</td>
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<tr>
<td></td>
<td>Primary Care Network Survey</td>
<td>University of Calgary, Alberta</td>
<td>[42]</td>
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<tr>
<td></td>
<td>Organizational Questionnaire</td>
<td>Institute national de santé publique du Québec</td>
<td>[48–53]</td>
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<tr>
<td></td>
<td>Primary Care Organization Surveys</td>
<td>Nova Scotia Department of Health</td>
<td>[55]</td>
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<tr>
<td></td>
<td>Comparison of Models of Primary Health Care in Ontario (COMP-PC)</td>
<td>University of Ottawa; Elisabeth Bruyère Research Institute</td>
<td>[11–13,44–46]</td>
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<td></td>
<td>The Management of Patients with Chronic Illness</td>
<td>University of Alberta</td>
<td>[43]</td>
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<tr>
<td></td>
<td>Accessibility and Continuity of Primary Care in Québec</td>
<td>Principle investigator: Jeannie Haggerty, Centre du recherche du Centre hospitalier de l'université de Montréal</td>
<td>[54]</td>
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<td></td>
<td>Survey of Primary Care Practices in Ontario</td>
<td>Collaborative project of the University of Toronto, University of Western Ontario, and McMaster University</td>
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<td>United States of America</td>
<td>Translating Research into Action for Diabetes (TRIAD)</td>
<td>Study Coordinating Center: University of Medicine and Dentistry of New Jersey</td>
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<td></td>
<td>Primary Care Depression Management Organizational Survey</td>
<td>Corresponding author: Dr. Edward P Post, University of Michigan &amp; Ann Arbor Veterans Affairs Medical Centre</td>
<td>[99]</td>
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<tr>
<td></td>
<td>Prescription for Health Independent Evaluation</td>
<td>Robert Wood Johnson Medical School, University of Medicine &amp; Dentistry of New Jersey</td>
<td>[96,97]</td>
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<tr>
<td></td>
<td>Physician Practice and Quality of Care Survey</td>
<td>Corresponding author: Dr. Mark Friedberg, RAND Corporation</td>
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<tr>
<td></td>
<td>Chronic Disease Prevention and Control Healthcare Practice Surveys</td>
<td>Washington State Department of Health</td>
<td>[98]</td>
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<td>National Survey of Physician Organizations and the Management of Chronic Illness</td>
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<td>Primary Care Access Study</td>
<td>Center for Clinical Epidemiology and Biostatistics, University of Pennsylvania, School of Medicine</td>
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<td></td>
<td>Primary Care Assessment Tool (PCAT)</td>
<td>Developed by Dr. Barbara Starfield</td>
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<td>Europe</td>
<td>Improving Quality of Care in Diabetes (iQuaD)</td>
<td>Institute of Health &amp; Society, Newcastle University; Newcastle Primary care Trust</td>
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Table 4.2: Organizational Attributes Covered in Data Collection Tools

<table>
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<th>Percentage of Tools Measuring Attribute (%)</th>
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<th>Location</th>
<th>History &amp; Evolution of the Clinic</th>
<th>Demographic Characteristics</th>
<th>Environment &amp; Practice Integration</th>
<th>Organizational Vision</th>
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<th>Organizational Structures</th>
<th>Service Provision &amp; Clinical Practice</th>
<th>Outputs</th>
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<td>Primary Care Access Study</td>
<td>Primary Care Assessment Tool (PCAT)</td>
<td>Improving Quality of Care in Diabetes (iQuaD)</td>
<td>National Survey of the Provision of Diabetes Services</td>
<td>O Primary Care Quality Management (PCQM) Tool</td>
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Figure 4.2: Percentage Of Organizational Attributes Captured Within Each Data Collection Tool

Note: Each percentage was calculated based on the 19 organizational concepts identified in Table 2. The Canadian Primary Health Care Practice-Based Surveys covered the most organizational attributes.
4.4 Discussion

Patients with chronic diseases are most effectively managed within the primary care setting (5–8). To determine how to optimize the care for patients that have chronic diseases, it is important to investigate the heterogeneity in organizational attributes within primary care and assess the impact of these attributes on health outcomes within this patient population. This study identified a wide range of comprehensive primary care organizational attribute data collection tools that could feasibly be utilized by clinicians or scientists in this type of evaluation and research. Specifically, 30 organizational attribute data collection tools were identified in this systematic search and review. The review found that the tools varied with respect to overall focus and level of organizational details captured, theoretical foundations, administration and completion methods, length and types of questions asked, and the extent to which psychometric property testing has been completed. Each tool that was identified captures important information about primary care organizational attributes that could be used to better understand the delivery of chronic disease prevention and management within the primary care setting. Given the breadth of organizational attributes that were captured in the data collection tools, the variation between tools and the fact that many of the tools were developed for use within a specific jurisdiction, no one tool was found to be superior for all potential research and clinical applications. Many of the organizational attribute data collection tools identified have the potential to be used or adapted for use for different research purposes. The decision on which tool is most suitable will likely depend on the location in which the clinicians or researchers intend to conduct the research and the attributes in which they are interested in investigating.

It is important to note that several weaknesses with the tools were apparent. For example, not all of the data collection tools were based on existing theoretical frameworks, which may limit their applicability to the primary care setting or chronic disease management. Utilizing a framework to guide the development of a tool is important to help identify variables and understand the relationships between these variables (114). Furthermore, the most common
method of completion was the use of a paper-based postal questionnaire that relied on self-report
from respondents and is often associated with low response rates (114). In addition, many of the
data collection tools that were identified were developed over a decade ago and may not
accurately reflect current practices and organization within the primary care setting. Recently
developed tools, such as the tool utilized within the QUALICOPC study that was implemented
between 2010 and 2013 (30,31), and the Canadian Primary Healthcare Practice-Based Surveys
that were recently developed and made available for use by researchers, clinicians and decision
makers in April 2013 (56,57), are preferable for future studies assessing primary care
organizational attributes.

Interestingly, most of the data collection tools that were identified were not disease
specific. Only four tools were identified that were specifically developed to measure
organizational attributes that related to diabetes care (75,76,82–86,108–110,140,141), and one
tool was identified that specifically related to the management of patients with depression (99).
Instead, many of the data collection tools were designed to collect organizational attribute
information that could be utilized to better understand the management of several chronic
diseases and incorporated disease-specific questions, such as questions specifically related to
diabetes, hypertension, asthma and/or cardiovascular disease. It is important to collect
organizational attribute information that is related to multiple chronic diseases given that patients
are often affected by more than one chronic condition (115).

Organizational attribute details captured by each tool varied substantially. The most
commonly assessed attributes across all of the data collection tools were organizational
environment and practice integration, human and technical resources, governance and
administration, clinical processes, quality improvement and patient safety mechanisms, specific
disease management practices, and degree of integration. The data collection tool that contained
the most comprehensive description of primary care organizational attributes, as identified by the classification system developed by Levesque and colleagues (20), was the Canadian Primary Health Care Practice-Based Surveys (56,57). This tool does not collect demographic characteristics of the population and patients served by a practice. However, it can be used in combination with its patient-level survey or linked to data from existing data sets that contain patient demographic details. Furthermore, unlike many of the tools that were identified in this study that were intended to measure attributes at a jurisdictional level, the Canadian Primary Health Care Practice-Based Surveys provide an opportunity to identify organizational attributes at a national level, and to make comparisons across different jurisdictions in Canada (56,57).

This review found only one organizational attribute data collection tool developed within Australia (80,81,112,113). It is possible that fewer organizational attribute data collection tools have been developed in certain countries over the past decade because there are well-established data collection programs already in place. For example, the Bettering the Evaluation and Care of Health (BEACH) program has been used in Australia since 1998 to measure primary care organizational attributes, among other variables (116). Researchers worldwide have been working towards establishing nationwide databases to monitor and evaluate the management of patients within a given population. Establishing a method to obtain national-level data within the primary care setting has become increasingly of interest to health care providers and researchers seeking to improve the quality of care delivered. There are several research networks that have been successful at conducting health surveillance research projects, such as the Clinical Practice Research Datalink in the United Kingdom (117), the European Practice Assessment (118), the Netherlands Information Network of General Practice (119) and the BEACH project in Australia (116).

The Canadian Primary Care Sentinel Surveillance Network (CPCSSN) is Canada’s first and only chronic disease EMR surveillance system. It is an initiative established in 2008 that is funded by the Public Health Agency of Canada through a contribution agreement with the
College of Family Physicians of Canada. One of the main purposes of CPCSSN is to enhance the effectiveness and efficiency of primary health care delivery, and to improve patient and system outcomes across the country by creating a platform for research, surveillance and education. It is currently composed of 10 practice-based research networks across eight provinces in Canada. CPCSSN collects information on all clinical encounters for all patients visiting practices of sentinel physicians but is specifically focused on the following eight chronic conditions: chronic obstructive pulmonary disease, depression, epilepsy, Parkinsonism, dementia, osteoarthritis, hypertension and diabetes (142,143). The CPCSSN currently has a short questionnaire that is administered to primary care practices affiliated with their network to acquire general demographic information. To best inform quality improvement strategies, a more comprehensive organizational attribute data collection tool would allow us to determine the distribution and nature of primary care organizational attributes across Canada and those organizational attributes associated with optimal health outcomes of patients with chronic diseases.

4.4.1 Strengths and limitations

Despite utilizing a comprehensive search strategy (16), it is possible that there are primary care organizational attribute data collection tools that were not captured in this systematic search and review. Furthermore, reporting on the various elements of each tool was restricted to the extent to which information was available within the articles. Lack of data pertaining to the psychometric properties of the tools limited our ability to assess the quality of many of the organizational attribute data collection tools identified. In addition, two concepts from the classification system established by Levesque et al. (20) were excluded in this study as none or few studies included questions pertaining to them (i.e. sustainability and efficacy, readiness to change and capacity for adaptation) (20).

Despite the limitations associated with this study, the findings provide a thorough description of organizational attribute data collection tools that have been developed and/or used within the primary care setting worldwide. Systematic search and review methodology (16) was
utilized to ensure that a complete list of organizational attribute data collection tools was found, and many of the tools that were identified were recent and widely used within the primary care setting. Furthermore, this study categorized the concept of ‘organizational human resources’ to identify the extent in which the tools captured information related to GPs, nurses and other health care or administrative staff within the practice. This review also highlights that there are different approaches to measuring organizational attributes within primary care. Researchers, primary care health care providers and stakeholder groups can use the findings from this study to obtain important information about primary care organizational structures and characteristics with the aim of improving the overall delivery of health care services for patients who have chronic diseases.

4.5 Conclusion

Thirty primary care organizational attribute data collections tools were identified in this systematic search and review that have been used in several countries worldwide. No single tool is recommended for use by clinicians or scientists as the decision on which tool to use or adapt will depend on the country of origin and the organizational attributes that are of most interest to capture in each study. The tool that was most recently developed and that captured the most organizational attributes was the Canadian Primary Health Care Practice-Based Surveys. Many of the tools that were identified have been used at a jurisdictional level. There is a need to collect organizational attribute information at a national level to better understand the management of chronic diseases across countries. Although there are existing databases in certain countries that collect information related to primary care organizational attributes, there is no existing platform in Canada. The data collection tools identified in this review can be used to assist countries in establishing a national-level data collection strategy to collect this important information that can be used to better understand the quality of chronic disease prevention and management.
4.6 Conflict of Interests

The authors declare no conflict of interest.

4.7 Acknowledgements

We would like to thank Dr. Christina Godfrey, RN, PhD, and Sarah Wickett, BSc, MLIS, from Queen’s University who provided invaluable support and guidance with this study.
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Chapter 5

Manuscript 3

Nursing contributions to chronic disease management in relation to organizational attributes within primary care practices in eastern Ontario: An application of the Measuring Organizational Attributes of Primary Health Care Survey
Abstract

Background: Various organizational-level attributes are being implemented in primary care practices in Ontario to improve healthcare delivery. However, there is currently no method of acquiring data to evaluate the distribution and nature of these organizational attributes. One key organizational attribute is the utilization of primary care interprofessional teams. Given that nurses comprise the largest proportion of healthcare professionals within primary care teams, it is important to determine the unique contributions of nurses to the primary care of individuals with chronic diseases.

Methods: We employed a cross-sectional survey design to determine the distribution and nature of organizational attributes of team-based primary care practice locations within eastern Ontario affiliated with the Canadian Primary Care Sentinel Surveillance Network. Team composition, nursing roles and functions, availability of primary care services and procedures, and chronic disease management activities were described using the ‘Measuring Organizational Attributes of Primary Health Care Survey’.

Results: 93% (n=26) of practice locations provided responses. The majority of primary care practice locations were Family Health Teams (n=21; 80.8%). The remaining practices locations were affiliated with Community Health Centers (n=4) and a Nurse Practitioner-Led Clinic (n=1). All of the Community Health Center practice locations and the majority of the Family Health Team practice locations (n=14; 66.7%) had been in operation for more than 10 years, whereas the Nurse Practitioner-Led Clinic had been in operation for 1-4 years. Aside from physicians, Nurse Practitioners and Registered Nurses were the two most common healthcare providers across all settings; only two practice locations did not have Nurse Practitioners or Registered Nurses.

Interpretation: This study highlights that there is variability in organizational attributes across primary care practice locations, as measured by the ‘Measuring Organizational Attributes of Primary Health Care Survey’. The findings also emphasize that nurses are a prominent team member within primary care practices, and engage in a wide range of chronic disease
management activities, suggesting a need to better understand their contributions to patient care so that their roles can be optimized.
5.1 Introduction

Primary healthcare is a fundamental component of the Canadian healthcare system (1,2). Many new organizational strategies have been implemented within the primary healthcare system to improve health outcomes, increase accessibility, and increase cost-efficiency (3,4). Within Ontario, organizational strategies have included the introduction of new physician payment models, electronic medical records, after-hours care, and addition of non-physician health providers, such as nurses, to form team-based practice models. Many of these organizational strategies have purportedly increased access to healthcare services, enhanced the efficiency of resource utilization, and improved chronic disease management (5–10). However, Canada’s primary healthcare system continues to rank lower than many other high-income countries on measures such as timely access to care, patient engagement, and interprofessional teamwork, suggesting a need to better understand which organizational strategies support or hinder the delivery of high-quality care (3).

Accordingly, comprehensive monitoring and evaluation of evolving components of the primary healthcare system is a priority of many stakeholders involved in primary healthcare system reform (3,11,12). One such component is the need to determine nurses’ unique contributions within team-based practices in the primary care setting (13–16). Within Ontario, this evaluation needs to include all three regulatory designations of nurses, including Registered Practical Nurses (RPNs), Registered Nurses (RNs), and Nurse Practitioners (NPs). In general, RPNs are regulated healthcare professionals who have obtained a college degree and care for patients with stable and predictable conditions. In provinces other than Ontario, the protected title for RPNs is ‘Licensed Practical Nurse (LPN)’ (17). RNs are regulated healthcare professionals who have obtained either a college diploma or university degree, care for patients with complex needs, and play a key role in health promotion, and chronic disease prevention and management (18). NPs are RNs who have acquired advanced knowledge and education, and can autonomously diagnose patients, order and interpret diagnostic tests, prescribe medications, and perform a wider
variety of clinical tasks than RNs and RPNs (19,20).

Although there are several evaluation methods that can be used within the primary care setting, many of these methods focus on patient and physician perspectives and collect little data about nursing. In 2013, the Canadian Institute for Health Information released a set of surveys, including an organizational, a provider, and a patient-level survey, to help with national efforts to acquire high-quality data for primary care performance measurement and evaluation (21). This is the only known data collection tool developed that has the potential to be used nationally within Canada to collect important information about a wide range of primary care characteristics and organizational attributes. Importantly, the “Measuring Organizational Attributes of Primary Health Care Survey” developed by the Canadian Institute for Health Information has items that capture data about non-physician providers (21). The purpose of this study was to implement the “Measuring Organizational Attributes of Primary Health Care Survey” within team-based primary care practices in eastern Ontario to determine the depth and range of organizational attributes across primary care practices, with a particular focus on the nursing contribution to patient care.

5.2 Methods

5.2.1 Study purpose and design

A cross-sectional survey design was used to describe the distribution and nature of organizational attributes of primary care practice locations within eastern Ontario. The organizational attributes assessed included team composition, nursing roles and functions, availability of different primary care services/procedures, and chronic disease management activities. Ethics approval for this study was obtained from the Queen’s University Health Sciences Research Ethics Board.

5.2.2 Setting and participants
This study used an inclusive sampling technique of all practice locations affiliated with primary care sites that participate in the Eastern Ontario Network of the Canadian Primary Care Sentinel Surveillance Network (CPCSSN) (22). The CPCSSN is Canada's first chronic disease surveillance system that serves as a platform for research to improve patient, organizational, and system outcomes by providing access to primary care electronic medical record data collected from patients affected by prevalent chronic diseases, such as diabetes and hypertension (23). For the purposes of this study, ‘practice locations’ were defined as locations in which providers deliver primary care services to individuals and ‘sites’ were defined as primary care organizations that contain one or more practice locations. At the time of study completion there were 13 primary care sites affiliated with the Eastern Ontario Network of the CPCSSN and each practice location (n=34) associated with these sites that had a participating CPCSSN physician was invited to participate in the study. Of the sites that were included within this study, 9 were Family Health Teams (FHTs), 3 were Community Health Centers (CHCs), and 1 was a Nurse Practitioner-Led Clinic (NPLC). In general, FHTs, CHCs and NPLCs deliver primary care using an interdisciplinary team structure. CHCs specifically serve vulnerable individuals within a community who have challenges accessing healthcare services, and focus on the broader social determinants of health (24–27).

5.2.3 Data collection tool

A modified version of the “Measuring Organizational Attributes of Primary Health Care Survey” developed by the Canadian Institute for Health Information was utilized (21) (Appendix F). The decision on which tool to use was informed by a systematic search and review that was conducted by the study authors (28). The selected questionnaire was designed to describe the composition of the primary care practice, healthcare services offered within the practice, and the way in which healthcare services are organized.

With permission from the developers of the questionnaire, minor modifications were made to better align the questionnaire with the chronic conditions addressed by the CPCSSN and
to add clarity to questions regarding nurses and their roles within primary care. For example, there was a question that asked respondents if their clinic offers systematic patient management and follow-up services for patients with different chronic diseases. To better align the questionnaire with the CPCCSN, the following conditions were added to the list of chronic diseases already present within that particular question: hypertension, depression, Parkinson’s disease, epilepsy, Alzheimer’s disease and chronic pain. With respect to questions regarding nurses in primary care, there was an item in the questionnaire that asked respondents to “Please complete the number of staff in your clinic and their Full-time Equivalents (FTEs)”. The position of “registered/licensed practical nurse” was added to the list of professions. Furthermore, there was an item that asked respondents “What are the roles and functions of nurses in your medical team?”. This item was re-organized so that the respondent had to distinguish between each regulatory designation of nurses, including NPs, RNs and RPNs, within each of the associated questions. Furthermore, a response option of ‘Unsure/Don’t know’ and/or ‘Not Applicable’ was added to each item within the questionnaire.

5.2.4 Questionnaire administration

Data collection took place between June and November 2014. Prior to survey distribution, a lead (e.g. Administrative Lead, Executive Director) at each site was contacted and invited to participate in the survey. For sites that agreed to participate in the survey, contact information for an individual at each practice location was obtained from existing records at the Eastern Ontario Network of CPCSSN. If individual contacts for each practice location affiliated with a site were unavailable, the lead at that site provided this information. Participants were sent an initial invitation to complete the questionnaire by e-mail through FluidSurveys™. To encourage survey completion, participants were sent 3 e-mail reminders at 2-week intervals and this was followed by phone call reminders at 1-2 week intervals. During the phone call reminders, the study coordinator explored the individual’s interest in completing the questionnaire and offered other completion strategies to the participants (e.g. offered to send a paper-copy of the
questionnaire, discussed whether there was a more appropriate person within the practice to complete the questionnaire). The phone call reminder was also used to confirm that the e-mail address details were accurate.

5.2.5 Statistical analyses

Data is presented at the practice location-level and is organized by model of care (i.e. FHT, CHC, NPLC). Data related to specific roles and functions that nurses undertook within primary care practices are further organized by regulatory designation (i.e. NP, RN, RPN). Categorical data is presented as frequencies and percentages, and was compared using $\chi^2$ testing. The NPLC was not included in $\chi^2$ analysis. Continuous data are presented as means and standard deviations (SDs). Data were analyzed using SPSS Version 22 (Armonk, NY: IBM Corp).

5.3 Results

5.3.1 Response Rate

The overall response rate for the survey was 93% (n=26) at the practice location-level. The completion strategy varied across sites and practice locations. The majority of sites had an individual at each practice location familiar with the organization and operations of the practice location complete the questionnaire. At two sites, the administrative lead completed 1 questionnaire on behalf of 1 practice location affiliated with their site and notified the study coordinator of items within the questionnaire that should have different responses at the other practice locations affiliated with that same site. When this strategy was utilized, questionnaire responses were duplicated within the data management software and responses to questions that varied across practice locations affiliated with the site (as identified by the administrative lead) were changed accordingly by the study coordinator. The mean length of time that it took participants to complete the questionnaire was 52 minutes with a SD of 29 minutes (range 24 to 119 minutes).

5.3.2 General Description of Primary Care Practices
The questionnaire was completed by 8 FHTs with a combined total of 21 different practice locations, 3 CHCs with a combined total of 4 different practice locations, and 1 NPLC with 1 practice location. The number of practice locations affiliated with a single site ranged from 1 to 5, and two FHTs and two CHCs only had a single practice location affiliated with their site. The most common position of the respondent was a manager or administrative lead (n=16; 62%). Other respondents were lead physicians (n=3; 12%), administrative personnel or assistants (n=4; 15%), physicians (n=2; 8%), or a NP (n=1; 4%). All practice locations affiliated with CHCs (n=4) and the respondent from the NPLC was a manager or administrative lead.

<table>
<thead>
<tr>
<th>Healthcare provider</th>
<th>Model of Care</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>FHT (n=21)</td>
</tr>
<tr>
<td>Registered Nurse</td>
<td>85.7 (18)</td>
</tr>
<tr>
<td>Nurse Practitioner</td>
<td>66.7 (14)</td>
</tr>
<tr>
<td>Dietitian</td>
<td>52.4 (11)</td>
</tr>
<tr>
<td>Social Worker</td>
<td>52.4 (11)</td>
</tr>
<tr>
<td>Diabetes Nurse Educator</td>
<td>23.8 (5)*</td>
</tr>
<tr>
<td>Registered Practical Nurse</td>
<td>42.9 (9)</td>
</tr>
<tr>
<td>Pharmacist</td>
<td>28.6 (6)</td>
</tr>
<tr>
<td>Occupational Therapist</td>
<td>19.0 (4)</td>
</tr>
<tr>
<td>Respiratory Therapist</td>
<td>14.3 (3)</td>
</tr>
<tr>
<td>Psychologist</td>
<td>14.3 (3)</td>
</tr>
<tr>
<td>Physician Assistant</td>
<td>4.8 (1)</td>
</tr>
<tr>
<td>Physiotherapist</td>
<td>4.8 (1)</td>
</tr>
</tbody>
</table>

*χ² = 4.05, p < 0.05 between FHT and CHC practice locations
Note: NPLC is not included in χ² analysis

All of the practice locations affiliated with CHCs and the NPLC were located in a city or small town. Of the practice locations affiliated with FHTs, 80.9% (n=17) were located in a city or small town and 19.1% (n=4) were located in a rural setting. All of the CHC practice locations and the majority of the FHT practice locations (n=14; 66.7%) were in operation for more than 10 years. The NPLC was in operation for 1 to 4 years. Furthermore, all practice locations had...
administrative support personnel including managerial, clerical, and reception staff, with a mean of 5.08 and SD of 3.35 administrative personnel (range 1 to 13) per practice location.

5.3.3 Healthcare Providers within Primary Care Practices

All practice locations affiliated with FHTs had at least two physicians with a mean of 5.2 and SD of 4.0 physicians per practice location (range 2 to 18). Similarly, CHCs had an average of 5.0 with a SD of 1.4 physicians per practice location (range 4 to 7). All practice locations affiliated with CHCs and the majority of practice locations affiliated with FHTs had at least one NP and at least one RN, making these the two most common non-physician healthcare providers across all settings. In contrast, only 50.0% of practice locations affiliated with CHCs and 42.9% of practice locations affiliated with FHTs had one or more RPN (Table 5.1). In addition, there were a total of three practice locations that only had RNs as nursing providers, and three practice locations that only had RPNs and diabetes nurse educators as nursing providers, each of which was affiliated with the FHT model of care (data not shown in table). Furthermore, a significantly higher proportion of practice locations affiliated with CHCs had at least one diabetes nurse educator in comparison to practice locations affiliated with FHTs ($\chi^2=4.05$, df 1, $p=0.04$). With respect to non-nursing healthcare providers, some FHT practice locations had at least one psychologist, physiotherapist or occupational therapist, whereas these providers were not present within practice locations affiliated with CHCs or the NPLC (Table 5.1). No practice locations had an optometrist, audiologist, speech language pathologist, or chiropractor.
### Table 5.2: Roles of nurses in each regulatory designation across different types of settings

<table>
<thead>
<tr>
<th>Nursing roles and regulatory designations*</th>
<th>Model of Care</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>FHT</td>
<td>CHC</td>
<td>NPLC</td>
<td></td>
</tr>
<tr>
<td><strong>Patient education (e.g. blood glucose testing, blood pressure)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nurse Practitioner</td>
<td>100 (14)</td>
<td>100 (4)</td>
<td>100 (1)</td>
<td></td>
</tr>
<tr>
<td>Registered Nurse</td>
<td>100 (18)</td>
<td>100 (4)</td>
<td>100 (1)</td>
<td></td>
</tr>
<tr>
<td>Practical Nurse</td>
<td>33.3 (3)</td>
<td>50.0 (1)</td>
<td>100 (1)</td>
<td></td>
</tr>
<tr>
<td><strong>Counseling on tobacco use, diet, and physical activity</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nurse Practitioner</td>
<td>85.7 (12)</td>
<td>100 (4)</td>
<td>100 (1)</td>
<td></td>
</tr>
<tr>
<td>Registered Nurse</td>
<td>83.3 (15)</td>
<td>100 (4)</td>
<td>100 (1)</td>
<td></td>
</tr>
<tr>
<td>Practical Nurse</td>
<td>22.2 (2)</td>
<td>0 (0)</td>
<td>100 (1)</td>
<td></td>
</tr>
<tr>
<td><strong>Follow-up of specific patient groups (e.g. chronic diseases)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nurse Practitioner</td>
<td>85.7 (12)</td>
<td>75.0 (3)</td>
<td>100 (1)</td>
<td></td>
</tr>
<tr>
<td>Registered Nurse</td>
<td>83.3 (15)</td>
<td>100 (4)</td>
<td>100 (1)</td>
<td></td>
</tr>
<tr>
<td>Practical Nurse</td>
<td>44.4 (4)</td>
<td>50.0 (1)</td>
<td>0 (0)</td>
<td></td>
</tr>
<tr>
<td><strong>Support for medical activities (e.g. BP/weight measurements)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nurse Practitioner</td>
<td>92.9 (13)</td>
<td>0 (0)</td>
<td>100 (1)</td>
<td></td>
</tr>
<tr>
<td>Registered Nurse</td>
<td>94.4 (17)</td>
<td>100 (4)</td>
<td>100 (1)</td>
<td></td>
</tr>
<tr>
<td>Practical Nurse</td>
<td>66.7 (6)</td>
<td>50.0 (1)</td>
<td>0 (0)</td>
<td></td>
</tr>
<tr>
<td><strong>Counselling on sexually transmitted or blood borne infections</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nurse Practitioner</td>
<td>100 (14)</td>
<td>100 (4)</td>
<td>100 (1)</td>
<td></td>
</tr>
<tr>
<td>Registered Nurse</td>
<td>38.9 (7)</td>
<td>50.0 (2)</td>
<td>100 (1)</td>
<td></td>
</tr>
<tr>
<td>Practical Nurse</td>
<td>22.2 (2)</td>
<td>50.0 (1)</td>
<td>0 (0)</td>
<td></td>
</tr>
<tr>
<td><strong>Liaise with long-term care, hospitals, and other facilities</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nurse Practitioner</td>
<td>71.4 (10)</td>
<td>100 (4)</td>
<td>100 (1)</td>
<td></td>
</tr>
<tr>
<td>Registered Nurse</td>
<td>61.1 (11)</td>
<td>100 (4)</td>
<td>100 (1)</td>
<td></td>
</tr>
<tr>
<td>Practical Nurse</td>
<td>55.6 (5)</td>
<td>0 (0)</td>
<td>0 (0)</td>
<td></td>
</tr>
<tr>
<td><strong>Participate in clinical decisions</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nurse Practitioner</td>
<td>92.9 (13)</td>
<td>100 (4)</td>
<td>100 (1)</td>
<td></td>
</tr>
<tr>
<td>Registered Nurse</td>
<td>72.2 (13)</td>
<td>100 (4)</td>
<td>100 (1)</td>
<td></td>
</tr>
<tr>
<td>Practical Nurse</td>
<td>44.4 (4)</td>
<td>100 (2)</td>
<td>100 (1)</td>
<td></td>
</tr>
<tr>
<td><strong>Conduct clinical activities as part of medical directive</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nurse Practitioner</td>
<td>85.7 (12)</td>
<td>75.0 (3)</td>
<td>100 (1)</td>
<td></td>
</tr>
<tr>
<td>Registered Nurse</td>
<td>66.7 (12)</td>
<td>100 (4)</td>
<td>100 (1)</td>
<td></td>
</tr>
<tr>
<td>Practical Nurse</td>
<td>44.4 (4)</td>
<td>50.0 (1)</td>
<td>100 (1)</td>
<td></td>
</tr>
<tr>
<td><strong>Order diagnostic examinations (e.g. blood tests, radiology)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nurse Practitioner</td>
<td>100 (14)</td>
<td>100 (4)</td>
<td>100 (1)</td>
<td></td>
</tr>
<tr>
<td>Registered Nurse</td>
<td>11.1 (2)</td>
<td>0 (0)</td>
<td>0 (0)</td>
<td></td>
</tr>
<tr>
<td>Practical Nurse</td>
<td>11.1 (1)</td>
<td>0 (0)</td>
<td>0 (0)</td>
<td></td>
</tr>
<tr>
<td><strong>Prescribe medications</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nurse Practitioner</td>
<td>100 (14)</td>
<td>100 (4)</td>
<td>100 (1)</td>
<td></td>
</tr>
<tr>
<td>Registered Nurse</td>
<td>16.7 (3)</td>
<td>0 (0)</td>
<td>0 (0)</td>
<td></td>
</tr>
<tr>
<td>Practical Nurse</td>
<td>0 (0)</td>
<td>0 (0)</td>
<td>0 (0)</td>
<td></td>
</tr>
</tbody>
</table>

*Percentages based on number of practices locations that reported to have ≥ 1 nurse within the specified nursing regulatory designation (refer to data presented in Table 3)
χ² = 5.16, p < 0.05 between FHT and CHC practice locations
Note: NPLC is not included in χ² analysis

5.3.1 Nursing Roles and Functions within Primary Care Practices

Respondents from practice locations that had a NP indicated that NPs were engaging in most roles listed in Table 5.2 at each practice location. There was a significantly higher proportion of NPs within FHT practice locations that engaged in support for medical activities, such as taking BP and weight measurements, compared to CHC practice locations (χ²=5.16, df 1, p=0.023). In fact, no NPs within CHC practice locations performed these activities. When comparing the roles of the various nursing providers, in general, the percentage of practice locations utilizing RNs for a particular role within a FHT or CHC was comparable to the percentage of practice locations utilizing NPs for many of the same roles. RPNs engage in the least number of tasks when compared to NPs and RNs. FHT practice locations were the only setting in which RNs reportedly prescribe medications and order diagnostic tests (Table 5.2)

5.3.2 Availability of Primary Care Services within Primary Care Practices

All practice locations performed influenza vaccinations, Papanicolaou (PAP) tests, and urinary pregnancy tests. The majority (>70%) of practice locations affiliated with FHTs and CHCs performed all of the services identified in Table 5.3. However, only 33.3% of FHTs performed pulmonary function tests and 50% of CHCs performed venipuncture. In fact, significantly less practice locations affiliated with FHTs performed pulmonary function tests in comparison to practices affiliated with CHCs (χ²=6.06, df 1, p=0.048) (Table 5.3). Practices with a NP were significantly more likely to conduct pulmonary function tests than practices without this nursing provider (OR=11.0, 95% CI 1.06 to 114.09; p=0.045). There were no significant relationships between the presence of any other nurse providers and services offered within the practice.

5.3.3 Chronic Diseases Management Attributes within Primary Care Practices
The majority of practice locations across all types of settings reported to have a process for systematic management and follow-up for the following chronic conditions: diabetes, hypertension, depression, chronic obstructive pulmonary disease, heart failure, chronic pain, asthma, Alzheimer’s disease and related dementia’s, osteoarthritis, Parkinson’s disease, and epilepsy (Table 5.4). A significantly greater proportion of practice locations affiliated with FHTs reported to have systematic management and follow-up for patients with hypertension (100% vs. 75%, \( \chi^2=5.47, \text{df 1, } p=0.019 \)), depression (100% vs. 75%, \( \chi^2=5.47, \text{df 1, } p=0.019 \)), and Alzheimer’s disease and related dementias (85.7% vs. 50%, \( \chi^2=6.65, \text{df 2, } p=0.036 \)) compared to practice locations affiliated with CHCs.

<table>
<thead>
<tr>
<th>Table 5.3: Availability of different primary care services and procedures</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
<tr>
<td>Model of Care</td>
</tr>
<tr>
<td>-------------------------------</td>
</tr>
<tr>
<td>Service or procedure</td>
</tr>
<tr>
<td>Venipuncture</td>
</tr>
<tr>
<td>Point-of-Care Testing</td>
</tr>
<tr>
<td>Rapid Streptococcal Testing</td>
</tr>
<tr>
<td>Skin Biopsy</td>
</tr>
<tr>
<td>PAP Test</td>
</tr>
<tr>
<td>Intrauterine Device Insertion</td>
</tr>
<tr>
<td>Suture/Minor Surgery</td>
</tr>
<tr>
<td>Rapid Urinalysis</td>
</tr>
<tr>
<td>Urine Pregnancy Test</td>
</tr>
<tr>
<td>Influenza Vaccination</td>
</tr>
<tr>
<td>Pulmonary Function Tests</td>
</tr>
</tbody>
</table>

\( \chi^2 = 6.06, p < 0.05 \) between FHT and CHC practice locations

Note: NPLC is not included in \( \chi^2 \) analysis

*Other response options not shown in table were “No/Unsure”
Table 5.4: Systematic patient management and follow-up

<table>
<thead>
<tr>
<th>Chronic diseases</th>
<th>Model of Care (%)</th>
<th>Disease a</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>FHT (n=21)</td>
<td>CHC (n=4)</td>
</tr>
<tr>
<td>Diabetes</td>
<td>100 (21)</td>
<td>100 (4)</td>
</tr>
<tr>
<td>Hypertension</td>
<td>100 (21)</td>
<td>75.0 (3)</td>
</tr>
<tr>
<td>Depression</td>
<td>100 (21)</td>
<td>75.0 (3)</td>
</tr>
<tr>
<td>COPD</td>
<td>90.5 (19)</td>
<td>100 (4)</td>
</tr>
<tr>
<td>Heart Failure</td>
<td>90.5 (19)</td>
<td>75.0 (3)</td>
</tr>
<tr>
<td>Chronic Pain</td>
<td>90.5 (19)</td>
<td>75.0 (3)</td>
</tr>
<tr>
<td>Asthma</td>
<td>85.7 (18)</td>
<td>100 (4)</td>
</tr>
<tr>
<td>Alzheimer’s/related dementias</td>
<td>85.7 (18)</td>
<td>50.0 (2)</td>
</tr>
<tr>
<td>Osteoarthritis</td>
<td>76.2 (16)</td>
<td>75.0 (3)</td>
</tr>
<tr>
<td>Parkinson’s disease</td>
<td>71.4 (15)</td>
<td>50.0 (2)</td>
</tr>
<tr>
<td>Epilepsy</td>
<td>61.9 (13)</td>
<td>50.0 (2)</td>
</tr>
</tbody>
</table>

*χ² p < 0.05 between FHT and CHC practice locations
Note: NPLC had systematic management and follow-up for each chronic disease listed; NPLC is not included in χ² analysis
aOther response options not shown in table were “No/Unsure”

Respondents from all settings reported to either always (23.1%, n=6) or often (76.9%, n=20) assist patients in setting and attaining self-management goals. Also, the majority of practice locations either always (42.3%, n=11) or often (50%, n=13) deliver care in accordance with clinical practice guidelines. Nearly all practice locations (92.3%, n=24) reported to have tools to assist with lifestyle counseling and health education or to help modify behaviours. Similarly, across all settings, 34.6% and 46.2% of practice locations reported to either always or often utilize flow sheets to track critical elements of care, respectively. There were no significant differences between the proportion of FHT and CHC practice locations that reported to engage in any of these chronic disease management activities.

5.4 Interpretation

This study implemented the Canadian Institute for Health Information’s recently developed “Measuring Organizational Attributes of Primary Health Care Survey” (21) and presents information about the organization of primary care practices in eastern Ontario, focusing
specifically on team composition, nursing roles, and general strategies that support chronic
disease management. Most practice locations included in this study were located in a city or small
town, and only FHT practice locations had practices located in a rural setting. A report published
by the Institute for Clinical Evaluative Sciences (2012) also found that FHTs tended to be more
rurally located than other models of care, including CHCs (29). The findings also indicated that
NPs and RNs were the most common non-physician healthcare providers employed within
primary care practices and that NPs and RNs seem to be undertaking many of the same roles.
Overall, the presence of healthcare providers was similar between practice locations affiliated
with FHTs and CHCs, with the exception of diabetes nurse educators, which were significantly
less common in FHT practice locations compared to CHCs. Furthermore, although nearly all
practice locations engage in important chronic disease management activities, there were certain
activities that have been associated with improved health outcomes that were not being performed
by all practices, such as goal-setting, an element of the self-management process, and utilizing a
flow sheet or system to track critical elements of care (30–36). The extent to which chronic
disease management activities were implemented and utilized was not captured in this study (i.e.
what and when goal-setting and flow sheets are being utilized).

There are few studies that specifically describe nursing roles or provide information on
nurse staffing and workforce trends within the primary care setting (5,7,9,10,37,38). The vast
majority of literature on this topic has been conducted in the acute, long-term, and home care
settings (13,15,39,40), or has been focused on the roles of NPs in primary care (10,41,42). The
sparse body of literature that focuses on the contributions of RNs and RPNs in primary care has
mainly been conducted in other countries, such as in the United Kingdom (38,43,44). Thus, there
is a growing need to study RNs’ and RPNs’ contributions to primary care in Canada (45). The
finding that NPs and RNs were the most common providers, after physicians, in the primary care
setting is consistent with other literature that has explored staffing patterns of healthcare
providers in primary care (46,47) and with Ontario statistics on nursing (48). In 2014, the College
of Nurses of Ontario reported that there were 2,462 RNs working in FHTs, CHCs, or NPLCs, in comparison to 995 NPs and 1,196 RPNs, making them the highest employed nursing provider within these settings.

Although it is well-documented that nurses within all regulatory designations play a key role in health promotion, disease prevention, and chronic disease management (18,49–60), their distinct educational preparations and scopes of practice should influence their participation in different roles in primary care. In this study, RNs and NPs, and to a lesser extent RPNs participated in similar patient assessment and management activities, such as counselling, teaching and assistance with clinical decisions. Our findings, and findings from other studies indicate that there is substantial overlap between the roles of nurses across regulatory designations, which may result in role confusion (61–66). Overall, it is imperative that nurses across each regulatory designation begin to address the confusion about their roles and to ensure their roles are optimized to support high-quality patient care within the primary care setting.

FHTs, CHCs, and NPLCs all deliver care using interdisciplinary team structures that are determined by the health needs of their surrounding communities (24–27). Interestingly, despite the growing need to better manage patients with diabetes within primary care, many practices in this study did not commonly have providers, such as pharmacists, dietitians, psychologists, and physiotherapists, who are often integral in providing comprehensive team-based primary care to patients with diabetes. For example, dietitians, pharmacists and psychological supports are associated with improved diabetes outcomes (67). Several studies, including two meta-analyses, have identified that practices that deliver collaborative care with a pharmacist are associated with significant decreases in hemoglobin A1c, low-density lipoprotein cholesterol, and blood pressure, and improved adherence and quality of life amongst patients (68–70). Without the support of these allied healthcare providers within practices, nurses are often required to absorb the roles most commonly performed by these providers (e.g. medication reconciliation, nutritional advice, psychosocial support). Overall, it is not clear what the composition of the overall healthcare team
should be to most effectively support chronic disease management. However, the identified variability across practices provides an opportunity to explore different team compositions and their effects on patient health outcomes.

5.4.1 Strengths

This study utilized the recently developed “Measuring Organizational Attributes of Primary Health Care Survey” (21) and obtained detailed information about the staffing levels and activities undertaken by nurses in each regulatory designation. This is important, as few studies to date have made distinctions between nursing regulatory designations in their work. This study was strengthened by a high response rate of 93%. The high response rate that was achieved in the present study may be at least partly attributable to the ease of access to contact information through the CPCSSN, which enabled study participants to be readily contacted for reminders to complete the questionnaire. In addition, the cost of completing the questionnaire was minimized through the use of an online questionnaire that was available through the affiliated academic institution. The online questionnaire offered participants the option of completing the questionnaire at their own pace by providing them with the opportunity to save their responses so that they could later return to the questionnaire and complete it at a more convenient time. The study coordinator could also track questionnaire completion progress online. If the study coordinator noticed that a participant had started but not completed the questionnaire, a friendly reminder to complete the questionnaire was offered to the respondent that included a web-link to pick-up where they had left off. Furthermore, having a designated study coordinator permitted consistent, scheduled, and regular follow-up at 1 to 2 week intervals with the individual identified to be the most suitable for completing the questionnaire. These reminders were initially completed using e-mail but were followed by phone call reminders towards the end of the data collection period. During these encounters, the study coordinator reminded the participants about their practices’ participation in the CPCSSN and explained how the data would benefit the CPCSSN. If a participant expressed concern about not being the most appropriate individual to
complete the questionnaire, contact information for another individual within the practice was obtained at that time. Participants were also offered alternative methods for completing the questionnaire (e.g. a paper-based version of the questionnaire). Although the combination of these data collection methods proved to be effective in this particular study, their suitability to larger studies in the primary care setting is unknown.

5.4.2 Limitations

The majority of survey respondents were administrative leads or managers, and therefore detailed information about the specific roles and functions that nurses undertook within the practices may not be as accurate had this information been collected directly from nurses themselves. However, the characteristics and structures that are intrinsic to the organization and delivery of care at a practice-level were accurately captured from these respondents (28). Similarly, given that the survey was completed by an individual employed by the primary care practice, it is possible that the individual may have been inclined to provide more positive responses (i.e. social desirability bias). This is particularly true if the respondent is an administrative worker rather than a healthcare professional (71). In addition, only one NPLC was included in this study which prevented meaningful statistical comparisons across the different types of settings to be made. Also, only primary care practices affiliated with the Eastern Ontario Network of CPCSSN were included in this study, thus the findings from this study are limited in terms of their generalizability.

5.5 Conclusion

It is evident that nurses play a major role in delivering primary care services, especially with respect to chronic disease management. With the evolving primary healthcare system, it is essential that nurses within each regulatory designation identify their unique contributions within primary care. Future research should focus on demonstrating nurses’ effects on health outcomes in patients within this setting, as well as the influence of specific organizational attributes in supporting the delivery of high-quality primary care.
5.6 Competing Interests

The authors have no competing interest to disclose.

5.7 Acknowledgements

The authors would like to thank the contributions of Rachael Morkem, Research Associate, from the Eastern Ontario Network of the CPCSSN for her assistance with data collection.
5.8 References


Chapter 6

Manuscript 4

Exploring relationships between the presence of nurse providers within family health teams located in south eastern Ontario and health outcomes of patients with Type 2 diabetes
Abstract

Background: As the organization of primary care continues to evolve towards more interdisciplinary team structures, demonstrating effectiveness of care delivery is becoming particularly important for nurses in this setting. This is especially true for understanding the contribution of Registered Nurses, the largest group of nursing providers within primary care. Research conducted to date has focused on nurses in general, without making clear distinctions between nursing regulatory designations, or has been focused in settings outside of primary care.

Methods: This study utilized nurse staffing data acquired through a cross-sectional survey of Family Health Teams and patient data from the Canadian Primary Care Sentinel Surveillance Network in south eastern Ontario to explore relationships between the presence of nurses, including Nurse Practitioners, Registered Nurses and Registered Practical Nurses, and outcomes in patients with Type 2 diabetes.

Results: The presence of nurse providers varied across Family Health Team practices: 66.6% had ≥1 Nurse Practitioner, 86.7% had ≥1 Registered Nurse and 46.7% had ≥1 Registered Practical Nurse. The presence of ≥ 1 Registered Nurse in a Family Health Team was associated with increased odds of diabetic patients having their hemoglobin A1c (OR=1.43, 95% CI: 1.20-1.69), fasting plasma glucose (OR=1.35, 95% CI: 1.08-1.68), blood pressure (OR=1.51, 95% CI: 1.27-1.81), and low-density lipoprotein cholesterol (OR=1.46, 95% CI: 1.19-1.79) measurements on-target. Practices with the lowest ratios of diabetic patients per Registered Nurse had a significantly greater proportion of patients who had hemoglobin A1c and fasting plasma glucose measurements on-target compared to practices with the highest ratios of diabetic patients per Registered Nurse.

Interpretation: This study demonstrated the ability to link nurse staffing data acquired through an organizational survey to patient data housed within the Canadian Primary Care Sentinel Surveillance Network. The findings suggest that Family Health Teams utilizing a model of care that incorporated Registered Nurses exhibited better patient outcomes.
6.1 Introduction

Within Ontario, the most common interdisciplinary model of care is a Family Health Team (FHT). FHTs were introduced in 2005 as a means to improve access to healthcare services. There are currently close to 200 FHTs in Ontario that deliver comprehensive care using an interdisciplinary team structure that often includes physicians and nurses (1,2). Importantly, the presence of nursing providers differs across FHTs, providing an opportunity to explore whether the variation in the presence of nursing providers affects the management of patients with chronic diseases, such as Type 2 diabetes.

In 2013, there were a total of 408,093 nurses within Canada, making nurses the largest healthcare provider group within all sectors of the healthcare system (3). With the increasing demand for professional and financial accountability across the healthcare system, nurses are continually being challenged to demonstrate that the care that they provide is safe and of high-quality (4). As the organization of primary care services continues to evolve towards more interdisciplinary models of care, demonstrating the contribution of human resources within these models of care is becoming particularly important for nurses employed within this setting (5–7).

Research examining the contribution of nurses to healthcare has been primarily performed within acute care and long-term care settings, and has focused on examining the relationship between staffing levels and patient health outcomes, such as the occurrence of adverse events (4,8,9). Within the primary care setting, few studies have examined the relationship between nurses and patient outcomes and there is also a scarcity of information about the number of nurses required to meet the increasing demands for primary care services in Canada (7,10). This is particularly true for Registered Nurses (RNs), which make up the largest group of nursing providers within the primary care sector (11). In fact, there is a consensus amongst the Canadian public, physicians, and nurses that the RN role within primary care is not clearly defined (10,12–14).
Studies examining nurses in primary care have either primarily focused on nurses in general, without making clear distinctions between regulatory designations, or have focused on the roles of Nurse Practitioners (NPs) alone. For instance, Hogg et al. (2009) found that the total number of nurses in a practice was independently and positively associated with health promotion (15), and Dahrouge et al. (2012) and Russell et al. (2009) have reported that the presence of a NP is associated with improved chronic disease prevention and management (16,17). There is therefore a need for evidence that documents RNs’N’s unique ability to deliver high-quality care within the primary care setting. This mission is supported by nursing organizations worldwide, including the International Council for Nurses and the Canadian Nurses Association (14,18). Similarly, the College of Family Physicians of Canada (2007) believes that access to care and wait-times can be reduced through the collaboration of general practitioners and RNs in primary care (19).

To address this important gap in the literature, the present study utilized nurse staffing data acquired through a cross-sectional organizational survey of FHT practices affiliated with the Canadian Primary Care Sentinel Surveillance Network (CPCSSN) in south eastern Ontario and electronic medical records (EMRs) from patients of these practices to explore relationships between primary care delivery models that incorporate different nurses (i.e. NPs, RNs, RPNs) and health outcomes in patients with Type 2 diabetes. Type 2 diabetes was the focus of this study given its high and increasing prevalence amongst the Canadian population (20) and the fact that nurses undertake important roles with respect to the prevention and management of complications associated with this disease.

6.2 Methods

6.2.1 Study design

A cross-sectional linkage study was performed. Data on primary care practice nurse staffing levels acquired from a cross-sectional organizational survey were linked with patient data
from the existing CPCSSN database. This study sought to explore associations between FHT models of care that have the presence of nurses from different regulatory designations (i.e. NPs, RNs, RPNs) and health outcomes of patients with Type 2 diabetes in south eastern Ontario. Given that RNs are employed in the greatest numbers in this setting, a particular emphasis has been placed on exploring models of care that incorporate RNs and their association with Type 2 diabetes management. Approval to conduct this study was obtained from the Queen’s University Faculty of Health Sciences Research Ethics Board.

6.2.2 Patient Sample

The patient sample was drawn from existing databases managed by the CPCSSN. CPCSSN is a chronic disease EMR surveillance system that seeks to improve the effectiveness and efficiency of primary healthcare delivery, and to improve patient and system outcomes across the country by creating a platform for research, surveillance and education. It is currently comprised of ten Practice Based Research Networks across Canada, including one that is located in eastern Ontario. The CPCSSN provides access to EMR data collected from patients affected by various chronic diseases, including diabetes (21,22). Therefore, the present sample is comprised of individuals with a CPCSSN diagnosis of diabetes, between the ages of 18 and 100, and who had at least 1 primary care encounter within the defined cohort year (i.e. April 1, 2013 and March 31, 2014) (n=6673). A CPCSSN diagnosis of diabetes includes the presence of the following elements within a patient’s personal EMR: existence of billing data code 250.X indicating a diagnosis of diabetes mellitus, medications that are specifically used for managing diabetes (e.g. insulin, glyburide, metformin), and laboratory test results that align with a diagnosis of diabetes (i.e. hemoglobin A1c > 7.0%, fasting plasma glucose ≥ 7.0 mmol/L). This diagnostic algorithm has been examined in a previous study and has demonstrated 95.6% sensitivity and 97.1% specificity (23). The study was limited to 12-months of observation based on the Canadian Diabetes Association (2013) recommendation to measure quality of care indicators within a 12-
month period (24). Furthermore, no distinction was made between Type 1 diabetes and Type 2 diabetes. However, given that over 90% of Canadians who have diabetes have Type 2 diabetes, the majority of the sample would be expected to have Type 2 diabetes (20,25,26).

6.2.3 Setting

At the time of study completion there were 15 FHTs located within the south eastern Ontario Local Health Integration Network (27), including 9 that participated in the Eastern Ontario Network of the CPCSSN. Each practice location affiliated with these 9 FHT sites were invited to participate in this study. Only practice locations that contributed data to the CPCSSN during the defined cohort year (i.e. April 1, 2013 to March 31, 2014) and participated in a survey that provided practice location organizational-level data are included in this study. In total, 8 FHT sites with a total of 15 affiliated practice locations met these criteria.

6.2.4 Data sources

Patient variables.

Patient-level data was obtained from databases maintained by the CPCSSN. The CPCSSN database has been assessed for quality issues and disease diagnoses have been validated using chart abstractions (28). The following patient characteristics were acquired from the CPCSSN databases: age, sex, and number of comorbidities. The main outcome measures related to diabetes management explored in this study included: hemoglobin A1c (HbA1c), fasting plasma glucose (FPG), blood pressure (BP), low-density lipoprotein cholesterol (LDL-C), and urine albumin creatinine ratio (UACR). According to the Canadian Diabetes Association (2013) Clinical Practice Guidelines, the following targets have been established to reduce the risk of developing microvascular or macrovascular complications associated with diabetes: HbA1c ≤ 7.0%, FPG < 7.0 mmol/L, BP < 130/80 mmHg, LDL-C ≤ 2.0 mmol/L, and UACR < 2.0 mg/mmol, and each of these diabetes indicators should be measured at least once annually (24).
**Organizational variables.**

Organizational-level data was obtained from a cross-sectional study that employed a modified version of the “Measuring Organizational Attributes of Primary Health Care Survey” (29). A complete description of the data collection tool and procedure utilized to obtain the organizational-level data is available elsewhere (Chapter 5, Manuscript 3). An item on the questionnaire asked respondents to provide physician and nursing staffing data about their practice. Specifically, the respondents were asked about the number of physicians and number of nurses within all regulatory designations (i.e. NPs, RNs, RPNs) who worked within their practice. Thus, the main exposure variables explored in this study were the presence of ≥ 1 of each of these nursing positions at the FHT practice locations (i.e. presence/absence of ≥ 1 NP, presence/absence of ≥ 1 RN, presence/absence of ≥ 1 RPN). The presence of a NP and other nurse providers has been used as an exposure variable in a previous study that explored the association between nurse staffing and the quality of chronic disease management in primary care (17).

**6.2.4.1 Linkage of data sources**

This is the first known study to link patient-level data available within the CPCSSN database, which is organized at a site-level, to organizational data, which exists at a specific practice location-level. Prior to this study, the identification of specific practice locations affiliated with each FHT site was not available within the CPCSSN database, limiting the exploration of patient data to the site-level only. The following paragraph describes how the linkage between the patient data organized at a site-level and the organizational survey data existing at a practice location-level was completed.

Within the CPCSSN database, each patient encounter has a corresponding site code that identifies which FHT site the patient belongs to, as well as a provider code that identifies which provider the patient receives care from. For the present study, the CPCSSN provided the study authors with a document containing a list of practice locations affiliated with each of the
participating FHT sites (n=8) that included the corresponding codes for providers delivering care at each practice location. Each participating practice location (n=15) was assigned a code (i.e. 1 to 15) which matched the codes assigned to each completed organizational survey. These practice location codes were linked to the provider identification codes of each included patient encounter within the large study database to determine which practice location each patient encounter occurred at. Finally, organizational survey data was imported into the large study database and was merged based on the practice location identification codes.

### 6.2.5 Statistical analyses

Data analysis was conducted using SPSS Version 22 (Armonk, NY: IBM Corp). Demographic characteristics of the patients in the sample were described using means and standard deviations (SDs) for continuous data, and frequencies and percentages for categorical data. One way ANOVA was used to explore differences in patients’ age across practice locations. All other patient demographic variables and outcome variables were compared across practice locations using $\chi^2$ analysis. To explore variability in diabetes management across practice locations, the percentage of patients with diabetes who had each diabetes management test completed within the defined cohort year was calculated, and the percentage of patients who had each diabetes management test on-target was also determined (24).

To explore whether FHT models of care that incorporate different nursing providers were associated with the observed variability in diabetic outcome indicators across FHT practice locations, logistic regression analyses were used and models were built using a traditional epidemiological paradigm with a backwards elimination procedure. The exposure variable used in each model was whether the practice had the presence or absence of $\geq$ 1 NP, presence or absence of $\geq$ 1 RN, or presence or absence of $\geq$ 1 RPN. Covariates included in each of the modeling processes included patient characteristics: sex (male or female), age (<65 years of age or $\geq$ 65 years of age), and comorbidity (none or presence of $\geq$ 1 additional chronic condition). These patient variables were important to explore as covariates within the model as they can influence
the effectiveness of Type 2 diabetes management (24). Using a backwards elimination strategy, an assessment of whether these covariates were modifiers of any relationships was first performed and this was followed by an assessment of whether they confounded the relationship. Modification was assessed via significance test at the significance-level of p<0.05. If a significant modification was found, the variable was kept in the model and analysis was stratified by the modifying variable (e.g. no comorbidity or presence of ≥ 1 additional chronic condition). Furthermore, if the covariates did not modify the relationship, an assessment for confounding was performed. Given that no patient variables changed the parameter estimate by >10%, no patient variables were included as confounders in the final models. Lastly, given that RNs are the most predominant nursing provider within FHTs, we also explored the effect of the ratio of diabetic patients to RNs. This ratio was categorized into quartiles (i.e. Q1=lowest diabetic patient to RN ratios - Q4=highest diabetic patient to RN ratios) and associations between the quartiles and diabetes outcome indicators were explored using ANOVA. Statistical significance was inferred when p<0.05.

6.3 Results

A description of patient characteristics across all practice locations is located in Table 6.1. Information about the number of physicians and nurse providers within each practice model, and the number of diabetic patients per RN is presented in Table 6.2. Overall, 86.7% of practices had at least one RN (average of 2.5 per practice), 66.6% of practices had at least one NP (average of 0.87 per practice), and 46.7% of practices had at least one RPN (average of 0.87 per practice). In the two practice locations without RNs, there was at least one RPN and at least one diabetes nurse educator present. With respect to the five practices without NPs, at three of these practices, there were no nursing providers and at the other two practices, there was at least one RPN and one diabetes nurse educator.
Table 6.1: Patient profile across practice locations

<table>
<thead>
<tr>
<th>Practice ID</th>
<th># of Patients</th>
<th>Male % (n)</th>
<th>Female % (n)</th>
<th>Mean Age (SD)</th>
<th>≥ 65 years % (n)</th>
<th>≥ 1 Comorbidity % (n)</th>
</tr>
</thead>
<tbody>
<tr>
<td>All Practices</td>
<td>6673</td>
<td>51.2 (3415)</td>
<td>48.8 (3258)</td>
<td>65.1 (14.0)</td>
<td>55.3 (3690)</td>
<td>70.9 (4734)</td>
</tr>
<tr>
<td>1</td>
<td>735</td>
<td>47.9 (352)</td>
<td>52.1 (383)</td>
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<td>45.6 (335)</td>
<td>69.0 (507)</td>
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<td>63.2 (14.9)‡</td>
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<td>51.1 (277)</td>
<td>76.9 (417)</td>
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<tr>
<td>8</td>
<td>832</td>
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<td>60.0 (499)</td>
<td>75.4 (627)</td>
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<td>51.3 (332)</td>
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<td>41.9 (80)</td>
<td>58.1 (111)</td>
<td>64.7 (14.4)</td>
<td>49.2 (94)</td>
<td>73.8 (141)</td>
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<td>304</td>
<td>56.6 (172)</td>
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<td>66.4 (13.4)</td>
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<td>77.3 (235)</td>
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<td>50.6 (86)</td>
<td>49.4 (84)</td>
<td>68.5 (12.8)</td>
<td>65.9 (112)</td>
<td>84.1 (143)</td>
</tr>
<tr>
<td>13</td>
<td>448</td>
<td>52.0 (233)</td>
<td>48.0 (215)</td>
<td>63.7 (14.0)†</td>
<td>52.9 (237)</td>
<td>78.8 (353)</td>
</tr>
<tr>
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<td>504</td>
<td>52.8 (266)</td>
<td>47.2 (238)</td>
<td>66.0 (13.4)</td>
<td>57.9 (292)</td>
<td>85.7 (432)</td>
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<td>281</td>
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<td>45.9 (129)</td>
<td>66.2 (13.8)</td>
<td>59.1 (166)</td>
<td>59.1 (166)</td>
</tr>
</tbody>
</table>

*p<0.05 compared to Location ID 3, 5, 6, 8, 11, 12, 14, 15
†p<0.05 compared to Location ID 3, 8, 12
‡p<0.05 compared to Location ID 8, 12
Table 6.2: Presence of physician and nurse providers within practices

<table>
<thead>
<tr>
<th>Practice ID</th>
<th># of Diabetic Patients</th>
<th># RNs (# of diabetic patients per RN*)</th>
<th># Physicians and other nursing providers at practice location</th>
<th>Diabetes Nurse Educators</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>GPs NPs RPNs</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>735</td>
<td>4 (184)</td>
<td>18 3 4 4</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>295</td>
<td>1 (295)</td>
<td>5 1 2 2</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>315</td>
<td>0 (n/a)</td>
<td>2 0 1 1</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>208</td>
<td>3 (69)</td>
<td>4 1 1 1</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>809</td>
<td>2 (405)</td>
<td>8 1 2 2</td>
<td></td>
</tr>
<tr>
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<td>1 (392)</td>
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<td></td>
</tr>
<tr>
<td>7</td>
<td>542</td>
<td>4 (136)</td>
<td>7 2 0 0</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>832</td>
<td>6 (139)</td>
<td>8 0 0 0</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>647</td>
<td>2 (324)</td>
<td>2 1 0 0</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>191</td>
<td>2 (96)</td>
<td>5 1 0 0</td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>304</td>
<td>2 (152)</td>
<td>6 1 0 0</td>
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<td>170</td>
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<td>2 1 0 0</td>
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<tr>
<td>13</td>
<td>448</td>
<td>0 (n/a)</td>
<td>5 0 2 2</td>
<td></td>
</tr>
<tr>
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<td>504</td>
<td>6 (84)</td>
<td>13 0 0 0</td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>281</td>
<td>1 (281)</td>
<td>4 0 1 1</td>
<td></td>
</tr>
</tbody>
</table>

Note: GPs=General Practitioners, NPs=Nurse Practitioners, RNs=Registered Nurses, RPNs=Registered Practical Nurses

The percentages of patients at each FHT practice location that had each diabetes management test completed and on-target are displayed in Table 6.3 and Table 6.4, respectively. The percentage of patients that had each test completed and on-target differed significantly across practice locations. BP measurements had the highest completion rates of all diabetes management tests (84.6%, range 47.7%-96.6%). HbA1c (58.3%, range 44.6%-69.7%) and LDL-C (57.6%, range 32.3%-70.8%) measurements were the diabetes management indicators most likely to be on-target.
Table 6.3: Diabetes management test completion (n=6673)

<table>
<thead>
<tr>
<th>Practice ID</th>
<th>HbA1c</th>
<th>FPG</th>
<th>BP</th>
<th>LDL-C</th>
<th>UACR</th>
</tr>
</thead>
<tbody>
<tr>
<td>All Practices</td>
<td>68.8 (4592)</td>
<td>48.6 (3245)</td>
<td>84.6 (5645)</td>
<td>58.3 (3893)</td>
<td>31.1 (2075)</td>
</tr>
<tr>
<td>1</td>
<td>80.5 (592)</td>
<td>48.0 (353)</td>
<td>96.6 (710)</td>
<td>65.0 (478)</td>
<td>44.8 (329)</td>
</tr>
<tr>
<td>2</td>
<td>79.7 (235)</td>
<td>38.0 (112)</td>
<td>96.3 (284)</td>
<td>65.8 (194)</td>
<td>46.1 (136)</td>
</tr>
<tr>
<td>3</td>
<td>87.0 (274)</td>
<td>80.0 (252)</td>
<td>90.2 (284)</td>
<td>74.6 (235)</td>
<td>49.5 (156)</td>
</tr>
<tr>
<td>4</td>
<td>47.6 (99)</td>
<td>73.6 (153)</td>
<td>96.2 (200)</td>
<td>76.0 (158)</td>
<td>22.6 (47)</td>
</tr>
<tr>
<td>5</td>
<td>11.9 (96)</td>
<td>10.4 (84)</td>
<td>82.9 (671)</td>
<td>9.5 (77)</td>
<td>3.6 (29)</td>
</tr>
<tr>
<td>6</td>
<td>89.0 (349)</td>
<td>71.4 (280)</td>
<td>93.4 (366)</td>
<td>78.8 (309)</td>
<td>45.7 (179)</td>
</tr>
<tr>
<td>7</td>
<td>79.7 (432)</td>
<td>44.5 (241)</td>
<td>75.5 (409)</td>
<td>61.6 (334)</td>
<td>30.3 (164)</td>
</tr>
<tr>
<td>8</td>
<td>84.9 (706)</td>
<td>77.5 (645)</td>
<td>88.5 (736)</td>
<td>73.2 (609)</td>
<td>42.8 (356)</td>
</tr>
<tr>
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<td>58.0 (375)</td>
<td>62.8 (406)</td>
<td>73.4 (475)</td>
<td>57.7 (373)</td>
<td>29.1 (188)</td>
</tr>
<tr>
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<td>82.2 (157)</td>
<td>75.4 (144)</td>
<td>89.0 (170)</td>
<td>69.1 (132)</td>
<td>33.5 (64)</td>
</tr>
<tr>
<td>11</td>
<td>70.1 (213)</td>
<td>65.1 (198)</td>
<td>66.1 (201)</td>
<td>67.1 (204)</td>
<td>34.5 (105)</td>
</tr>
<tr>
<td>12</td>
<td>77.1 (131)</td>
<td>18.2 (31)</td>
<td>84.7 (144)</td>
<td>59.4 (101)</td>
<td>8.2 (14)</td>
</tr>
<tr>
<td>13</td>
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<td>40.0 (179)</td>
<td>15.8 (71)</td>
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<tr>
<td>14</td>
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<td>96.0 (484)</td>
<td>57.7 (291)</td>
<td>34.1 (172)</td>
</tr>
<tr>
<td>15</td>
<td>83.3 (234)</td>
<td>39.5 (111)</td>
<td>47.7 (134)</td>
<td>76.9 (216)</td>
<td>23.1 (65)</td>
</tr>
</tbody>
</table>

Note: HbA1c=Glycated Hemoglobin, FPG=Fasting Blood Glucose, BP=Blood Pressure, LDL-C=Low-Density Lipoprotein Cholesterol, UACR=Urine Albumin Creatinine Ratio

$^\gamma_2 p<0.001$; significant differences in percentage of pts who had each test completed across practice locations
Table 6.4: Diabetes management outcome indicators on-targeta

<table>
<thead>
<tr>
<th>Practice ID</th>
<th>HbA1c ≤ 7.00b</th>
<th>FPG &lt; 7.00b</th>
<th>BP &lt; 130/80b</th>
<th>LDL-C ≤ 2.00b</th>
<th>UACR &lt; 2.00b</th>
</tr>
</thead>
<tbody>
<tr>
<td>All Practices</td>
<td>58.3 (2676)</td>
<td>47.0 (1524)</td>
<td>37.4 (2109)</td>
<td>57.6 (2240)</td>
<td>45.3 (939)</td>
</tr>
<tr>
<td>1</td>
<td>57.4 (340)</td>
<td>46.5 (164)</td>
<td>31.7 (225)</td>
<td>52.5 (251)</td>
<td>47.4 (156)</td>
</tr>
<tr>
<td>2</td>
<td>54.9 (129)</td>
<td>48.2 (54)</td>
<td>33.1 (94)</td>
<td>56.2 (109)</td>
<td>50.7 (69)</td>
</tr>
<tr>
<td>3</td>
<td>56.2 (154)</td>
<td>44.4 (112)</td>
<td>43.7 (124)</td>
<td>55.7 (131)</td>
<td>52.6 (82)</td>
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<tr>
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<td>69.7 (69)</td>
<td>71.2 (109)</td>
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<td>57.4 (27)</td>
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<td>55.3 (193)</td>
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<td>46.9 (84)</td>
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<td>46.9 (192)</td>
<td>66.8 (223)</td>
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<td>44.7 (159)</td>
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<tr>
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<td>51.2 (208)</td>
<td>26.9 (128)</td>
<td>45.0 (168)</td>
<td>27.7 (52)</td>
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<tr>
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<td>63.7 (100)</td>
<td>41.7 (60)</td>
<td>38.8 (66)</td>
<td>57.6 (76)</td>
<td>45.3 (29)</td>
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<td>45.8 (92)</td>
<td>56.9 (116)</td>
<td>48.5 (51)</td>
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<td>57.1 (8)</td>
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<tr>
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<td>40.8 (73)</td>
<td>43.7 (31)</td>
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<tr>
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<td>41.3 (52)</td>
<td>30.6 (148)</td>
<td>62.9 (183)</td>
<td>48.8 (84)</td>
</tr>
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<td>44.8 (60)</td>
<td>70.8 (153)</td>
<td>49.2 (32)</td>
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</table>

Note: HbA1c=Glycated Hemoglobin, FPG=Fasting Blood Glucose, BP=Blood Pressure, LDL-C=Low-Density Lipoprotein Cholesterol, UACR=Urine Albumin Creatinine Ratio

bPercentages calculated based on # of patients that had each test completed (refer to Table 3)

χ2 p<0.001; significant differences in percentage of pts who had each indicator on-target across practice locations

FHT models of care that had at least one RN were significantly associated with increased odds of patients within a practice having HbA1c (OR 1.43, 95% CI 1.20-1.69), FPG (OR 1.35, 95% CI 1.08-1.68), BP (OR 1.51, 95% CI 1.27-1.81), and LDL-C (OR 1.46, 95% CI 1.19-1.79) on-target (Table 6.5). These observed relationships were independent and not modified or confounded by patient characteristics. In contrast, FHT practice models that incorporated at least one NP were significantly associated with decreased odds of patients having HbA1c (OR 0.67, 95% CI 0.52-0.85) and LDL-C (OR 0.62, 95% CI 0.48-0.81) on-target. This relationship was modified by the presence of at least one additional chronic condition and was significant when patients only had diabetes (Table 6.5). Similarly, FHT practice models that incorporated at least
one RPN were significantly associated with decreased odds of patients having HbA1c (OR 0.82, 95% CI 0.71-0.94), BP (OR 0.60, 95% CI 0.53-0.68), and LDL-C (OR 0.70, 95% CI 0.62-0.80) on-target. Some of these relationships were also modified by the presence of at least one additional chronic condition (Table 6.5).

Table 6.5: Patients that had diabetes management outcome indicators on-target at practices with or without the presence of nurses

<table>
<thead>
<tr>
<th>Nurse Practitioner</th>
<th>On-Target, % (n)</th>
<th>HbA1c</th>
<th>FPG</th>
<th>BP</th>
<th>LDL-C</th>
<th>UACR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes, ≥1</td>
<td>56.6 (1514)</td>
<td>61.7 (941)</td>
<td>65.9 (1390)</td>
<td>58.8 (1316)</td>
<td>58.7 (561)</td>
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</tr>
<tr>
<td>No</td>
<td>43.4 (1162)</td>
<td>38.3 (583)</td>
<td>34.0 (719)</td>
<td>41.2 (924)</td>
<td>41.3 (388)</td>
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</tr>
<tr>
<td>OR</td>
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<td>1.12</td>
<td>0.62</td>
<td>0.87</td>
<td></td>
</tr>
<tr>
<td>95% CI</td>
<td>0.52, 0.85</td>
<td>0.87, 1.56</td>
<td>1.00, 1.25</td>
<td>0.48, 0.81</td>
<td>0.73, 0.04</td>
<td></td>
</tr>
<tr>
<td>P Value</td>
<td>≤0.001†</td>
<td>0.96</td>
<td>0.05</td>
<td>≤0.001†</td>
<td>0.13</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Registered Nurse</th>
<th>On-Target, % (n)</th>
<th>HbA1c</th>
<th>FPG</th>
<th>BP</th>
<th>LDL-C</th>
<th>UACR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes, ≥1</td>
<td>88.6 (2372)</td>
<td>90.4 (1378)</td>
<td>90.8 (1916)</td>
<td>90.9 (2036)</td>
<td>88.0 (826)</td>
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</tr>
<tr>
<td>No</td>
<td>11.4 (304)</td>
<td>9.6 (146)</td>
<td>9.2 (193)</td>
<td>9.1 (204)</td>
<td>12.0 (113)</td>
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</tr>
<tr>
<td>OR</td>
<td>1.43</td>
<td>1.35</td>
<td>1.51</td>
<td>1.46</td>
<td>0.815</td>
<td></td>
</tr>
<tr>
<td>95% CI</td>
<td>1.20, 1.69</td>
<td>1.08, 1.68</td>
<td>1.27, 1.81</td>
<td>1.19, 1.79</td>
<td>0.62, 1.07</td>
<td></td>
</tr>
<tr>
<td>P Value</td>
<td>≤0.001</td>
<td>&lt;0.01</td>
<td>≤0.001</td>
<td>≤0.001</td>
<td>0.15</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Registered Practical Nurse</th>
<th>On-Target, % (n)</th>
<th>HbA1c</th>
<th>FPG</th>
<th>BP</th>
<th>LDL-C</th>
<th>UACR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes, ≥1</td>
<td>39.1 (1045)</td>
<td>36.8 (561)</td>
<td>40.6 (857)</td>
<td>35.9 (804)</td>
<td>44.3 (416)</td>
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<tr>
<td>No</td>
<td>60.9 (1631)</td>
<td>63.2 (963)</td>
<td>59.4 (1252)</td>
<td>64.1 (1436)</td>
<td>55.7 (523)</td>
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</tr>
<tr>
<td>OR</td>
<td>0.82</td>
<td>1.05</td>
<td>0.60</td>
<td>0.70</td>
<td>1.37</td>
<td></td>
</tr>
<tr>
<td>95% CI</td>
<td>0.71, 0.94</td>
<td>0.91, 1.22</td>
<td>0.53, 0.68</td>
<td>0.62, 0.80</td>
<td>1.15, 1.64</td>
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</tr>
<tr>
<td>P Value</td>
<td>0.005‡</td>
<td>0.48</td>
<td>≤0.001§</td>
<td>≤0.001</td>
<td>≤0.001</td>
<td></td>
</tr>
</tbody>
</table>

Note: HbA1c=Glycated Hemoglobin, FPG=Fasting Blood Glucose, BP=Blood Pressure, LDL-C=Low-Density Lipoprotein Cholesterol, UACR=Urine Albumin Creatinine Ratio, OR=Odds Ratio, CI=Confidence Interval

† Adjusted for presence/absence of ≥ 1 comorbidity. Data presented represents patients with only diabetes. No significant relationship when patients have ≥ 1 additional chronic condition.

‡ Adjusted for presence/absence of ≥ 1 comorbidity. Data presented represents patients with ≥ 1 additional chronic condition. No significant relationship when patients only have diabetes. Relationship also significant when patients only have diabetes (OR=0.74, 95% CI: 0.63-0.95)

§ Adjusted for presence/absence of ≥ 1 comorbidity. Data presented represents patients with ≥ 1 additional chronic condition. Relationship also significant when patients only have diabetes.

FHT models of care with fewer diabetic patients per RN were also associated with improved diabetes outcomes (Table 6.6). In general, models of care with a lower diabetic patient per RN ratio tended to have the highest percentage of patients with each diabetic measurement.
on-target. This relationship was statistically significant for HbA1c and FPG measurements between FHTs with the lowest diabetic patient per RN ratio (i.e. quartile 1) in comparison to the highest diabetic patient per RN ratio (i.e. quartile 4). Furthermore, when comparing practice models with the highest diabetic patients per RN ratio (i.e. the upper two quartiles), the percentages of patients with FPG and LDL-C measurements on-target were significantly greater in practice models that fell within quartile 3 (i.e. lower diabetic patient to RN ratio) in comparison to quartile 4.

Table 6.6: Comparison of on-target diabetes management outcome indicators across quartiles of registered nurses per diabetic patients

<table>
<thead>
<tr>
<th>Quartiles*</th>
<th>Total patients within quartiles % (n)</th>
<th>On-Target, % (n)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>HbA1c</td>
</tr>
<tr>
<td>Q1</td>
<td>28.2 (1407)</td>
<td>31.4 (744)*</td>
</tr>
<tr>
<td>Q2</td>
<td>33.0 (1647)</td>
<td>38.2 (906)</td>
</tr>
<tr>
<td>Q3</td>
<td>17.9 (893)</td>
<td>20.3 (482)</td>
</tr>
<tr>
<td>Q4</td>
<td>20.8 (1037)</td>
<td>10.1 (240)</td>
</tr>
</tbody>
</table>

F Test: 4.02 2.94 9.27 2.95 2.46

P Value: <0.01 0.03 <0.01 0.03 0.06

Note: HbA1c=Glycated Hemoglobin, FPG=Fasting Blood Glucose, BP=Blood Pressure, LDL-C=Low-Density Lipoprotein Cholesterol, UACR=Urine Albumin Creatinine Ratio

* Quartiles are calculated based on # of diabetic patients per RN (displayed in Table 6.3). Q1 is defined as practices with less than 90 diabetic patients per RN (n=3) (i.e. lowest diabetic patient to RN ratio), Q2 is defined as practices with 91-152 diabetic patients per RN (n=4), Q3 is defined as practices with 152-310 diabetic patients per RN (n=3), Q4 is defined as practices with greater than 311 diabetic patients per RN (n=3) (i.e. highest diabetic patient to RN ratio).

†Significantly different compared to Q4 (p<0.05) (ANOVA)

In the primary care setting, different models of care delivery have been implemented to improve the delivery of healthcare services to patients with chronic diseases (30,31). Within these models of care, the implementation of nursing human resources has varied across practice settings. This study sought to explore whether variations across FHT practice locations in the types of nursing providers present are associated with the management of patients with Type 2
diabetes, as measured by diabetes outcome indicators. The findings from this study indicated that there are considerable variations across FHTs in terms of the percentage of patients with diabetes who have the recommended diabetes management tests completed and on-target. In addition, across all practice locations, nearly half of patients that had the recommended diabetes management tests completed did not have their measurements on-target. This study also identified that the observed variability in the percentage of patients with diabetes measurements on-target across FHT practices was associated with the presence of different nursing providers.

Although the overall percentages of patients having recommended diabetes management tests completed and on-target within our study were generally low, the findings align with existing literature. A population-based study conducted in eastern Ontario explored HbA1c testing and reported that 58% of individuals with diabetes received recommended HbA1c testing, and of those tested, less than 50% had HbA1c levels on-target (32,33). In addition, it has been clearly documented in the literature that nurses across all regulatory designations are extensively involved in chronic disease prevention and management activities (15,16,34–42). However, few studies have specifically explored whether the presence of nurses within interdisciplinary primary care models are associated with improved chronic disease management, such as the management of Type 2 diabetes. The lack of much needed evidence that documents the unique contributions nurses make to chronic disease management is likely a result of challenges in outcome measurement (8,43). Thus, the present study sought to address this important gap in the literature and explore this relationship by using a large administrative database, namely the CPCSSN.

With respect to NPs, it is important to note that the findings from the present study differ from existing literature that has shown positive effects of the NP role within primary care. For instance, within Ontario, the presence of at least one NP in a primary care practice was associated with high-quality chronic disease management care (17). Also, larger studies have demonstrated that practices with NPs deliver better diabetic care than those with physicians alone or those employing physicians and physician assistants (35,44,45). The contradicting findings might be
explained by several factors associated with this particular study. For instance, NPs do not have unique identification codes within the EMRs and therefore we could not determine the extent of involvement the NPs had in the delivery of diabetic care. Also, the presence of NPs within FHT models of care was considerably low (range 0 to 3 per practice location). Given the inability to directly link NP care to patient care and the small presence of NPs within the practice models, findings from the present study should be interpreted with caution. Future studies should also explore whether the overall composition of the team is associated with the percentage of patients that have diabetes management tests completed and on-target. In addition, it is possible that the NPs within practices included in this present study were not engaging in diabetic management care that could influence whether HbA1c or LDL-C measurements were on-target. Barriers preventing NPs from practicing to their full scope have been well documented in the literature, such as physicians’ lack of understanding of the NP role and employer restrictions placed on NPs preventing them from utilizing their full scope of practice (43). Conversely, the NP, in accordance with the expanded role, may be more disproportionately involved in diagnostic and medical management of the patient with diabetes; leaving less time for the support of other chronic disease management strategies. As a result of these factors, NPs roles across practices may fall into the typical role of a RN, as well as providing care consistent with their NP role. This variability of role implementation and team structure potentially influences the team ability to effectively provide and manage diabetic care. Future studies should explore this important relationship and determine whether specific roles or processes of NPs within FHTs are associated with improved diabetes outcome indicators.

Within Canada, the literature examining the relationship between models of care that incorporate RNs and health outcomes of patient with diabetes is sparse. Nevertheless, the positive relationships between the presence of RNs in FHTs and health outcomes of patients with diabetes are consistent with literature that has been conducted in the primary care setting in other countries. Griffiths et al. (2010) conducted a cross-sectional study using existing national
databases from the United Kingdom to determine the association between the number of RNs within a primary care practice and clinical outcome performance indicators. Higher nurse staffing levels were significantly associated with improved outcome performance of diabetes, hypertension, chronic obstructive pulmonary disease, and coronary heart disease care, and decreased hospital admissions for asthma and chronic obstructive pulmonary disease (46). Similar findings have also been made outside of the primary care setting and within other disciplines. For instance, Kane et al. (2007) conducted a systematic review to explore studies that investigated the association between RN staffing and nursing-sensitive patient outcomes as a measure of quality of care within acute care settings in the United States. Overall, a greater number of RNs in hospitals was significantly associated with reduced adverse events, including patient mortality, hospital acquired pneumonia, and shorter lengths of stay (8). With respect to physicians, smaller patient to physician ratios have also been associated with improved diabetic care (17). Although it may not be surprising that better care is associated with smaller patient to provider ratios, demonstrating this relationship quantitatively using large datasets is important to help inform policy-makers making decisions regarding primary healthcare reform.

The relationship between FHT practices with at least one RPN and diabetic outcomes was not as clear as that of RNs. The presence of one or more RPNs in a FHT practice was associated with a decrease in the percentage of patients with HbA1c, BP, and LDL-C levels on-target, and an increase in the percentage of patients with UACR on-target. However, many of these associations were only significant for patients that had at least one additional chronic condition. The complexity of the diabetic patient might explain this observed relationship, given that RPNs typically care for more stable and less complex patients than RNs and NPs (47). Moreover, we know there is substantial overlap between RNs and RPNs with regards to their roles in primary care (37; Chapter 5, Manuscript 3) making it difficult to clearly differentiate unique contributions of each role.

6.4.1 Strengths
This is the first known study to utilize the CPCSSN database to explore relationships between FHT models of care employing different nursing providers and health outcomes of patients with Type 2 diabetes in Ontario, Canada. Previous studies exploring the relationship between organizational characteristics, such as nursing human resources, have relied on patient data obtained from chart abstraction. In addition, given that the quality of chronic disease management is associated with the organization of a practice in which patients receive care, a clear strength of this study was the ability to explore patient outcomes using the CPCSSN database in the context of nursing, which is a central component of primary care organizations. Furthermore, this study demonstrated that organizational data available at a practice location-level can be feasibly linked to patient data within the CPCSSN database, which is organized at a site-level. The establishment of this linkage is important for future studies exploring the heterogeneity in organizational attributes across primary care practice locations. Importantly, the ability to explore relationships between nurse staffing and patient health outcomes using a large administrative database is a vital step towards demonstrating nurses’ added value within primary care settings in Canada. In the future it will be important to conduct larger studies of a similar nature to better understand which attributes of different models of care best support the management of patients with chronic diseases, such as Type 2 diabetes.

6.4.2 Limitations

Despite these strengths, there are limitations that should be noted. Low rates of diabetes test completion could be a result of providers incorrectly or not documenting care in the patient’s EMR. Furthermore, we were unable to determine whether the low percentage of test completion was a result of providers not ordering the test or a patient’s decision to not undergo recommended testing. In addition, the sample used in this study (n=15 FHT practices) may not be representative of other FHTs in Ontario and the functions of nurses within those practices. Given that the unit of analysis in this study was the practice location and was quite small (i.e. n=15 practice locations), the number of covariates included in the logistic regression models had to be
carefully considered. Although patient characteristics that can affect the management of Type 2 diabetes, such as age, sex, and presence of additional chronic conditions, were included as covariates in the logistic regression model, future studies that are large in nature should explore whether other patient, provider, and organizational variables affect the observed relationships between FHT models incorporating different nurse providers and diabetic patient outcomes. Patient variables related to the date of onset of diabetes, and social determinants of health, such as income and education, and provider information, such as years of experience, that can affect chronic disease management, are not yet readily available within the CPCSSN database and therefore were not included in the analysis. Additional organizational variables that can affect the management of Type 2 diabetes, such as the presence of other healthcare providers, extended opening hours, and EMRs that support patient registries, recall, and reminder systems (48), should also be explored as covariates in future studies. Also, unlike physicians, nurses do not have unique identification codes to use in EMRs, and therefore it was not possible to determine whether patients in practices had any direct contact with the various nursing providers included in the study (i.e. the specific roles of nurses were not be evaluated). Taken together, although this study identified important relationships between models of care that employ different nursing providers and diabetic health outcomes, the findings should be interpreted with caution and larger studies should be performed.

6.5 Conclusion

Type 2 diabetes is increasingly being managed within the primary care setting using interdisciplinary team structures, such as FHTs (49,50). This study provides valuable information about the impact of FHT models of care that employ nurses on patients living with diabetes. More specifically, this study identified that FHT models of care that incorporated at least one RN were associated with better diabetic care. Despite the limitations associated with this study, these findings provide a foundation for further exploration of the effectiveness of the nursing role within primary care. The need to better understand nursing contributions within this setting and
how to best organize team structures and processes to optimize nursing roles was clearly identified by this study. Nurses have the highest proportion of patient interactions among all healthcare providers (51) and are well positioned within primary care to improve the effectiveness and efficiency of healthcare delivery. Redesign of primary care delivery models must take these findings into consideration and ensure nurses are a central component in new strategies and innovations. Future research should focus on further understanding the relationships identified in the present study and explore nursing within the larger context of the primary care team. The effects of nurses on outcomes related to chronic conditions other than diabetes should also be explored.

6.6 Competing Interests

The authors have no competing interest to disclose.

6.7 Acknowledgements

The authors would like to acknowledge Rachael Morkem (Research Associate, CPCSSN) for her assistance with data collection and Shahriar Khan (Senior Data Analyst, CPCSSN) for his assistance in preparing the CPCSSN database that contained the patient-level data utilized in this study.
6.8 References


Chapter 7

General Discussion

7.1 Summary of Main Findings

7.1.1 Nursing Contributions to Primary Care

One of the main objectives of this thesis was to determine the nature and range of activities performed by nurses of different regulatory designations working in primary care. The data presented in Chapter 3, Manuscript 1 and Chapter 5, Manuscript 3 demonstrated that nurses engage in a wide range of activities within the primary care setting in Ontario, many of which support chronic disease management. Taking vital signs, providing immunizations/vaccinations, performing wound care, obtaining smoking history, providing education on smoking use, physical activity, and diet, and following-up with specific patient groups, such as those with chronic diseases, were identified as the most common activities performed across all nursing regulatory designations in both of these studies. Importantly, there were many nurses who were not undertaking important activities that support chronic disease management and there was considerable overlap between the roles of nurses within different regulatory designations, suggesting that there is an opportunity for optimizing nursing roles within this setting. In fact, 40% of the respondents from the provincial nursing survey reported that they did not have a clear job description and 25% of respondents reported that they did not practice within their scope of practice.

The above findings are consistent with other research that has been conducted worldwide. Many studies have identified that nurses may not practice to their full scope of practice within the primary care setting and that they often engage in tasks that do not utilize their nursing knowledge or skill-set, such as clerical work, stocking supplies, and cleaning equipment (1–4). Role confusion between different nurse providers and other members of the healthcare team is a well-established issue within the primary care setting (1,2,5–7). When the roles of individuals in a
healthcare team are not well defined, improper role implementation and ineffective integration of different types of healthcare professionals may compromise patient care (8,9). Therefore, it is imperative that nursing roles be clarified within the primary care setting to avoid role confusion. As well, primary care organization structures and processes need to support the optimization of the nursing role within the context of the interdisciplinary team.

7.1.2 Evaluation of Nursing Contributions within Primary Care

As the organization of primary care moves toward more interdisciplinary team structures, it is imperative that nurses demonstrate their contribution to patient care amongst a variety of other healthcare providers present within this setting (10–13). Performance measurement is an essential component of nursing care that can provide accountability to nursing practice (11,14). A diverse set of outcomes deemed reflective of nursing care have been identified through the combined efforts of many researchers across the globe. However, much of this work has focused on nursing care within the acute care, complex-continuing care, long-term care, and home care settings (15–18). For example, research conducted within the United Kingdom has identified three outcomes that can be used to measure the contribution of Registered Nurses (RNs) to patient care and patient outcomes within the acute care setting. These indicators include the prevention of falls, incidence of pressure ulcers, and protection from infection. This research also identified 11 nursing-sensitive indicators that are unique to the nursing care provided within ambulatory chemotherapy settings. These indicators are currently undergoing further testing to identify their sensitivity to nursing care (19). In Canada, five nursing-sensitive outcomes have been developed and are voluntarily being collected within the provinces of Ontario, Saskatchewan, and Manitoba. These outcomes have been identified to be relevant for adult populations within the acute care, complex-continuing care, long-term care and home care settings, and include functional status, symptom status (i.e. pain, nausea, dyspnea, fatigue), therapeutic self-care (i.e. readiness for discharge), patient safety/adverse occurrences (i.e. pressure ulcers, falls), and patient satisfaction with nursing care. These outcomes were chosen
because they have clear definitions, there is empirical evidence linking them to nursing interventions, and they have valid and reliable measures, thus enabling them to reflect the performance of the nursing profession. Recently, physiological distress, healthcare utilization, and mortality rate were also identified as nursing-sensitive outcomes within these settings (15,18).

To address the need for studies demonstrating the contribution of nurses to patient care within the primary care setting, this thesis explored relationships between nurse staffing and health outcomes of patients with Type 2 diabetes. Chapter 6, Manuscript 4 is the first known study that has explored this relationship utilizing a large administrative dataset in Ontario, Canada, namely the Canadian Primary Care Sentinel Surveillance Network (CPCSSN). Overall, the findings indicated that practices that employ at least one RN exhibited better diabetic care than those that did not have any RNs within their practice. Although there is little research that has been conducted on this topic, a similar relationship between nurse staffing and patient outcomes was found within the primary care setting in the United Kingdom (20). Griffiths et al. (2010) conducted a cross-sectional study in the United Kingdom to explore the association between the number of RNs within a primary care practice and clinical outcome performance indicators. Higher nurse staffing levels in a primary care practice were significantly associated with improved diabetes, hypertension, chronic obstructive pulmonary disease, and coronary heart disease care, and decreased hospital admissions for asthma and chronic obstructive pulmonary disease (20). Similarly, within the acute care setting, a systematic review that explored studies that investigated the association between RN staffing and nursing-sensitive patient outcomes as a measure of quality of care in the United States, found that a greater number of RNs in hospitals was significantly associated with reduced adverse events, including patient mortality, hospital acquired pneumonia, and shorter lengths of stay (17). Reductions in adverse events and length of stay are associated with substantial cost savings, suggesting that nurses may improve the cost efficiency of patient care (21). Taken together, these findings have identified a beneficial
relationship between nurse staffing and patient outcomes and set a foundation for further
evaluation of the contribution of nurses within the context of the healthcare team to patient care
across healthcare settings.

7.1.3 Organizational Attributes within Primary Care

Chronic diseases, such as Type 2 diabetes, are increasingly being managed within the
primary care setting (22–27). Although certain primary care organizational attributes have been
shown to affect the overall management of patients with Type 2 diabetes within this setting
(28,29), there is currently no method of obtaining national data to describe the distribution and
nature of these organizational attributes. Given that the primary healthcare system is continuously
undergoing changes as part of reform initiatives, there is a growing need to collect high-quality
data regarding organizational attributes to aid in the measurement and evaluation of strategy
implementation (30,31).

The present thesis addressed this issue and identified a variety of data collection tools that
could be used to measure organizational attributes within the primary care setting (Chapter 4,
Manuscript 2). The most comprehensive data collection tool identified in the systematic search
and review, namely the “Measuring Organizational Attributes of Primary Health Care Survey”
(32), was then used to acquire important information about the distribution of organizational
attributes across primary care practices in eastern Ontario (Chapter 5, Manuscript 3). Data from
the “Measuring Organizational Attributes of Primary Health Care Survey” demonstrated that
there is heterogeneity in organizational attributes across primary care practices in eastern Ontario.
For instance, primary care services such as venipuncture, point-of-care testing, pulmonary
function testing, and intrauterine device insertion were not consistently available across primary
care practices. Although the majority of practices reported to have processes for systematic
patient chronic disease management and follow-up, certain conditions were not uniformly
represented across practice locations, including heart failure, asthma, osteoarthritis, and chronic
pain. The heterogeneity in chronic disease management strategy implementation was apparent in
the provincial nursing survey study as well, specifically with respect to the underrepresentation of chronic disease management programs for asthma, heart failure, and arthritis, which aligns with the existing literature on this topic (33). Also, although nearly all practice locations that completed the organizational attribute survey reported to be engaging in important chronic disease management activities, there were certain activities that have been associated with improved health outcomes that were not being performed by all practices, such as goal-setting, an element of the self-management process, and utilizing a flow sheet or system to track critical elements of care (29,34–38).

7.2 Strengths and Limitations

There are several strengths and limitations associated with this thesis that should be noted. First, the cross-sectional nature of the studies did not allow for any causal conclusions to be drawn. Also, with respect to the provincial nursing survey, the low response rate (18.8%) and the inability to sample all primary care nurses in Ontario limited the generalizability of the study findings. Similarly, the sample utilized for the organizational attribute survey, discussed in Manuscript 3 and Manuscript 4, was limited to a relatively small number of primary care practices located in eastern Ontario, thus limiting the overall generalizability of the findings. Another major limitation related to the use of the CPCSSN database in Chapter 6, Manuscript 4 and the quality of the data that was collected from primary care practices. Certain practices did not fully document all aspects of diabetic care within their electronic medical records (EMRs) resulting in missing data and exclusion from the fourth manuscript. Furthermore, the CPCSSN extracts patient data based on physician identification codes, as nurses do not have unique identifiers to document within EMRs. Therefore, it was not possible to determine or capture information on the specific activities that nurses performed on a regular basis within practices.

A clear strength of the provincial nursing survey and the organizational attribute survey was the inclusion of all nursing regulatory designations. Specifically, with respect to the nursing
survey, respondents included Nurse Practitioners (NPs), RNs, and Registered Practical Nurses (RPNs). With respect to the organizational attribute survey, modifications were made to items that related to nursing to incorporate all regulatory designations (i.e. NPs, RNs, RPNs). Furthermore, given that EMRs do not capture individualized practice-level characteristics which may lead to variations in patient outcomes, a major strength of this research was the successful collection (93% response rate) of practice-level data from practices affiliated with the CPCSSN that can be used to better understand patient outcomes observed across participating practice locations. The online administration of the organizational attribute survey and the utilization of the CPCSSN databases minimized the overall costs required to conduct the study as well. In addition, this thesis is the first known study that has implemented the newly developed organizational-level questionnaire, “Measuring Organizational Attributes of Primary Health Care Survey” (32). This thesis is also the first known study that has utilized CPCSSN data to explore relationships between nurse staffing within the primary care setting in Ontario and health outcomes of patients with type 2 diabetes. Both of these contributions to the literature set the groundwork for future exploration of organizational attributes and nursing contributions in primary care settings across Ontario.

7.3 Future Research Directions

The studies included in this thesis demonstrate the feasibility of using CPCSSN to conduct larger studies that can provide pan-Canadian evaluations of patient outcomes related to chronic disease management. The data acquired from the organizational attribute survey conducted in Manuscript 3 is not specific to diabetes and thus, a clear direction for future research involves the linkage of the organizational-level data to patient outcome indicators associated with other chronic conditions available within the CPCSSN database (i.e. hypertension, osteoarthritis, chronic obstructive pulmonary disease, depression, Alzheimer’s disease and related dementias, epilepsy, Parkinson’s disease) (39). Specifically, the contributions of different nurse providers on the care of individuals with other chronic conditions should be explored, and the optimal ratio and
skill-mix of different nursing providers, family physicians, and other healthcare professionals in primary care needs to be investigated in future studies (12,13,40). Although data acquired through the organizational attribute survey captured some of this information, larger studies should be conducted in the future to address this important topic. Also, in addition to the organizational-level variables discussed in this thesis, there were many other variables that were collected from the organizational attribute survey that should be explored in-depth. For example, the survey collected information on accessibility and processes that support communication and transitions between the participating primary care practices and other healthcare settings, both of which are important areas of study in Canada (10,30). Furthermore, this study utilized the recently developed “Measuring Organizational Attributes of Primary Health Care Survey” (32), another clear direction for future research will be to review the items within the survey, to analyze the quality of responses obtained within the present study, and to make recommendations that might improve the quality of data acquired, should this tool be used in future studies.

Another important direction for future research identified by this thesis is the need to establish a provincial and/or national strategy to collect high-quality data reflective of nursing practice within the primary care setting. There are several existing approaches used to collect information from either physicians or patients within the primary healthcare system in Canada to help monitor and evaluate progress with overall reform initiatives and to identify potential strategies that support high-quality care, namely the National Physicians Survey (41) and the Commonwealth Fund International Survey of Primary Care Doctors (42). Given that nurses form the core of primary care teams, future research should focus on establishing a strategy to acquire high-quality data from nurses in this setting as well, which in turn could be used to help create interventions and implement strategies centered around nursing care to better support high-quality care within the primary care setting. Currently, the Health Outcomes for Better Information and Care (HOBIC) initiative is being used to collect nursing-sensitive outcome data in Ontario to provide researchers with the opportunity to investigate the effect that nursing practice has on
patient outcomes within settings outside of primary care, including acute care, complex-continuing care, long-term care, and home care settings. The HOBIC project is an initiative funded by the Ontario Ministry of Health and Long-Term Care that was originally developed in 1999 in response to the downsizing and restructuring of the healthcare system (15,18,43,44). Similarly, the Canadian-HOBIC initiative, based on the HOBIC project, is being implemented in Manitoba and Saskatchewan to capture nursing-sensitive outcome data within acute care, complex-continuing care, long-term care, and home care settings (18). These initiatives could potentially be used as a platform for the development of a strategy to collect nursing related data within the primary care setting. Other potential strategies that could be employed are the creation of unique nursing identification codes for documentation within EMRs or the development of an annual survey administered to nurses who work in the primary care setting that collects valuable information about their experiences with the primary healthcare system. Overall, it is essential that linkage between existing or new sources of data that provide information about nurses within primary care and large, population-based datasets continue to be performed to demonstrate the significant contributions that nurses have within the primary care setting. This is particularly important for RNs, as they are continuously being replaced by less skilled healthcare providers (45).

Documents that have been created to help guide the implementation of nurses within different primary healthcare settings should be reviewed and amended to ensure that there are clear recommendations that make distinctions between nursing regulatory designations. For instance, the Ministry of Health and Long-Term Care developed role definitions for various non-physician healthcare providers to help guide their implementation into Family Health Teams. Within this document, the roles of RNs and RPNs are consolidated into a single description, creating unclear role descriptions between both of these nurse providers (46). Similarly, in a published report regarding nursing employment in Canada, the Canadian Institute for Health Information (2014) included both RNs and NPs in their definition of a RN (47). Unclear
distinctions between nursing designations in reports such as these contribute to role confusion and should be addressed in future studies. This research is also relevant to the planning of healthcare services for individuals with chronic diseases, and will provide information that can be used to help modify or develop a model to support the evaluation of nursing roles within the primary care setting and delivery high-quality type 2 diabetes management within primary care. In order to complete these proposed research activities, partnerships between researchers, nursing organizations, nursing interest groups, and practicing healthcare providers that share a similar vision to enhance the nursing role within primary care and demonstrate significant nursing contributions within primary care should be established.

7.1 Candidate’s Contributions

For each manuscript contained within this thesis, I played a fundamental role in the development and creation of the research questions that were pursued. This required comprehensive synthesis and critical appraisal of existing literature to identify gaps and formulate clear study rationales and research objectives. I also performed data acquisition and analysis for both the provincial nursing survey and organizational attribute survey, and was chiefly responsible for the successful completion of the systematic search and review of organizational attribute data collection tools. Furthermore, I independently wrote each manuscript included within this thesis with editorial contributions from my supervisor and committee members.

Through the completion of these activities, I have acquired important research skills that will be fundamental to my success as an independent nurse researcher. I have demonstrated a strong understanding of different types of reviews, including systematic reviews, scoping reviews, and systematic search and reviews, and have independently and effectively executed a systematic research and review from beginning to end. I possess a solid understanding of cross-sectional study designs and the challenges associated with primary data collection, and have acquired the ability to link datasets and conduct analyses using a large, administrative database. Furthermore, based on research completed as part of this thesis, I have prepared many conference abstracts and
independently delivered several presentations at local, provincial and national conferences. This demonstrates my understanding of the importance of continuously engaging in knowledge translation activities and has provided me with opportunities to improve my communication and presentation skills. With assistance from my supervisor, I have also prepared numerous applications for various research awards, including the Ontario Graduate Scholarship and Canadian Institutes of Health Research Doctoral Research Award, which has provided me with valuable writing experience that I will build upon through my future career as a nurse researcher.

7.2 Conclusion

As team-based structures are becoming more prominent, there is a growing need to clearly identify nursing contributions to primary care delivery. Nurses are well positioned to influence patient outcomes within primary care, however the unique contributions of nurses to patient outcomes have yet to be firmly established within this healthcare setting. The studies presented within this thesis identified important findings that increase our understanding of the organization of primary care and begin to demonstrate the significant contributions that nurses make within the primary care setting. Nurses were found to undertake a wide range of roles and responsibilities within the primary care setting, many of which overlapped across regulatory designations. Importantly, the presence of RNs was associated with improved diabetic care. In the future it will be important to extend these findings to a larger-scale and utilize the variability in primary care organizational attribute implementation across jurisdictions and provinces to further understand their effect on chronic disease management within primary care.
7.3 References


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