The association of primary care continuity with avoidable emergency department visits and hospitalizations for older adults living in Québec: An inverse probability of treatment weighting analysis

Giovanna Busa, BSc
Department of Epidemiology, Biostatistics and Occupational Health
Faculty of Medicine and Health Sciences
McGill University
Montreal, Québec, Canada
2023

This thesis is submitted to McGill University in partial fulfillment of the degree of Master of Science in Epidemiology

Abstract

Background: Avoidable hospitalizations, which refer to hospitalizations for a condition that could have been prevented with appropriate and effective primary care, disproportionally occur among older adults. Indeed, about half of avoidable hospitalizations occur among older adults and this number could be on the rise given Canada's population aging. The high prevalence of avoidable hospitalizations may signify issues in treating older adults in the primary healthcare system. One avenue to prevent avoidable hospitalizations is primary care continuity which enables better management of long-term conditions and allows for earlier detection and treatment of acute events and in turn, prevents avoidable hospitalizations. Scant studies have accurately accounted for confounding when studying the impact of primary care continuity on avoidable outcomes. In addition, the association between primary care continuity and avoidable hospitalizations has been seldom explored in Québec. This study aims to measure the association between primary care continuity and avoidable emergency department visits and avoidable hospitalizations among older adults.

Design: Retrospective cohort (2005-2016), with inverse probability of treatment weighting using propensity scores.

Data: The Care Trajectories-Enriched Data (TorSaDE) cohort, which links patient-reported socio-demographic information from survey data (Canadian Community Health Survey) with Québec provincial health administrative data (Régie de l'assurance maladie du Québec (RAMQ)).

Inclusion: Participants (n= 15,256) were 65+ years old and had ≥ 2 primary care visits in the year prior to survey completion. Participants were followed for 1 year, or until death.

Exposure: High or low relational primary care continuity as defined by the validated Usual Provider of Care Index (UPC) and measured during the year prior to CCHS completion.
Outcome: Measured during 1 year after CCHS completion. Primary: high or low avoidable emergency department visits and hospitalizations as defined by a validated list of ambulatory care-sensitive conditions. Secondary: High or low all-cause emergency department visits or hospitalizations.
Results: Among the 15,256 respondents, the mean age was 74.41 years (Standard deviation (SD)=6.95) and 59.2% were female. The average number of visits per year with a general physician were 4.36 (SD=3.17) and the average UPC score was 0.87(SD=0.20). Among the respondents, 65% had high primary care continuity; this subgroup was characterized by a higher prevalence of men and residents in rural areas and of lower household income and greater medical need. The weighted sample was balanced by covariates and thus there were only negligible differences between the control and treatment group. There was a total of 10251 all-cause emergency department visits, 5135 all-cause hospitalization visits, 1186 Ambulatory Care Sensitive Condition (ACSC) emergency department visits, and 542 ACSC hospitalizations. Thus, approximately 12 % of all emergency department visits and 11% of all hospitalizations were potentially avoidable. 5198 (34%) and 3412 (22%) of respondents experienced at least one emergency department visit or hospitalization respectively. 864 (5.7%) respondents experienced at least one ACSC emergency department visits while 308 (2.0%) experienced at least one ACSC hospitalization. High primary care continuity was associated with lower odds of all-cause hospitalization 0.935(95% confidence interval, CI [0.875-0.999] $p < 0.05$) but not all-cause emergency 0.976 (95% CI [0.921-1.035] $p = 0.422$). High primary care continuity was associated with a higher odds of avoidable emergency department visits but not associated with avoidable

hospitalizations. The odds ratios were 1.131 (95% CI [1.002-1.276] $p<0.05$) and 1.127(95%CI [0.923-1.376] respectively.

Conclusion: High primary care continuity may be an avenue for reducing hospitalizations for older adults in Québec, but more research is needed to understand its influence on avoidable outcomes.

Résumé

Contexte : Les hospitalisations évitables, c'est-à-dire les hospitalisations pour une pathologie qui aurait pu être évitée grâce à des soins primaires appropriés et efficaces, touchent de manière disproportionnée les personnes âgées. En effet, environ la moitié des hospitalisations évitables se produisent chez les personnes âgées et ce chiffre pourrait être en augmentation compte tenu du vieillissement de la population canadienne. La forte prévalence des hospitalisations évitables pourrait être un signe de problèmes dans le traitement des personnes âgées dans le système de soins de santé primaire. L'un des moyens de prévenir les hospitalisations évitables consiste à assurer la continuité des soins primaires en permettant une meilleure gestion des affections de longue durée ainsi qu'une détection et un traitement plus précoces des événements aigus, ce qui permet de prévenir les hospitalisations évitables. Peu d'études ont pris en compte avec précision les facteurs de confusion lorsqu'elles ont étudié l'impact de la continuité des soins primaires sur les résultats évitables. De plus, l'association entre la continuité des soins primaires et les hospitalisations évitables a été rarement explorée au Québec. Cette étude vise à mesurer l'association entre la continuité des soins primaires et les visites à l'urgence et les hospitalisations évitables chez les personnes âgées.

Conception : Cohorte rétrospective (2005-2016), avec pondération de la probabilité inverse de traitement à l'aide de scores de propension.

Données: La cohorte de Trajectoire de Soins-Données Enrichies (TorSaDE), qui couple les informations sociodémographiques déclarées par les patients à partir de données d'enquête (Enquête sur la santé dans les collectivités canadiennes (ESCC)) aux données administratives provinciales sur la santé du Québec (Régie de l’assurance maladie du Québec (RAMQ)).

Inclusion: Les participants (n= 15 256) étaient âgés de 65 ans et plus et avaient effectué ≥ 2 visites de soins primaires au cours de l'année précédant la réalisation de l'enquête. Les participants ont été suivis pendant un an ou jusqu'à leur décès.

Exposition: continuité relationnelle élevée ou faible des soins primaires, telle que définie par l'indice validé de continuité avec le médecin habituel (UPC) mesurée au cours de l'année précédant la réalisation de l'ESCC.

Outcomes : Mesuré pendant un an après l'achèvement de l'ESCC. Primaire : nombre élevé ou faible de visites aux urgences et d'hospitalisations évitables, telles que définies par une liste validée de conditions sensibles aux soins ambulatoires. Secondaire : nombre élevé ou faible de visites aux urgences ou d'hospitalisations toutes causes confondues.

Résultats : Parmi les 15 256 personnes sondées, l'âge moyen était de 74,41 ans (écart-type (ET)=6,95), 59,2 % étaient des femmes. Le nombre moyen de visites par an avec un omnipraticien était de 4,36 (ET= 3,17) et le score UPC moyen était de 0,87 (ET=0,20). Parmi les personnes interrogées, 65 % avaient une continuité élevée en matière de soins primaires, et ce groupe se caractérisait par une prévalence plus élevée d'hommes et de résidents de zones rurales, ainsi que par des revenus du ménage plus faibles et des besoins médicaux plus importants. L'échantillon pondéré était équilibré en fonction des covariables et il n'y avait donc que des différences négligeables entre le groupe de contrôle et le groupe de traitement. Il y a eu un total de 10251 visites aux urgences 5135 hospitalisations 1186 visites aux urgences en raison d’une conditions propices aux soins ambulatoires (CPSA) et 542 hospitalisations en raison d’une CPSA. Donc, environ 12 % de toutes les visites aux urgences et 11 % de toutes les hospitalisations étaient potentiellement évitables.5198 (34%) et 3412 (22%) des personnes

sondées ont eu au moins une visite aux urgences ou une hospitalisation respectivement. 864 (5,7 %) des personnes ont eu au moins une visite aux urgences d'une CPSA tandis que 308 (2,0 %) ont eu au moins une hospitalisation d'une CPSA Une continuité élevée des soins primaires était associée à une probabilité plus faible d'hospitalisation toutes causes confondues 0,935 ((intervalle de confiance (IC) 95 % [0,875-0,999] p <0,05) mais pas de visite à l'urgence toutes causes confondues 0,976 (IC 95 % [0,921-1,035] p= 0,422). Une continuité élevée des soins primaires était associée à une probabilité plus élevée de visites évitables aux urgences, mais pas d'hospitalisations évitables. Les rapports de cotes étaient respectivement de 1,131 (IC 95 % [1,002-1,276] p<0,05) et de 1,127 (IC 95 % [0,923-1,376]).

Conclusion : Une continuité élevée des soins primaires pourrait être un moyen de réduire les hospitalisations chez les personnes âgées au Québec, mais des recherches supplémentaires sont nécessaires pour comprendre son influence sur les résultats évitables.

Thesis organization

This thesis contains six main chapters. Chapter 1 provides and introduction of the thesis topic. Chapter 2 includes a comprehensive review of the relevant literature on primary care continuity, avoidable emergency department use, and hospitalizations. It provides an overview of Québec's primary healthcare, definitions of pertinent concepts and terms, a conceptual model, and a literature review of known predictors associated with primary care continuity and/or the risk of avoidable emergency department use and hospitalizations. Chapter 3 includes the thesis objective and hypothesis. Chapter 4 and 5 feature the body of the thesis, including the methodology and results respectively. Chapter 6 concludes with a comprehensive scholarly discussion of the findings and their relevance for policy development and future research.

Contribution of Authors

I, Giovanna Busa, conceptualized the objectives and studies design and drafted the entire thesis. I was responsible for leading this study. I conducted the literature review, data manipulation, and statistical analysis.

Dr. Amélie Quesnel-Vallée supervised the production of this thesis and was involved in the study's conceptualization and design, editing, providing feedback and suggestions for all manuscripts, and supporting chapters throughout the whole production process.

Dr. Isabelle Vedel co-supervised the production of this thesis. She was involved in the study's conceptualization and design, editing, providing feedback and suggestions for all manuscripts, and supporting chapters throughout the whole production process.

Dr. Isabelle Dufour was an active member supporting the statistical components of the research. Given her extensive knowledge of and experience working with the database, she consulted on algorithm building and statistical analyses.

Dr. Claire Godard-Sebillotte was an active member of the thesis committee, provided feedback on the conceptualization and design, and revised chapters of this thesis critically for important intellectual content.

Dr. Erin Strumpf was an active member of the thesis committee, provided feedback on the conceptualization and design, and revised chapters of this thesis critically for important intellectual content**.**

Acknowledgments

Thank you to the Department of Epidemiology, Biostatistics, and Occupation Therapy and the Graduate Award Program through the Department of Equity, Ethics, and Policy for providing me with incredible learning opportunities. I'm grateful for all the knowledge I acquired during my master's degree.

I would like to sincerely thank my supervisors, Dr. Quesnel-Vallée and Dr. Vedel. I am grateful for their guidance and support both academically and emotionally throughout my thesis. Especially, Amélie, who showed constant compassion towards me and trusted my abilities as a researcher. In addition, they encouraged me to pursue extracurricular experiences which greatly added to my graduate experience. I look forward to collaborating with them again in the future.

Thank you to Dr. Srumpf and Dr. Godard-Sebillotte for their expertise as thesis committee members. They motivated me to perform to the best of my abilities. I wish to express my gratitude to Dr. Dufour. Her feedback immeasurably improved my thesis. Thank you, Dr. Rachel McKay, for your critiques and attention to detail.

Thank you to the members of the ROSA Team for their passionate discussions, feedback, and expertise on Québec's health care services and geriatrics.

To the Ph.D. students, Clara, Michaela, and Divine-Favour, I appreciate your mentorship and kindness.

To my cohort. It was a pleasure to meet so many intriguing students from diverse backgrounds. I'm especially thankful for Nora, Diana, Soukaina, and Sara, who are great collaborators, teachers, and friends to me.

Last but not least, I would like to thank my parents, Natale and Brigida Busa, my brother, Pasquale, my extended family, friends, and my better half, François, for their love and support.

Table of Contents

List of Tables

List of Figures

List of Abbreviations and Acronyms

ACSC	Ambulatory care sensitive condition
CBC	Canadian Broadcasting Corporation
CCHS	Canadian Community Health Survey
CHA	Canada Health Act
CDC	Centers for Disease Control and Prevention
CI	Confidence interval
CIHI	Canadian Institute for Health Information
CIHR	Canadian Institute for Health Research
ED	Emergency department
FMG	Family medicine group
GP	General physician
ICD	International Classification of Diseases
ISQ	Institut de la Statistique du Québec
IPTW	Inverse probability of treatment weighting
LCI	Lower confidence interval
NRC	National Research Council
OR	Odds ratio
PCC	Primary care continuity
PHC	Primary healthcare
QC	Québec
RAMQ	Régie de l'assurance maladie du Québec
RCT	Randomized control trial
RECORD	REporting of studies Conducted using Observational Routinely collected health Data
SD	Standard deviation
SMD	Standard mean difference
STROBE	Strengthening the Reporting of Observational Studies in Epidemiology
TorSaDE	The Care Trajectories-Enriched Data
UCI	Upper confidence interval
UPC	Usual Provider of Care
WHO	World Health Organization

Chapter 1: Introduction

Worldwide, people today live on average twice as long as they did in the nineteenth century (Roser et al., 2013). Globally, as of 2020, the number of people 60 years old and older has outnumbered children younger than 5 years old (World Health Organization WHO, 2021). Consequently, the distribution of the population has shifted towards older ages, a phenomenon known as population aging. Because of worldwide population aging, the World Health Organization (WHO) has launched a global collaboration called "The Decade of Healthy Ageing (2021–2030)". The movement focuses on reducing health inequities and improving the lives of older people and their families and communities. One area of focus is "delivering person-centered integrated care and primary health services responsive to older people" (World Health Organization WHO, 2021).

Canada is not insulated from this global trend, and indeed, in 2016, for the first time in history, the Canadian census recorded a greater number of older adults (65 years old or older) than children under 15 years old (Statistics Canada, 2018). As of 2021, there are seven million Canadians 65 and older compared to six million children under 15 years older (Statistics Canada, 2022a). This is largely due to the aging of the Baby Boomer generation, a cohort of individuals born between 1946 and 1965, and the largest in Canadian history (Statistics Canada, 2022b). And this is still an ongoing process, as by 2030 (Statistics Canada, 2022c) about 25 percent of Canadians will be older adults and by 2050, the population of oldest adults will have tripled relative to 2021 (Statistics Canada, 2022b). Québec has the second largest population of older adults in Canada and has the highest proportion of oldest adults along with New Brunswick and Saskatchewan (Statistics Canada, 2022c).

This rapid population aging is expected to result in a commensurate increase in the prevalence of chronic diseases such as dementia, diabetes, and cardiovascular disease (National Research Council, 2001). In turn, these increased health needs will put pressure on the health system, unless we optimize health services caring for older adults (Fulmer et al., 2021; National Research Council, 2001).

One measure of health system performance is the rate of avoidable health services (Anderson, 1996; Canadian Institute for Health Information, 2023); health services that could have been potentially prevented with appropriate and effective primary care. A large proportion of emergency department visits and hospitalizations made by older adults are potentially avoidable (Billot et al., 2016; Sanmartin et al., 2011). Preventing avoidable health services not only improves patient outcomes and satisfaction, but it is also a cost-efficient intervention (Lin et al., 2017).

One strategy for preventing avoidable health services is by relational primary care continuity (PCC) which refers to the relationship between a physician and a patient that extends beyond specific episodes of illness (Haggerty et al., 2003; Hennen, 1975; Rogers & Curtis, 1980). Primary care continuity could reduce avoidable emergency and hospital use, through various means, such as, improving the management of chronic conditions, or improving the detection and treatment of acute exacerbations (Barker et al., 2017; Huntley et al., 2014). Essentially, maintaining primary care continuity can enable comprehensive primary care leading to a reduction of avoidable emergency department and hospital utilization.

Previous research on the association between primary care continuity and avoidable emergency department use and hospitalizations among older adults has certain limitations. These studies often fail to adequately consider causation or incorporate important sociodemographic

variables, potentially introducing biased results. Additionally, there is a scarcity of literature focused on the Canadian or Québec context.

It is, therefore, pertinent to comprehensively examine primary care continuity as a potential intervention to reducing avoidable emergency department visits and hospitalizations in a growing aging population. The objective of this thesis is to investigate the association of primary care continuity with the occurrence of all-cause emergency department visits, all-cause hospitalizations, avoidable emergency department visits, and avoidable hospitalizations among older adults residing in Québec. The study will employ a causal inference methodological approach, which balances the treatment and control group based on health administrative and sociodemographic information. This research marks an initial stride toward informing healthcare policies aimed at reducing avoidable emergency and hospital use among the older adult population in Québec and enhancing the quality of care provided to this growing population.

Chapter 2: Literature Review

2.1 Primary healthcare

2.1.1 Concepts and definitions related to primary healthcare

Primary Health Care (PHC) constitutes a theoretical framework that pertains to both the methodologies and principles governing the organization of healthcare. Within this comprehensive framework, PHC includes primary care, disease prevention, population health, health promotion, and community development. This approach is designed holistically to offer vital health services tailored to the needs of the community (Shoultz & Hatcher, 1997; World Health Organization, 1978).

Primary care is a constituent of PHC: "While primary care is distinct from PHC, the provision of essential primary care is an integral component of an inclusive PHC strategy" (Tarlier et al., 2003). Primary care is often defined as a model of care that supports first-contact, continuous, comprehensive, and coordinated care (also known as the 4C's model). It aims to optimize population health and reduce disparities across the population by ensuring that subgroups have equal access to services (Jimenez et al., 2021). Some authors also include person-centered care as the fifth component to the model (Bitton et al., 2018).

There are five core functions of primary care:

1. First contact creates a strategic entry point for and improves access to health services.
2. Continuity promotes the development of long-term personal relationships between a person and a health professional or a team of providers.
3. Comprehensiveness ensures that a diverse range of promotive, protective, preventive, curative, rehabilitative, and palliative services are provided in an appropriate context.

4. Coordination encourages the organization of services and care across levels of the health system and over time.
5. Person-centered care ensures that people have the education and support needed to make decisions and participate in their own care (Bitton et al., 2018; Jimenez et al., 2021).

This thesis will focus on continuity and comprehensiveness while also recognizing the core functions are inter-related to one another. And all five core functions of primary care are needed to ensure high quality primary care services.

2.1.2 Development of primary healthcare in Canada

The central aim of Canadian healthcare, as outlined in the 1985 Canada Health Act (CHA), is to "protect, promote and restore the physical and mental well-being of residents of Canada and to facilitate reasonable access to health services without financial or other barriers" (Canada Department of Justice, 1985). The federal government ensures adherence to this goal, mandating that all citizens and legal residents in Canada be provided "reasonable access to medically necessary hospital, physician, and surgical-dental services that require a hospital." This is implemented by allocating financial resources to provinces and territories through the Canada Health Transfer based on their fulfillment of specific "criteria and conditions related to insured health services and extended health care services" (Canada Department of Justice, 1985).

The patient-centered medical home model was introduced by the American Academy of Pediatrics in 1967. The original version of the model emphasized the importance of a consistent location where patients could access care. Prior to then, primary care never specified a specific location; it referred only to the specialization of care in which patients did not require a referral. (Stange et al., 2010). The World Health Organization's Alma-Ata Declaration in 1978 closely

followed this idea, highlighting the significance of the medical home, especially concerning social determinants of health (World Health Organization, 1978). During the 1990s, the Institute of Medicine in the United States of America began formally defining the 'medical home' as a distinct concept within family medicine practice, with an awareness of health determinants (Donaldson et al., 1996).

While Canada was a global forerunner in the health policy and population health sphere on many fronts (e.g., as the host of the WHO 1st International Conference on Health Promotion in Ottawa in 1986 that led to the landmark Ottawa Charter for Health Promotion) (Gagné & Lapalme, 2017), the primary care reforms launched during the 1980s did not result in comprehensive system-wide changes (Hutchison et al., 2011). Thus, faced with significant challenges in access to primary care, in 2000, the Canadian federal government initiated an 800-million-dollar funding program aimed at supporting the advancement of primary care reforms across provinces and territories (Weatherill, 2007). Consequently, from 2000 to 2006, the Primary Health Care Transition Fund provided funding for innovations in primary care that placed varying degrees of emphasis on novel organizational and service delivery strategies in each province and territory (Aggarwal & Hutchison, 2021). One of the innovative concepts that was promoted into Canada's primary care reform was inspired by the United State of America's patient-centered medical home model.

2.1.3 Development of primary healthcare in Québec

While it took some time for pan-Canadian federal initiatives to roll-out, many provinces were already putting these principles in action, such as in Québec. The patient-centered medical home model was indeed among one of the important influences in guiding the development of

the Local Community Service Centres (CLSCs) in the 1970s and, later, in steering the Family Medicine Groups (FMG) model.

In 1972 CLSCs were introduced as a publicly funded and governed organizations that offered a variety of health and social services (Levesque et al., 2013; Wankah et al., 2022). Despite allied health professionals expressing favourable views on interprofessional collaborations within the CLSC model, the model had limitations. For instance, the model did not gain momentum in Québec and was largely not accepted by general physicians who had reservations about the salary payment structure. Problems also emerged concerning variations in the range of services provided by CLSCs across the province, which were seen as disparities rather than legitimate differences based on population needs (Breton et al., 2011; Levesque et al., 2013; Wankah et al., 2022).

June 15, 2000, the commission proposed the FMG model that was intended to reorganize the delivery of primary care in Québec. This reform was in response to the failed attempt of have general physicians join CLSCs and a growing criticism that general physicians were not integrated with other health professionals. The new changes associated with the model included additional remuneration to clinics that extended their opening hours and hired nurses and administrative staff to work alongside physicians. By 2002, FMGs were implemented. FMGs are comprised of six to twelve general physicians who collaborate with nurses and other healthcare providers. Their purpose is to deliver primary healthcare services to enrolled patients based on contractual arrangements established with the provincial government (Breton et al., 2011; Wankah et al., 2022). In 2004, a structural reform created ninety-five health and social service centres through administrative mergers of CLSCs, acute-care hospitals, and long-term care homes (Breton et al., 2010).

Starting in 2008, three additional reforms were implemented and shared a common goal of increasing access to primary care. In 2008, a local central waiting list for people without a general physician (also called unattached patients) was created. Between 2009-2010, two legislations introduced regulation for nurse practitioners to provide care in FMGs under the supervision of general physician partners (Breton et al., 2015; Wankah et al., 2022). Therefore, more primary care providers were available to patients. 2015 was a crucial year for health policy reform. Bill 20 was enacted to "promote access to family medicine and specialized medicine services and to amend various legislative provisions"(Nationale du Québec, 2017). To fulfill this act, general physicians were obligated to maintain a quota of registered patients with the quota decreasing as the general physician's seniority increases. Failure to meet the quote resulted in a potential reduction of 30 percent of their earnings. However, before the bill became a law it was revised; By the end of 2017, general physicians were required to meet two targets: 1) 85% of Québec residents must have a general physician and 2) general physicians must ensure the patients registered to them see them, and no other physicians, 80% of the time. If these objectives were reached, Bill 20 pertaining to general physicians would not be implemented (Laberge & Gaudreault, 2019; Nationale du Québec, 2017; Wankah et al., 2022; Young, 2015).

2.2 Primary care continuity

2.2.1 Concept and definitions of primary care continuity

In Chapter 2.1, the five core functions of primary care were listed, with one of the functions being continuity. Furthermore, there are four types of continuity; relational continuity, information continuity, longitudinal/contact continuity, and coordination continuity (Strumpf et al., 2022). This thesis will focus on relational continuity when referring to primary care continuity.

Primary care continuity refers to the relationship between a general physician and a patient that extends beyond specific episodes of illness or disease (Haggerty et al., 2003). This involves the establishment of a rapport and mutual trust between the patient and the primary physician (Hennen, 1975; Rogers & Curtis, 1980). The general physician's commitment to caring for the patient is irrespective of the nature of the patient's health condition. Instead, the physician vows to continue to treat the patient all their life (McWhinney, 1975). By strengthening the relationship between general physician and patient, primary care continuity enables better management of long-term conditions and allows for earlier detection and treatment of acute events and in turn, prevents potentially avoidable hospitalization (Barker et al., 2017; Huntley et al., 2014; Rogers & Curtis, 1980; Roser et al., 2013). Nevertheless, disadvantages may exist with high primary care continuity, namely clinical inertia (the failure of the physician to advance a patient's treatment). There are several reasons why clinical inertia may arise, but for one, physicians may lack the relevant knowledge, training, and resources to care for patients with chronic diseases. Consequently, clinical inertia is a major factor that contributes to adverse events related to diabetes mellitus and hypertension mismanagement (O'Connor et al., 2005). In this case, high primary care continuity may prevent a patient from receiving a diagnosis and/or necessary treatment (Chau et al., 2021; O'Connor et al., 2005). In addition, while relational continuity should involve a physician "taking responsibility" for a patient, it does not necessarily imply truly "being responsible". It does not assure the development of a trusting patient-physician relationship or diligent continuity of care, two factors that could lead to better health outcomes (Strumpf et al., 2022).

In summary, primary care continuity increases the likelihood that the physician becomes knowledgeable in the patient's medical history, preferences, and needs, leading to more effective

and personalized care. Without primary care continuity patients are at greater risk of receiving fragmented care, which can potentially lead to missed diagnoses, unnecessary tests, or conflicting treatment recommendations (Jee, 2023).

2.3 Avoidable emergency department visits and hospitalizations

2.3.1 Avoidable health services as a measure of non-comprehensive primary care

To measure if primary care is comprehensive, scholars often seek to capture the clinical appropriateness of the health services delivered. The Canadian Institute for Health Information (CIHI) defines appropriate and effective care as:

> health services [that] are provided based on scientific knowledge about who could benefit from the service, reducing the incidence, duration, intensity, and consequences of health problems. Services are appropriate and effective when they are provided to all who could benefit and when person-centered decisions are made to refrain from providing services to those not likely to benefit. (Canadian Institute for Health Information, 2013)

Therefore, healthcare services that do not follow this definition are inappropriate and ineffective and their consequences are viewed as avoidable.

2.3.2 Ambulatory care sensitive conditions as a measure of avoidable health services

Avoidable hospitalizations are also called “preventable hospitalizations” or “unnecessary hospitalizations” or “inappropriate hospitalizations”. Avoidable hospitalizations are hospitalizations for a condition that could have been prevented with appropriate and effective primary care (Billings et al., 1993). The most well-known and used indicator to measure avoidable hospitalizations is ambulatory care sensitive condition (ACSC) hospitalizations (Canadian Institute for Health Information, 2023). Ambulatory care refers to any type of care

that is treated outside a hospital. It can include primary care, along with other care services, like occupational health care or serology (Purdy et al., 2009).

The ACSC hospitalization indicator measures the age-standardized acute care hospitalization rate for conditions where appropriate and effective ambulatory care prevents or reduces the need for admission to the hospital (Canadian Institute for Health Information, 2023; Walsh et al., 2012). The ACSC emergency departments indicator is also used. Although it is recognized that not all admissions related to these conditions can be prevented, it is believed that receiving suitable ambulatory care could potentially avert the onset of such illnesses or conditions, control an acute episodic illness or condition, or manage a chronic disease or condition. A disproportionally high rate of ACSC emergency department visits or ACSC hospital admissions is thought to indicate difficulties in accessing appropriate primary healthcare (Canadian Institute for Health Information, 2023). For instance, a primary care worker can assist a patient with asthma in managing their symptoms. However, if the patient does not receive adequate or effective care, it may result in avoidable complications, such as hospitalization for an asthma exacerbation.

2.4 Confounding variables of primary care continuity and avoidable health services

2.4.1 Concept model

Andersen's Behaviour Model of Health Services Use (figure 1) is a conceptual model that will be used as a guiding framework for this thesis (Andersen, 1995). The model aims to understand why individuals use health services, to define and measure equitable access to health care, and to assist in developing policies to promote equitable access. The fourth and most recent variation of the model describes population factors and environmental factors that can lead to healthcare use and health outcomes. Healthcare use is determined by three population factors: predisposing factors, enabling factors, and need factors. Predisposing factors can include

characteristics such as race, gender, and health beliefs. Enabling factors can include characteristics revolving around support such as financial support (income and health insurance) and family support. Lastly, need represents both perceived and actual medical need for healthcare services. Environmental traits can include the influence of healthcare systems (i.e., policy, resources, and organization) and the impact of the external environment (i.e., physical, political, and economic components) (Andersen, 1995).

Traditionally, Andersen's model includes "health outcomes" which refer to indicators to measure "quality of care", "health status, and "consumer satisfaction". In this thesis, the term "healthcare use" will refer to primary care continuity. The term "health outcome" will be measured by patient's health status post healthcare use. Health status will be measured by the number of all-cause emergency department visits, all-cause hospitalizations, avoidable emergency department visits, and avoidable hospitalizations.

2.4.2 population characteristics

In this section, the population characteristics associated with primary care continuity, emergency department use, and hospitalization will be described. There is limited literature available on the association between population characteristics and avoidable emergency department use or avoidable hospitalization, but information will be provided when such literature is available.

2.4.2.1 medical need

Patients with greater medical need have a higher risk of hospitalizations and emergency department visits (Bahrmann et al., 2019). Patients with complex medical conditions or multiple comorbidities require demanding close supervision and ongoing treatment that put them at risk for unplanned hospital admissions when complications arise. Moreover, these patients may

experience sudden exacerbations of their condition that require immediate medical attention, leading to frequent emergency department visits (Bahrmann et al., 2019; Reed et al., 2015).

2.4.2.2 sex and gender

Lifestyle factors and health conditions can differ between sexes (Bailey et al., 2022). Studies have demonstrated that women have more chronic health conditions than men and visit general physicians more often (Bertakis et al., 2000). In addition, gender norms can bias care-seeking behaviours (Hammond et al., 2010; Vaidya et al., 2012; Viera et al., 2006). For example, cisgender men are generally less likely than cisgender women to use preventive health services and attend routine check-ups. Cisgender men might seek primary care less due to the perceived stigma of mental health or to retain their "masculinity" (Hammond et al., 2010). Men who delay seeking medical attention until their conditions progress face an increased risk of health complications that necessitate emergency medical intervention. Generally, older women exhibit elevated hospitalization rates in contrast to older men. This discrepancy can be partially explained by women's extended life expectancy and differences in chronic diseases and other health conditions suffered by each sex. Men tend to have a higher susceptibility to heart diseases and cancer which are strongly associated with a higher mortality risk. Conversely, women have higher rates of arthritis, osteoporosis, and fractures, which are less life threatening (Carmel, 2019). Regarding avoidable hospitalizations, the literature is mixed. One study reported that the odds of avoidable hospitalizations were higher in women compared to men. But studies using gender stratification, acknowledge that the discrepancy between ACSC hospitalizations might not be due to biological differences. After stratifying for sex: low income and being separated and divorced increased the odds of an ACSC-related admission for men while being underweight significantly increased the odds for women (Sanmartin et al., 2011).

2.4.2.3 race, ethnicity, and immigration

Race is often referred to as a "master status", which subsumes and exacerbates other statuses, including socioeconomic status (Aspinall & Song, 2013). This observation tends to be borne out in health studies. Racialized minorities indeed have a greater risk of poor self-rated health, obesity, and hypertension compared to a white person while holding other sociodemographic variables constant (Gagné & Veenstra, 2017). In Canada, Indigenous peoples have a greater risk of smoking, cancer, heart disease, and asthma compared to a non-Indigenous person, holding other sociodemographic variables constant (Ramraj et al., 2016).

Racial and ethnic disparities in primary care access, continuity, and quality of care may arise because majority and minority patients with the same needs are treated differently by the same provider, a situation that may arise notably due to prejudice and stereotypes (Strumpf, 2022).. In terms of preventative health, one study found that black men were more likely to receive a cholesterol check than white men (Strumpf, 2022). Mistrust of the medical institution and perceived racism can lead to avoiding medical treatment and thus lead to detrimental health outcomes in minority patients. One study found that African American men with higher medical mistrust or greater perceived racism were significantly more likely to delay blood pressure screenings and cholesterol screenings (Powell et al., 2019).

In addition, systemic inequities can also more fundamentally hinder access to care for certain minority groups; for instance, Indigenous peoples in Canada are still affected by systemic inequities arising out of a legacy of colonialism dating back several hundreds of years. This is evidenced for instance by the fact that Indigenous peoples living on reserves have a lower physician supply and less access to adequate health services (Gunn, 2017). Joyce's principle, named after Joyce Echaquan, is a recent initiative, which aims to ensure that every Indigenous

person has the right to equitable access to social and health services without facing discrimination. The principle emphasizes the importance of acknowledging and respecting Indigenous people's traditional and contemporary knowledge in all health-related matters (Moucarry, 2023).

If Indigenous people are less likely to receive primary care services that are appropriate and effective, they could experience more avoidable health services. One study found that Indigenous peoples in Canada were almost three times more likely to experience an avoidable hospitalization compared to white Canadians. But the estimate was not precise since the number of Indigenous peoples included in the study was too small to report (Sanmartin et al., 2011). In general, there is limited research available on the association between race, ethnicity, and avoidable emergency department visits or avoidable hospitalizations This scarcity stems from the relatively low representation of minority groups in the study samples.

Immigration can disrupt access to healthcare. In Canada, healthcare coverage for non-citizens differs based on immigration status. Refugees and asylum seekers are eligible for some temporary coverage during the time that they are ineligible under any provincial or territorial health insurance (Naseem, 2015). Meanwhile, it typically takes other classes of immigrants three months to be admissible to the public system in most provinces (Hilliard & Brindamour, 2020). Finally, there is no health coverage for immigrants without status (also known as undocumented immigrants). Thus, immigrants without status in Canada will often avoid healthcare out of fear of deportation and cost of healthcare services (Gagnon et al., 2022). More generally, immigrants can also be unfamiliar with Canada's healthcare system and resources and thus involuntarily avoid healthcare services (Turin et al., 2020). A recent study found that recent immigrants to Canada (less than 10 years immigrated), were less likely than established immigrants (10 years

or more since immigrated) to have a regular healthcare provider. However, there was no difference in the mean number of medical consultations in the past year of recent and established immigrants. Although the number of medical consultations did not differ, the 2015–2016 Canadian Community Health Survey reported that a greater proportion of established immigrants than recent immigrants sought usual care from a physician's office than a walk-in clinic (Ravichandiran et al., 2022).

Therefore, recent immigrants might be more likely to have low rates of primary care continuity which in turn could lead to more hospitalization and emergency department visits. But most studies report that the rate of hospitalization is the same or less than in immigrants compared to Canadian-born people (Laroche, 2000; Statistics Canada, 2021). Similarly, one study reported that immigration status was preventative of avoidable hospitalizations (Wallar & Rosella, 2020) These findings align with the concept of the healthy immigrant effect, indicating that immigrants often possess better initial health status than their Canadian counterparts, with this advantage diminishing over time (Athari, 2020). Overall, understanding the complex interplay between immigration, healthcare access, and health outcomes is essential for promoting equitable healthcare for all population groups in Canada.

2.4.2.4 socioeconomic status

Canadians with lower socioeconomic status experience disparities in accessing and utilizing primary health services. For instance, privatized pension schemes and health services disproportionately benefit people with more social and economic assets in old age (Lee et al., 2021; Quesnel-Vallée et al., 2015). Although Canada has a universal healthcare system, those without private insurance plans may experience unmet needs with uninsured services (e.g., physiotherapy, mental health services) due to cost (Statistics Canada, 2019). In addition, one

study found that callers who presented themselves as low socioeconomic persons living in Toronto faced discrimination when trying to book an appointment at a physician's office compared to high socioeconomic callers (Olah et al., 2013).Therefore, people with lower socioeconomic status might have low primary care continuity because they have difficulties accessing primary care, both at the public and private level, and in turn, have greater emergency department utilization. On the contrary, one study shows that persons with dementia living in a lower socioeconomic status area had higher continuity of care than persons with dementia living in a higher socioeconomic status area (Godard-Sebillotte, 2020). Patients with higher incomes could choose timely treatment through private out-of-pocket financing over continuous treatment which may or may not lead to more positive health outcomes (Lee et al., 2021)**.**

Moreover, patients with lower socioeconomic status represent most emergency department visits (Carrière, 2004; Khan et al., 2011). One theory is that to seek preventative care, many patients, or their caregivers, must give up work hours, increasing the total cost of care. Thus, people with low socioeconomic status may delay seeking care until conditions worsen to the point where they need emergency services (Gagnon et. al., 2022). In other cases, patients with low socioeconomic status will use emergency department services regardless of the urgency of the visit (Carrière, 2004; Khan et al., 2011).

2.4.2.5 geographic location

Geographic location (e.g., rural or urban residence) can also influence primary care continuity and risk of avoidable hospitalization. In rural areas, access to primary care providers may be limited due to a shortage of healthcare professionals and long travel distances (Nielsen et al., 2017). This can result in reduced continuity of care, with patients having difficulty seeing the same provider consistently (Rudoler et al., 2022). On the other hand, urban areas often offer a

higher density of healthcare facilities and providers, making it easier for individuals to access primary care services and establish ongoing relationships with their physicians. This enhanced accessibility in urban settings promotes better continuity of care, leading to improved health outcomes for patients (Gillespie, 2023; Wilson et al., 2020). Therefore, the risk of avoidable hospitalization has been reported to be higher in patients living in rural areas (Ridge et al., 2022). Although, initiatives in Québec, such as les plans régionaux d'effectifs medicaux, which stipulate where primary physicians offer their services, aim to eliminate this geographic disparity (Hanes, 2023).

2.4.2.6 marital status

Lastly marital status has been associated with primary care continuity and (avoidable) emergency department use and hospitalizations. The marriage protection effect refers to the phenomena that married people have more advantages in economic resources, social and psychological support, and health behaviors. This in turn leads to healthier outcomes (Waldron et al., 1996). One study found that older adults who were not married or common law had a higher risk of avoidable hospitalization (Sanmartin et al., 2011).

2.5 Primary care continuity and avoidable health services in older adults

2.5.1 Primary care continuity and older adults

In Canada, older adults are defined as individuals aged 65 years and older. As of 2021, there are seven million Canadian older adults compared to six million children under 15 years older (Statistics Canada, 2022a). As individuals age, the prevalence of most chronic diseases and conditions increases, including hypertension, osteoarthritis, osteoporosis, ischemic heart disease, and chronic obstructive pulmonary disease. Moreover, older adults may experience diminished autonomy, mobility, and cognition, requiring them to be more dependent on healthcare

professionals and informal caregivers to assist them with their health needs (Public Health Agency of Canada, 2020). These circumstances underscore the necessity for tailored approaches to medical care for older adults, emphasizing the importance of a comprehensive and accessible healthcare system.

High primary care continuity is more common in older adults or individuals living with chronic health conditions. However, this is partially likely an endogenous association, as patients who are older adults and/or have chronic health conditions require more follow-up visits with the same physician compared to patients who are younger adults and/or have acute health problems (Centers for Disease Control and Prevention (CDC), 2017; Rogers & Curtis, 1980).

2.5.2 (Avoidable) health services and older adults

Potentially avoidable hospitalizations are more commonly observed among older adults with chronic conditions, usually caused by acute complications (Billot et al., 2016; Sanmartin et al., 2011). In 2015, adults 60 years and older represented 50 percent of avoidable hospitalizations among adults (Sanmartin et al., 2011). Indeed, studies have estimated that between 10 to 30 percent of all emergency department visits and hospitalizations among older adults would be considered avoidable (Chong et al., 2022; Godard-Sebillotte et al., 2021a; Godard-Sebillotte et al., 2021b; Lesser et al., 2020; Lin et al., 2017; Mahmoudi et al., 2020; Nyweide et al., 2013)

Typically, studies based on populations of older adults without a specific chronic condition report that this population experiences between 10 to 20 percent of avoidable emergency department visits or hospitalizations (Lesser et al., 2020; Mahmoudi et al., 2020; Nyweide et al., 2013) whereas studies on populations of older adults with a specific chronic condition report closer to 30 percent of avoidable emergency department visits or hospitalizations (Chong et al., 2022; Godard-Sebillotte et al., 2021a; Godard-Sebillotte et al.,

2021b; Lin et al., 2017). This discrepancy might highlight the complexity of managing chronic conditions and the increased susceptibility to acute exacerbations or complications necessitating emergency care or hospitalization.

It is important to note that avoidable emergency departments visits and avoidable hospitalization, along with emergency department visits and hospitalizations in general, have a particularly detrimental impact on older adults. They are indeed more susceptible to functional decline, mobility decline, misalignment between their medical needs, and complications arising from treatment and procedures (Dufour et al., 2019) . By preventing avoidable hospitalizations, better patient outcomes and satisfaction can be achieved (Lin et al., 2017).

2.5.3 Studies on primary care continuity and avoidable health services for older adults

There is a greater body of scholarly work addressing emergency department visits and hospitalizations compared to the focus on potentially emergency department visits and potentially avoidable hospitalization. Given the scarcity of research on avoidable outcomes, it is imperative to research the topic to gain a better understanding of it.

Numerous studies worldwide have reported that high primary care continuity is associated with less emergency department visits, hospitalizations, potentially avoidable emergency department visits, and potentially avoidable hospitalizations for older adults. In general, these studies suggest a moderate to low-risk reduction associated with high primary care continuity (Bayliss et al., 2015; Chong et al., 2022; Godard-Sebillotte et al., 2021a; Ionescu-Ittu et al., 2007; Jones et al., 2020; Knight et al., 2009; Nyweide et al., 2013). While some of these studies did not find statistical significance, the authors assert clinically significant and meaningful findings (Amjad et al., 2016; VanderWeele & Ding, 2017). However, before ascertaining the findings from these studies, their limitations must be considered.

2.5.4 Knowledge Gaps

Randomized controlled clinical trials (RCTs) are considered the gold-standard method for determining the effectiveness and safety of a treatment. RCTs can show that a new treatment is better than a current standard treatment or a placebo (Kabisch et al., 2011). Yet, when it comes to existing long-term human connections, RCTs pose challenges as it is nearly impracticable to conduct prospective randomization. In cases where physician-patient relationships span over several decades and develop into deeply personal connections, RCTs are either unethical or unfeasible (Kabisch et al., 2011). Many previous studies examining the relationship between primary care continuity and avoidable emergency department visits or hospitalizations used an observational study design which fails to properly account for bias (Chong et al., 2022; Nyweide et al., 2013; Van Der Pol et al., 2019). It is thus essential to utilize the innovative approach of inverse probability treatment weighting, which mimics an RCT (Austin & Stuart, 2015). By using this method, bias is minimized by ensuring that the treatment and control groups are similar based on confounding variables, thus increasing the validity of the results (Hernán & Robins, 2020; Austin & Stuart, 2015). This technique, which increases exchangeability, contributes to a more precise understanding of the impact of primary care continuity on emergency department visits and hospitalizations.

Furthermore, the shortcomings of previous studies are exacerbated by the lack of access to social demographic information. Without this crucial information, the potential for unmeasured confounding exists, which could significantly impact the reliability of their findings (Austin, 2011). It is thus essential to include sociodemographic information in a study analysis. This addition enhances the comprehensiveness of the research and provides a more nuanced

understanding of the relationship between primary care continuity and emergency department visits or hospitalizations.

Lastly, most of the literature is limited to studies conducted in the United States of America (Amjad et al., 2016; Mahmoudi et al., 2020; Nyweide et al., 2013). Canada's healthcare system is not directly comparable to that of the United States of America, as they have significant differences in terms of structure, financing, and delivery of care (Ridic et al., 2012) . Furthermore, provincial healthcare systems are not directly comparable either and therefore, findings across Canada are not necessarily generalizable to Québec (Hutchison et al., 2011). Only one study was found on primary care continuity and avoidable hospitalizations for older adults living in Québec (Godard-Sebillotte et al., 2021a). Therefore, more studies on primary care continuity and avoidable emergency department visits and avoidable hospitalizations in older adults living in Québec are needed.

Chapter 3: Thesis objective and hypothesis

3.1 Objective

The objective of this thesis is to investigate the association of primary care continuity with the occurrence of all-cause emergency department visits, all-cause hospitalizations, avoidable emergency department visits, and avoidable hospitalizations among older adults residing in Québec.

3.2 Hypothesis

It is hypothesized that high primary care continuity will be negatively associated with experiencing at least one all-cause emergency department visits, all-cause hospitalizations, avoidable emergency department visits, or avoidable hospitalizations among older adults residing in Québec.

Chapter 4: Methodology

4.1 Preface

In this chapter, I describe the data and methods for this thesis.

4.2 Design

This study is an analysis of a retrospective cohort of older adults living in Québec, Canada (2007 - 2016). The Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) and REporting of studies Conducted using Observational Routinely collected health Data (RECORD) guidelines were followed (Benchimol et al., 2015; Von Elm et al., 2007).

4.3 Data and sample

Data were extracted from The Care Trajectories - Enriched Data (TorSaDE) cohort (Vanasse et al., 2021), which links self-reported individual socio-demographic information from the Canadian Community Health Survey (CCHS) with health service use information from the provincial public universal health insurance system (Régie de l'assurance maladie du Québec (RAMQ). This includes 5 cycles of CCHS (2007, 2009, 2011, 2013, and 2015) linked with 21 years of medical data (1996-2016 inclusive). Health administrative data provided include health insurance registry, hospitalizations, medical visits, emergency room visits, public prescription plans, interventions from local community service centres, and death registry.

The TorSaDE cohort is a representative sample of the Québec population aged 12 and older who participated in one of the five cycles of the general CCHS and agreed to share the information collected in this survey with provincial and territorial ministries of health, the Institut de la Statistique du Québec (ISQ), Health Canada, and the Public Health Agency of Canada for statistical purposes (Vanasse et al., 2021). Excluded are individuals living on First Nation reserves and settlements, institutional residents, full-time members of the Canadian

Forces, and residents of certain remote regions (Statistics Canada, 2015). Participants aged 65 and older at the date of their CCHS interview were included in this study (figure 2).

4.4 Exposure

Participants' exposure status depends on their level of primary care continuity (PCC). High primary care continuity is defined as having had every primary care visit with the same general physician during the exposure period. Persons with low primary care continuity had primary care visits with at least two general physicians, during the exposure period.

This definition of high primary care continuity stems from the dichotomization of the Usual Provider of Care (UPC) index, a validated proxy of relational continuity (Breslau & Haug, 1976; Breslau & Reeb, 1975; Pollack et al., 2016). UPC measures the proportion of visits performed by the general physician that the patient visited most frequently out of all visits. The index was generated annually by TorSaDE from the number of medical visits billed to RAMQ that correspond to a patient identification code and a physician identification code. Most persons had a score of one; because of this distribution and to facilitate knowledge transfer to decision-makers, the UPC (low <1 vs high = 1) was dichotomized. The population was restricted to persons with at least two primary care visits, as continuity of care indices cannot be computed with less than two visits.

Exposure periods correspond with one of the 5 cycles of CCHS. For example, those who completed the CCHS in 2007 will have their social demographic information captured in 2007 and exposure measured in 2007.

4.5 Outcomes

It was recorded if a participant had an emergency department or hospital admission or a visit from ambulatory care sensitive conditions (ACSC), a validated measure of potentially avoidable hospitalization (Canadian Institute for Health Information, 2023; Walsh et al., 2012). Given the

context, the list of ACSC typical of older adults was used instead of the shorter list typical of the general population (Walsh et al., 2012) (Table 1). The number of all-cause emergency visits and all-cause hospitalizations a patient experienced was calculated by TorSaDE annually based on RAMQ medical billing information. ACSC are conditions where ambulatory care may reduce or prevent the patient from needing to be admitted to the hospital (Canadian Institute for Health Information, 2023). Because of the way the database was organized, ICD-9 and ICD-10 codes were used to compute ACSC hospitalization, but only ICD-9 codes were used for ACSC emergency department visits. For the event to be coded as an ACSC outcome, an ACSC ICD code had to be reported as the primary diagnosis of that event. Since participants mostly had 0 or 1 of each outcome, the outcomes (yes =1, no=0) were dichotomized. The outcomes were measured during the 1-year period after the exposure period. Follow-up ended 1 year after the exposure period or earlier if the participant died. The decision to set the follow-up period as one year was driven by two essential considerations: first, to align with previous published study methodologies(Godard-Sebillotte et al., 2021), and second, to mitigate potential loss to follow-up arising from the increased risk of mortality among older adults (Berry et al., 2010) .

4.6 Construction of a weighted sample

Propensity score and inverse probability of treatment weighting (IPTW) was used to minimize bias in analyzing routinely collected data. These methods aim at creating a weighted sample in which the exposed and unexposed groups are balanced for measured and unmeasured confounders(Austin, 2011, 2016; Godard-Sebillotte et al., 2019; M. Hernán & Robins, 2020; Sourial et al., 2018). Under the assumption that there is “no unmeasured confounding” these methods allow estimating the impact of a non-randomized exposure, here high primary care continuity (Austin, 2011, 2016; Godard-Sebillotte et al., 2019; M. Hernán & Robins, 2020; Sourial et al., 2018).

The propensity score modeled the probability of having high versus low primary care continuity. Predictors included in the propensity score were population characteristics based on medical need, enabling factors, and predisposing factors inspired by Andersen's model (Andersen, 1995). In epidemiological terminology, the forementioned population characteristics can be considered as confounders as they are associated with both the exposure (primary care continuity) and the outcomes (figure 3) (Austin, 2011; M. Hernán & Robins, 2020; Pourhoseingholi et al., 2012). Potential confounding factors or predictors of the outcomes, were all measured before the study's start date (Austin, 2011) (figure 4). Predictors were sex, age, comorbidity (using the Combined Charlson and Elixhauser Comorbidity index (Simard et al., 2018)), perceived overall health, previous emergency department visits, previous hospitalizations, rurality, immigrant status, Indigenous status, race, education attainment, marital status, and household income (Table 2).

Missing data were found in some categorical variables. Missing data were treated by imputation (in the case of categorical variables, missing data were replaced by the mode) for variables with missing data that constituted less than three percent of the sample size. The Indigenous status variable had more than three percent missing data and thus it was recoded to include a "missing status" level. In addition, 14 respondents were excluded from the sample for violations of the common support region and positivity. The analysis was restricted to people whose propensity score was in the propensity score's common support region, as recommended (1 person was excluded) (Austin, 2016). The positivity assumption (the conditional probability of receiving a given treatment cannot be 0 or 1 in any patient subgroup) was assessed. Variables were assessed for structural and random positivity (M. Hernán & Robins, 2020). In the presence of structural violations, casual inferences cannot be made about the entire population using

IPTW (M. Hernán & Robins, 2020). There are no known structural positivity violations. Random positivity was assessed in each covariate. One covariate (number of days in hospital) was restricted from the model for having a lot of sparsity, which is a validated approach to reducing random positivity (M. Hernán & Robins, 2020). Removing the variable made little to no difference in confounding bias. In other covariates, "trimming" was used to remove respondents for whom there exists no variability in observed treatment assignment (Conover et al., 2021). There were 13 respondents removed from the sample for random positivity violations and those removed represented data with extreme values in the 99th percentile. This approach led to negligible differences in odds ratio estimates and slightly narrower confidence intervals (Table 3).

4.7 Association between high primary care continuity and outcomes

For each outcome, the odds ratio was computed using a logistic regression, and the level of significance of the associations was estimated using a Chi-squared Wald test. The odds ratio signifies the odds that an outcome will occur given a particular exposure, compared to odds that the outcome will occur in the absence of the same exposure. An odds ratio of 1 signifies that the exposure does not affect the odds of the outcome occurring. An odds ratio of greater than or less than 1 signifies that the exposure is associated with higher odds or lower odds of the outcome respectively (Szumilas, 2010). Chi-squared Wald test is a parametric measure of independence between variables. A value of 0 indicates independence whereas values greater than 0 can indicate dependence or further known as an association between the 2 variables (Gudicha et al., 2017).

The rates of attrition in the exposed and unexposed were comparable so a time-to-event analysis was not performed. To be conservative, respondents who died were included in the final study sample (McCoy, 2017).

4.8 Sensitivity analyses

Sensitivity analyses were performed to assess the presence of unmeasured confounding. Sensitivity analyses to unmeasured confounders are key, as propensity scores and IPTW allow estimating the impact of a non-randomized exposure, under the assumption of "no unmeasured confounding" (Austin, 2011, 2016; Austin & Stuart, 2015; Godard-Sebillotte et al., 2019; M. Hernán & Robins, 2020; Sourial et al., 2018). E-values were computed, as defined by VanderWeele and colleagues (Haneuse et al., 2019; VanderWeele & Ding, 2017). An E-value of 1, indicates that no unmeasured confounding is needed to explain the observed association. The significance of the E-values were interpreted according to known strengths of association of potential unmeasured confounders (Lebrun, 2012; Levoy et al., 2022). In addition, considering five cycles of the CCHS were used in this study, it was pertinent to perform a sensitivity analysis to determine its influence on the data capture. A sensitivity analysis of the change in exposure between different cycles of the CCHS was performed to discern any potential influence of secular trends. Notably, the study period coincided with multiple primary healthcare reforms and as such, this analysis aimed to account for any potential impact these external factors could have on the observed outcomes.

Data were analysed by Giovanna Busa who performed the cohort extraction and the analyses using SAS Enterprise Guide software version 8.3.7 and R studio version 4.2.3.

Chapter 5: Results

5.1 Preface

In this chapter, I describe the findings from the thesis. I explain the characteristics of the sample population, the odds ratios of the main outcomes, and techniques used to reduce bias.

5.2 Population description

A primary care continuity index was computable for the 15256 persons (69%) with at least two primary care visits during the exposure period. The characteristics of these two populations are presented in Table 4. The 15256 persons with at least two primary care visits were older, were treated for a higher number of comorbidities, experienced a greater number of hospitalizations and emergency department visits in the previous 2 years, self-rated lower general health, were less educated, had a slightly lower household income in the past 12 months, and were more likely to be widowed than the excluded individuals (those with less than two primary care visits). Thus, the sample population represents a group of individuals with greater medical need than those excluded.

5.3 Unweighted vs weighted

In the study sample, the mean age was 74.41 years (SD=6.95), 59.2% were female. The average number of visits per year with a general physician was 4.36 (SD=3.17) and the average UPC score was 0.87 (SD=0.20). Most of the sample, 9905 (65%) of respondents, had high primary care continuity (all visits with the same physician) (Table 5). In the unweighted sample, persons with high compared to low primary care continuity were more likely to be men, live in a rural area, have a lower average number of primary care visits in the previous year, and a slightly higher percentage of respondents had experienced at least one emergency department visit in the previous year (Table 6). In the weighted sample, all standard mean differences in baseline characteristics between the two groups were negligible (<0.1) (Table 7) which indicates that the

model is balanced (Austin, 2011). Standard mean differences (also called absolute standard differences) are widely used statistical method for assessing model fit and covariate balance which has less limitations than other statistical methods (Ali et al., 2015).

5.4 Summary of Outcomes

During the 1-year outcome period, there was a total of 10251 all-cause emergency department visits, 5135 all-cause hospitalization visits, 1186 ACSC emergency department visits, and 542 ACSC hospitalizations. These results imply that approximately 12 % of all emergency department visits and 11% of all hospitalizations were potentially avoidable. 5198 (34%) and 3412 (22%) of respondents experienced at least 1 emergency department visit or hospitalization respectively. 864 (5.7%) respondents experienced at least 1 ACSC emergency department visits while 308 (2.0%) experienced at least one ACSC hospitalization (Table 8)

The most common ACSC emergency department visits were related to the following conditions: Urinary tract infections (n=204), Chronic obstructive pulmonary disorder (COPD) or Chronic bronchitis (n=144), hypertension (n=142), and pneumonia (n=138). The most common ACSC hospitalizations were related to the following conditions: pneumonia (n=88), angina (n=74), cardiac heart failure or congestive heart failure (n=61) and asthma (Table 9).

5.5 Association between high primary care continuity, all cause emergency department visits, and all cause hospitalizations.

In the unweighted models, high primary care continuity was not associated with all-cause emergency department visits or all cause-hospitalizations. The odds ratios were 1.002 (95% CI [0.934-1.074] and 0.956 (95% CI [0.883-1.035]) respectively. In the weighted models, high primary care continuity was associated with lower odds of all-cause hospitalization 0.935(95%CI [0.875-0.999] $p < 0.05$) but not all-cause emergency 0.976 (95% CI [0.921-1.035] $p = 0.422$). Therefore, on average, the odds of experiencing at least one all-cause hospitalization in a year for

respondents who experienced high primary care continuity were 0.07 times less compared to respondents who experienced low primary care continuity. On average, the odds of experiencing at least one all-cause emergency department visit in a year for respondents who experienced high primary care continuity were 0.03 times less compared to respondents who experienced low primary care continuity. Refer to Table 10.

5.6 Association between high primary care continuity and potentially avoidable ED and potentially avoidable hospitalization

In the unweighted models, high primary care continuity was associated with higher odds of avoidable emergency department visits but not associated with avoidable hospitalizations. The odds ratios were 1.160(95% CI [1.002-1.344] $p<0.05$) and 1.140 (95%CI [0.898 -1.456] respectively. The same trend occurred in weighted models, although the confidence intervals were narrower. The odds ratios were 1.131 (95% CI [1.002-1.276] $p<0.05$) and 1.127 (95%CI [0.923-1.376] respectively. Therefore, on average, the odds of experiencing at least one ACSC emergency department for a respondent who experienced high primary care continuity were 1.13 times greater compared to a respondent who experienced low primary care continuity. The results for the odds of avoidable hospitalizations are inconclusive as the estimate could range from 0.08 times lower odds to 1.38 times greater odds of experiencing at least one ACSC hospitalization for a respondent who experienced high primary care continuity compared to a respondent who experienced low primary care continuity. Refer to Table 10.

5.7 Sub analyses and Sensitivity analyses

368 respondents died during the outcome period. Death was censored. There was a negligible difference in the proportion of respondents who died in the in the control group compared to the treatment group (Table 8).

E-values were computed as odds ratios. The observed odds ratios could be explained by an unmeasured confounder that was associated with both the exposure and the outcomes with an odds ratio of 1.1-1.516, depending on the outcome, above and beyond the measured confounders. However, weaker confounding could not do so. The confidence interval could be moved to include the null by an unmeasured confounder that was associated with both the treatment and the outcome with an odds ratio of 1.613-2.179 depending on the outcome, above and beyond the measured confounders, but weaker confounding could not do so (VanderWeele & Ding, 2017) (Table 11).

A sensitivity analysis of the exposure between different cycles of the CCHs showed negligible differences (Table 12).

Chapter 6: Discussion

6.1 Preface

In this chapter, I provide a summary of findings from the thesis and their relevance for decision making and future research. I also briefly discuss the strengths and limitations of my methodological approaches and data sources. Lastly, I offer concluding remarks.

6.2 Summary of findings

To our knowledge, this was the first study in Canada on the association between high primary care continuity and potentially avoidable emergency department visits and hospitalizations in older adults that combined health administrative data with socio-demographic data using a rigorous causal inference methodology. In the following paragraphs, we discuss the implications of the four sets of associations resulting from our analyses, starting with all-cause emergency department visits and hospitalisations, and ending with avoidable emergency department visits and hospitalizations.

High primary care continuity was not statistically associated with all-cause emergency department visits, in contrast with several prior studies. However, those studies were either cross-sectional studies, and thus the direction of the observed associations could not be determined, or the study population differed from this one (Amjad et al., 2016; Bayliss et al., 2015; Godard-Sebillotte et al., 2021a; Ionescu-Ittu et al., 2007; Jones et al., 2020). For example, studies on older adults living with dementia reported that high primary care continuity was associated with fewer emergency department visits (Amjad et al; 2016; Godard-Sebillotte et al., 2021a). One study reported only a small decrease in emergency department visits due to high primary care continuity (Bayliss et al., 2015). Nevertheless, although the findings were not reported as statistically significant, they may have clinical significance. There were approximately 0.3 times lower odds of experiencing at least one all-cause emergency department visits in the high primary care

continuity group compared to the low primary care continuity group. Given the detrimental impact that emergency department visits have on older adults, such as functional decline, mobility decline, misalignment between their medical needs, and complications arising from treatment and procedures (Dufour et al., 2019), supporting high primary care continuity, may significantly increase the quality of life and decrease adverse events for older adults.

In turn, high primary care continuity was significantly associated with fewer all-cause hospitalizations, which aligns with previous literature (Amjad et al., 2016; Godard-Sebillotte et al., 2021; Knight et al., 2009). There are three major reasons that may explain why high primary care continuity is associated with fewer hospitalizations. First, high primary care continuity can enhance the management of chronic ailments and the identification and treatment of sudden worsening conditions. This is particularly crucial in the case of older adults, who often have multiple chronic conditions (Billot et al., 2016; Centers for Disease Control and Prevention (CDC), 2017; Rogers & Curtis, 1980; Sanmartin et al., 2011). Second, a longstanding primary care relationship may be essential for evaluating and addressing the burden and stress experienced by caregivers, as these factors significantly contribute to situations that lead to hospital admissions (Arriagada, 2020; Levoy et al., 2022; Nakayama et al., 2023). Third, an established primary care relationship can facilitate a palliative care approach, allowing for discussions about advanced directives and end-of-life care preferences. This can help prevent unwanted hospitalizations for patients and caregivers who would rather receive end-of-life care in the comfort of their homes (Feng et al., 2014; Hanson et al., 2017).

Turning now to avoidable conditions, contrary to the prevailing literature (Chong et al., 2022; Van Der Pol et al., 2019), we found that high primary care continuity was statistically significantly associated to a 1.13 times greater odds of at least one avoidable emergency

department visit compared to low primary care continuity. One potential explanation for this disparity is that this study did not limit the sample to individuals with specific health conditions. Studies have shown that the risk of emergency department visits is affected by disorder-specific factors including the progression of a patient's disease and comorbidities (Dufour et al., 2023; Godard-Sebillotte et al., 2021; Lesser et al., 2020; Sanmartin et al., 2011). This aspect of the data is valuable because the continuity of primary care with a general physician can vary depending on the patient's progression within the diagnosis/illness trajectory. Maintaining a consistent relationship with a primary care provider is of paramount importance during the initial phases of diagnosis, where they offer guidance and symptom management. As the illness progresses, ongoing monitoring and treatment may be overseen by a general physician, often in collaboration with specialists (Savoy et al., 2017). Hence, it is plausible that the respondents with high primary care continuity in this study are situated in the early stages of their diagnostic trajectory and have not yet acquired the skills to manage their symptoms, thereby resulting in an increased number of emergency department visits that could have potentially been prevented.

Another possible explanation is that the results could be impacted by the variability of the type of ACSCs observed. This study reported the highest proportion of ACSC emergency department visits related to urinary tract infections compared to other ACSCs (Table 9) which is consistent with other studies (Hsieh et al., 2019). One study reported an increased odds of urinary tract infection-related complications in patients aged 55-74 years old and patients 75 years old or older compared to adults 16-34 years old within 30 days of having a urinary tract infection-related primary care visit (Aryee et al., 2023). This finding could reflect difficulties general physicians face in managing or preventing urinary tract infections for older-adult patients. Or the issue could be related to clinical inertia and other forms of mismanagement of risk factors for urinary tract

infection-related complications such as chronic kidney disease, urinary catheters, prior antibiotic use, recurrent urinary tract infections, fecal incontinence, and diabetes mellitus (Aryee et al., 2023; O'Connor et al., 2005). Lastly a positive association between high primary care continuity and avoidable emergency department visits might suggest that the primary healthcare services patients received in this study were not comprehensive, inappropriate, and ineffective (Canadian Institute for Health Information, 2014, 2023). Given this finding is novel, more research is required before concluding.

Finally, high primary care continuity was not significantly associated with ACSC hospitalizations. Notably, the confidence interval was wider for ACSC hospitalizations compared to other outcomes (figure 5), ostensibly due to the small number of ACSC hospitalizations that were reported. Therefore, conclusions should be considered tentative until further research can support them. While most studies have reported that high primary care continuity is associated with fewer ACSC hospitalizations (Godard-Sebillotte et al., 2021a; Mahmoudi et al., 2020) some studies reported a very small association (Nyweide et al., 2013) or no significant association (Amjad et al., 2016).

In summary, while this study reported statistically and clinically significant associations between high primary care continuity on all-cause hospitalizations and ACSC emergency department visits, further research and systematic reviews are needed to determine the association of high primary care continuity on all-cause emergency department visits and ACSC hospitalizations.

6.3 Strengths

The shortcomings of previous studies are exacerbated by the lack of access to social demographic information. Without this crucial information, the potential for unmeasured

confounding exists, which could significantly impact the reliability of their findings. By utilizing both sociodemographic variables and health administrative data, this study provided a more comprehensive estimate than previous studies. This study utilized a robust methodology to minimize confounding in analyzing routinely collected data (Austin et al., 2015). Inverse probability treatment weighting indeed can be considered to replicate the conditions of a randomized clinical trial in observational data. By using this method, bias is minimized by ensuring that the treatment and control groups are similar based on confounding variables, thus increasing the validity of the results. This technique, which increases exchangeability (Hernán & Robins, 2020; Austin & Stuart, 2015). Non-positivity, a commonly violated assumption in IPTW studies, was successfully reduced without inducing confounding bias (Conover et al., 2021; M. Hernán & Robins, 2020). Confounding bias was successfully reduced, and negligible standardized mean differences were reported in the weighted model. Sensitivity analyses showed that the results could be sensitive to an unmeasured confounder, though in rather unlikely scenarios according to the current literature. Indeed, the unmeasured confounder would have to be moderately-to-strongly associated with both the exposure and the outcome after having controlled for all observed confounders included in the propensity score. This is an unlikely scenario according to the current literature (Gjestsen et al., 2018; Lebrun, 2012; Levoy et al., 2022; Turin et al., 2020). For example, caregiver availability and the primary language of patient or health services are potential confounding factors but are not consistently found to be associated with hospital use in the literature. When an association is found, its magnitude is lower than the estimated E-values (Lebrun, 2012; Levoy et al., 2022).

The measures used to create the exposure and outcome closely replicated that of other studies on this topic. Many studies have used the validated UPC index to measure primary care

continuity. The algorithm for ACSCs was created using validated ICD codes and was used in previous studies (Canadian Institute for Health Information, 2023; Feng et al., 2014; Godard-Sebillotte et al., 2021; Walsh et al., 2012). This replication helps build confidence in the scientific merit of the findings.

6.4 Limitations

Caution should be applied when comparing the findings of this study to other studies on the topic. Compared to previous studies, this study reported higher levels of primary care continuity. More specifically, "low primary care continuity" in this study was comparable to "medium primary care continuity" in other studies with an index greater than 0.5 and less than 0.8 (Ionescu-Ittu et al., 2007). Whereas this study reported low primary continuity as an average of 0.63 (SD=0.16).

Some data limitations must also be acknowledged. As of 2009, nurse practitioners were permitted to treat patients in FMGs under the supervision of a general physician (Breton et al., 2015; Wankah et al., 2022). However, in the provincial health administrative database, non-physician (e.g., nurse and social workers) visits are not registered. Thus, the study could be an underrepresentation of the total number of primary care visits of older adults living in Québec since 2009, which could have led to overly conservative estimates. In addition, it was impossible to assess the quality of the primary care visits. While primary care continuity is associated with better patient outcomes, it does not assure the development of a trusting patient-physician relationship or diligent continuity of care (Strumpf et al., 2022). Therefore, the exposure variable might not entirely capture the essence of primary care continuity. Adding variables that measure the quality of primary care visits, or the tendency for general physicians to make patient-centred decisions might enrich the research. Lastly, language use other than French and English was unable to be reported due to the scarcity of participants who reported in the survey that their first language

was neither French nor English. When considering the impact of ethnicity and immigration on healthcare access and use, one must also consider the impact of language. Research has identified the negative impact of language barriers on physician care, hospital care, emergency/ambulance services and many other health services (Bowen, 2001). Language barriers impede effective communication between immigrant patients and physicians, leading to poorer quality of care (Turin et al., 2020).

6.5 Implications and policy relevance

The findings in this study can help inform primary healthcare to care for older adults, as they showed clinical and statistically significant findings reinforcing that access to and continuity with a general physician might decrease all-cause ED use and hospitalization. The findings on ACSC emergency department use and ACSC hospitalizations are less conclusive.

This study comes at a crucial time, as there is a policy "window of opportunity" to catalyse change in primary healthcare in Québec (CBC News, 2022; Macnaughton et al., 2013). As in many other provinces, lack of access to general physicians is a perennial problem in Québec (CBC News, 2022; Godard-Sebillotte et al., 2021; Hendry, 2021), where approximately one million people (out of a population of about eight million) do not have a general physician (Strumpf et al., 2022). Bill 20, with the objective of achieving a registration rate of 85 percent of the Québec population with a primary care physician by December 31st, 2017, fell short of its goal. By December 31st, 2018, only an 81 percent registration rate was achieved. Several suggested reasons exist for the prevailing primary healthcare issues, one of which is an unintended consequence of Bill 20; the stringent conditions imposed on primary care physicians have led to diminished interest in pursuing family medicine compared to other specializations (Laberge & Gaudreault, 2019).

Since March 2022, the Québec Minister of Health and Social Services has launched many initiatives to facilitate access to high-quality and timely primary care services. For example, Bill

11 includes the "act to increase the supply of primary care services by general [physicians] and to improve the management of that supply." The primary focus of these reforms is to improve the enrolment of patients with general physicians (Strumpf et al., 2022).

Wait times and physician shortage are two main issues that afflict primary care access. Wait times to register for or visit a general physician in Québec, and especially in Montréal, are long and partially attributed to physician shortage (Hendry, 2021). Long wait times could therefore be a driving factor for low primary care continuity in individuals. That is, they cannot enrol with a physician and thus cannot access primary care. Furthermore, patients enrolled with general physicians are also impacted. Patients enrolled with a general physician are often confronted with a trade-off between rapid access and continuity. For instance, in family medicine groups, patients may have to compromise to obtain a same-day appointment by seeing a healthcare provider other than their general physician (Oliver et al., 2019).

Although this study does not directly assess the impact of policy interventions, it is difficult to ignore the influence that the political environment has on healthcare service use. Andersen's Behavioural Model of Health Services Use highlights the impact that changes on the healthcare system have on health of the population, their health behaviour and thus their health outcomes (Andersen, 1995). During the study period, three main primary healthcare reforms occurred in Québec. The finding that high primary care continuity is associated with fewer hospitalizations might validate the effectiveness of these bills, although further analyses using methods better suited for measuring the causal impact of interventions would be required before making a definitive assessment.

Improving primary care continuity can be accomplished through multiple measures. First, through collaborative efforts with key stakeholders and the dissemination of these findings to

policymakers, general physicians, specialists, patients, caregivers, as well as representatives of patients and caregivers, the emphasis can be placed on the significance of striving for a consistent and high-quality patient-physician relationship. Second, these findings can be employed to support policies and healthcare institutions facilitating the accessibility of general physicians to patients during acute situations and ensuring proactive follow-up for the delivery of excellent primary care.

6.6 Future studies

In large part because we studied a general population of older adults rather than a cohort defined by the presence of a diagnosed condition as much of the prior literature, we observed a relatively low average number of visits to general physicians. Indeed, about thirty percent of the respondents had to be excluded from the study population for having less than two primary care visits in the preceding year. The low average observed could be attributed to a variety of factors: (1) the principal provider may not necessarily be the general physician; (2) primary care nurses could be providing some of the care, but their visits might not be documented in the database; (3) it might also indicate challenges in accessing primary care, possibly stemming from issues related to inequality; (4) our population might simply have been relatively healthy, and accordingly had no need for two or more visits with a physician per year. Indeed, even if our sample members followed guidelines that adults over 65 years old, especially individuals living with chronic conditions, should have a routine checkup at least once per year, they would not qualify for a measure of primary care continuity that is based on 2+ annual visits (Jin, 2022).

Future research should look at the impact of primary care continuity provided by interprofessional primary care teams on emergency department visits, hospitalizations, and avoidable emergency department visits and hospitalizations. Interprofessional primary care teams can enable patients to receive timely primary care from another primary care health professional while their primary physician is absent or unavailable. Nevertheless, interprofessional team-based

primary care poses its own distinct challenges and is not sufficient on its own to reduce avoidable hospitalizations. There is a requisite for enhancements in other factors supporting a robust primary care system, such as comprehensiveness, to enhance overall healthcare services (Haj-Ali et al., 2020; Supper et al., 2014). In addition, future researchers could explore alternative measures of continuity that span several years rather than annual intensity. That said, considering that the individuals excluded from this study were less educated, had a slightly lower household income in the past 12 months, and were more likely to be widowed, these findings could suggest inequitable barriers in access to primary care. Future research is needed to explore barriers in primary care access and ensure older adults living in Québec receive equitable care.

6.7 Conclusion

Increasing primary care continuity might be an avenue to reduce emergency department visits and hospitalizations among older adults on a population-wide level. This study provides evidence that high primary care continuity is associated with more emergency department visits. However, given the novelty of this discovery, future research is necessary to verify these results. Future research should seek to understand the mechanisms underlying the association between high primary care continuity and hospital use, investigate barriers and facilitators to increase primary care continuity in the Québec context, and evaluate the impact of policies or interventions aiming to increase primary care continuity on avoidable emergency department visits and hospitalizations.

Chapter 7: References

Aggarwal, M., & Hutchison, B. (2021). *Toward a primary care strategy for Canada*. *Canadian Foundation for Healthcare Improvement*. https://doi.org/10.13140/RG.2.2.13854.05442

Ali, M. S., Groenwold, R. H. H., Belitser, S. V., Pestman, W. R., Hoes, A. W., Roes, K. C. B., Boer, A. D., & Klungel, O. H. (2015). Reporting of covariate selection and balance assessment in propensity score analysis is suboptimal: A systematic review. *Journal of Clinical Epidemiology*, *68*(2), 122–131. https://doi.org/10.1016/j.jclinepi.2014.08.011

Amjad, H., Carmichael, D., Austin, A. M., Chang, C.-H., & Bynum, J. P. W. (2016). Continuity of care and health care utilization in older adults with dementia in fee-for-service Medicare. *JAMA Internal Medicine*, *176*(9), 1371. https://doi.org/10.1001/jamainternmed.2016.3553

Andersen, R. M. (1995). Revisiting the behavioral model and access to medical care: Does it matter? *Journal of Health and Social Behavior*, *36*(1), 1. https://doi.org/10.2307/2137284

Anderson, G. M. (1996). Common conditions considered sensitive to ambulatory care. *Goel v, Williams JI, Anderson GM, Blackstien-Hirsch P, Fooks C, Naylor CD, Eds. Patterns of Health Care in Ontario. The ICES Practice Atlas. 2nd Ed. Ottawa, ON: Canadian Medical Association*, 104.

Arriagada, P. (2020). *The experiences and needs of older caregivers in Canada* (Government 75-006–X; Insights on Canadian Society). Statistics Canada. https://www150.statcan.gc.ca/n1/pub/75-006-x/2020001/article/00007-eng.html

Aryee, A., Rockenschaub, P., Robson, J., Priebe, M., Ahmed, Z., Fhogartaigh, C. N., Ball, D., Hayward, A., & Shallcross, L. (2023). Hospital admission after primary care consultation for community-onset lower urinary tract infection: A cohort study of risks and predictors using linked data. *British Journal of General Practice*, *73*(734), e694–e701. https://doi.org/10.3399/BJGP.2022.0592

Aspinall, P. J., & Song, M. (2013). Is race a 'salient…' or 'dominant identity' in the early 21st century: The evidence of UK survey data on respondents' sense of who they are. *Social Science Research*, *42*(2), 547–561. https://doi.org/10.1016/j.ssresearch.2012.10.007

Athari, M. (2020). *The healthy immigrant effect: A policy perspective* [thesis]. Simon Fraser University.

Austin, P. C. (2011). An introduction to propensity score methods for reducing the effects of confounding in observational studies. *Multivariate Behavioral Research*, *46*(3), 399–424. https://doi.org/10.1080/00273171.2011.568786

Austin, P. C. (2016). Variance estimation when using inverse probability of treatment weighting (IPTW) with survival analysis. *Statistics in Medicine*, *35*(30), 5642–5655. https://doi.org/10.1002/sim.7084

Austin, P. C., & Stuart, E. A. (2015). Moving towards best practice when using inverse probability of treatment weighting (IPTW) using the propensity score to estimate causal treatment effects in observational studies. *Statistics in Medicine*, *34*(28), 3661–3679. https://doi.org/10.1002/sim.6607

Bahrmann, A., Benner, L., Christ, M., Bertsch, T., Sieber, C. C., Katus, H., & Bahrmann, P. (2019). The Charlson Comorbidity and Barthel Index predict length of hospital stay, mortality, cardiovascular mortality and rehospitalization in unselected older patients admitted to the emergency department. *Aging Clinical and Experimental Research*, *31*, 1233–1242.

Bailey, R. L., Dog, T. L., Smith-Ryan, A. E., Das, S. K., Baker, F. C., Madak-Erdogan, Z., Hammond, B. R., Sesso, H. D., Eapen, A., Mitmesser, S. H., Wong, A., & Nguyen, H. (2022). Sex differences across the life course: A focus on unique nutritional and health considerations among women. *The Journal of Nutrition*, *152*(7), 1597–1610. https://doi.org/10.1093/jn/nxac059

Barker, I., Steventon, A., & Deeny, S. R. (2017). Association between continuity of care in general practice and hospital admissions for ambulatory care sensitive conditions: Cross sectional study of routinely collected, person level data. *BMJ*,(2017; 356 :j84). https://doi.org/10.1136/bmj.j84

Bayliss, E. A., Ellis, J. L., Shoup, J. A., Zeng, C., McQuillan, D. B., & Steiner, J. F. (2015). Effect of continuity of care on hospital utilization for seniors with multiple medical conditions in an integrated health care system. *The Annals of Family Medicine*, *13*(2), 123–129. https://doi.org/10.1370/afm.1739

Benchimol, E. I., Smeeth, L., Guttmann, A., Harron, K., Moher, D., Petersen, I., Sørensen, H. T., Von Elm, E., Langan, S. M., & RECORD Working Committee. (2015). The REporting of studies Conducted using Observational Routinely-collected health Data (RECORD) Statement. *PLOS Medicine*, *12*(10), e1001885. https://doi.org/10.1371/journal.pmed.1001885

Berry, S. D., Ngo, L., Samelson, E. J., & Kiel, D. P. (2010). Competing risk of death: An important consideration in studies of older adults. *Journal of the American Geriatrics Society*, *58*(4), 783–787. https://doi.org/10.1111/j.1532-5415.2010.02767.x

Bertakis, K. D., Azari, R., Helms, L. J., Callahan, E. J., & Robbins, J. A. (2000). Gender differences in the utilization of health care services. *The Journal of Family Practice*, *49*(2), 147–152.

Billings, J., Zeitel, L., Lukomnik, J., Carey, T. S., Blank, A. E., & Newman, L. (1993). Impact of socioeconomic status on hospital use in New York City. *Health Affairs*, *12*(1), 162–173. https://doi.org/10.1377/hlthaff.12.1.162

Billot, L., Corcoran, K., McDonald, A., Powell-Davies, G., & Feyer, A.-M. (2016). Impact evaluation of a system-wide chronic disease management program on health service utilisation: A propensity-matched cohort study. *PLOS Medicine*, *13*(6), e1002035. https://doi.org/10.1371/journal.pmed.1002035

Bitton, A., Veillard, J. H., Basu, L., Ratcliffe, H. L., Schwarz, D., & Hirschhorn, L. R. (2018). The 5S-5M-5C schematic: Transforming primary care inputs to outcomes in low-income and middle-income countries. *BMJ Global Health*, *3*(Suppl 3), e001020. https://doi.org/10.1136/bmjgh-2018-001020

Bowen, S. (2001). *Language barriers in access to health care*. Health Canada Ottawa.

Breslau, N., & Haug, M. R. (1976). Service delivery structure and continuity of care: A case study of a pediatric practice in process of reorganization. *Journal of Health and Social Behavior*, *17*(4), 339–352.

Breslau, N., & Reeb, K. G. (1975). Continuity of care in a university-based practice. *Journal of Medical Education*, *50*(10), 965–969. https://doi.org/10.1097/00001888-197510000-00006

Breton, M., Brousselle, A., Boivin, A., Roberge, D., Pineault, R., & Berbiche, D. (2015). Who gets a family physician through centralized waiting lists? *BMC Family Practice*, *16*(1), 10. https://doi.org/10.1186/s12875-014-0220-7

Breton, M., Denis, J.-L., & Lamothe, L. (2010). Incorporating public health more closely into local governance of health care delivery: Lessons from the Québec experience. *Canadian Journal of Public Health*, *101*(4), 314–317. https://doi.org/10.1007/BF03405293

Breton, M., Lévesque, J.-F., Pineault, R., & Hogg, W. (2011). Primary care reform: Can Quebec's Family Medicine Group Model benefit from the Eeperience of Ontario's Family health teams? *Healthcare Policy = Politiques De Sante*, *7*(2), e122-135.

Canada Department of Justice. (1985). *Canada Health Act*.

Canadian Institute for Health Information. (2014). *National Ambulatory Care Reporting System and Continuing Care Reporting System, 2013–2014.* https://secure.cihi.ca/free_products/ED_Report_ForWeb_EN_Final.pdf

Canadian Institute for Health Information. (2023). *Ambulatory care sensitive conditions [indicator].* [Computer software]. https://www.cihi.ca/en/indicators/ambulatory-care-sensitive-conditions

Carmel, S. (2019). Health and well-being in late life: Gender differences worldwide. *Frontiers in Medicine*, *6*, 218. https://doi.org/10.3389/fmed.2019.00218

Carrière, G. (2004). *Use of hospital emergency rooms* (Vol. 16, No.1; Health Reports). Statistics Canada. https://www150.statcan.gc.ca/n1/pub/82-003-x/2004001/article/7039-eng.pdf

CBC News. (2022, March 29). *New Quebec health plan promises better access to care, improved working conditions for nurses*. https://www.cbc.ca/news/canada/montreal/healthcare-reforms-quebec-1.6400317

Centers for Disease Control and Prevention (CDC). (2017). QuickStats: Percentage of adults aged ≥18 years who have seen or talked to a doctor or other Health care professional about their own health in the past 12 months, by sex and age group—National Health Interview Survey, United States, 2015. *MMWR. Morbidity and Mortality Weekly Report*, *66*(02), 65. https://doi.org/10.15585/mmwr.mm6602a12

Chau, E., Rosella, L. C., Mondor, L., & Wodchis, W. P. (2021). Association between continuity of care and subsequent diagnosis of multimorbidity in Ontario, Canada from 2001–2015: A retrospective cohort study. *PLOS ONE*, *16*(3), e0245193. https://doi.org/10.1371/journal.pone.0245193

Chong, C., Campbell, D., Elliott, M., Aghajafari, F., & Ronksley, P. (2022). Determining the association between continuity of primary care and acute care use in chronic kidney disease. *The Annals of Family Medicine*, *20*(3), 237–245. https://doi.org/10.1370/afm.2813

Conover, M. M., Rothman, K. J., Stürmer, T., Ellis, A. R., Poole, C., & Jonsson Funk, M. (2021). Propensity score trimming mitigates bias due to covariate measurement error in inverse probability of treatment weighted analyses: A plasmode simulation. *Statistics in Medicine*, *40*(9), 2101–2112. https://doi.org/10.1002/sim.8887

Donaldson, M. S., Yordy, K. D., Lohr, K. N., & Vanselow, N. A. (1996). *Primary care: America's health in a new era*.

Dufour, I., Chouinard, M.-C., Dubuc, N., Beaudin, J., Lafontaine, S., & Hudon, C. (2019). Factors associated with frequent use of emergency-department services in a geriatric population: A systematic review. *BMC Geriatrics*, *19*(1), 185. https://doi.org/10.1186/s12877-019-1197-9

Dufour, I., Vedel, I., Courteau, J., & Quesnel-Vallée, A. (2023). Trajectories of care of community-dwelling people living with dementia: A multidimensional state sequence analysis. *BMC Geriatrics*, *23*(1), 250. https://doi.org/10.1186/s12877-023-03926-x

Feng, Z., Coots, L. A., Kaganova, Y., & Wiener, J. M. (2014). Hospital and ED use among medicare beneficiaries with dementia varies by setting and proximity to death. *Health Affairs*, *33*(4), 683–690. https://doi.org/10.1377/hlthaff.2013.1179

Fulmer, T., Reuben, D. B., Auerbach, J., Fick, D. M., Galambos, C., & Johnson, K. S. (2021). Actualizing better health and health care for older adults: Commentary describes six vital directions to improve the care and quality of life for all older Americans. *Health Affairs*, *40*(2), 219–225. https://doi.org/10.1377/hlthaff.2020.01470

Gagné, T., & Lapalme, J. (2017). 1986: Ottawa and onwards. *The Lancet Public Health*, *2*(2), e71.

Gagné, T., & Veenstra, G. (2017). Inequalities in hypertension and diabetes in Canada: Intersections between racial identity, gender, and income. *Ethnicity & Disease*, *27*(4), 371–378. https://doi.org/10.18865/ed.27.4.371

Gagnon, M., Kansal, N., Goel, R., & Gastaldo, D. (2022). Immigration status as the foundational determinant of health for people without status in Canada: A scoping review. *Journal of Immigrant and Minority Health*, *24*(4), 1029–1044. https://doi.org/10.1007/s10903-021-01273-w

Gillespie, J. (2023). Health disparities for Canada's remote and northern residents: Can COVID-19 help level the field? *Journal of Bioethical Inquiry*, *20*(2), 207–213. https://doi.org/10.1007/s11673-023-10245-8

Gjestsen, M. T., Brønnick, K., & Testad, I. (2018). Characteristics and predictors for hospitalizations of home-dwelling older persons receiving community care: A cohort study from Norway. *BMC Geriatrics*, *18*(1), 203. https://doi.org/10.1186/s12877-018-0887-z

Godard-Sebillotte. (2020, May 26). *Godard-Sebillotte C, Arsenault-Lapierre G, Quesnel-Vallée A, Sourial N, Rochette L, Vedel I. Equity, care and health service use in community-dwelling persons with dementia, a population-wide descriptive study from Quebec (2000-2017). (2020, May 26-29). 2020 Canadian Association of Health Services and Policy Research (CAHSPR) Conference. Saskatoon, Canada. Oral. Conference cancelled.*

Godard-Sebillotte, C., Karunananthan, S., & Vedel, I. (2019). Difference-in-differences analysis and the propensity score to estimate the impact of non-randomized primary care interventions. *Family Practice*, *36*(2), 247–251. https://doi.org/10.1093/fampra/cmz003

Godard-Sebillotte, C., Strumpf, E., Sourial, N., Rochette, L., Pelletier, E., & Vedel, I. (2021a). Primary care continuity and potentially avoidable hospitalization in persons with dementia. *Journal of the American Geriatrics Society*, *69*(5), 1208–1220. https://doi.org/10.1111/jgs.17049

Godard-Sebillotte, C., Strumpf, E., Sourial, N., Rochette, L., Pelletier, E., & Vedel, I. (2021b). Avoidable Hospitalizations in persons with dementia: A population-wide descriptive study (2000–2015). *Canadian Geriatrics Journal*, *24*(3), 209–221. https://doi.org/10.5770/cgj.24.486

Gudicha, D. W., Schmittmann, V. D., & Vermunt, J. K. (2017). Statistical power of likelihood ratio and Wald tests in latent class models with covariates. *Behavior Research Methods*, *49*(5), 1824–1837. https://doi.org/10.3758/s13428-016-0825-y

Gunn, B. L. (2017). *Ignored to death: Systemic racism in the Canadian healthcare system*. Office of the United Nations High Commissioner for Human Rights. https://www.ohchr.org/sites/default/files/Documents/Issues/IPeoples/EMRIP/Health/UniversityManitoba.pdf

Haggerty, J. L., Reid, R. J., Freeman, G. K., Starfield, B. H., Adair, C. E., & McKendry, R. (2003). Continuity of care: A multidisciplinary review. *BMJ (Clinical Research Ed.)*, *327*(7425), 1219–1221. https://doi.org/10.1136/bmj.327.7425.1219

Haj-Ali, W., Moineddin, R., Hutchison, B., Wodchis, W. P., & Glazier, R. H. (2020). Role of Interprofessional primary care teams in preventing avoidable hospitalizations and hospital readmissions in Ontario, Canada: A retrospective cohort study. *BMC Health Services Research*, *20*(1), 782. https://doi.org/10.1186/s12913-020-05658-9

Hammond, W. P., Matthews, D., Mohottige, D., Agyemang, A., & Corbie-Smith, G. (2010). Masculinity, medical mistrust, and preventive health services delays among community-dwelling African-American men. *Journal of General Internal Medicine*, *25*(12), 1300–1308. https://doi.org/10.1007/s11606-010-1481-z

Hanes, A. (2023, February 18). *Prems driving new doctors out of public health system.* The Montreal Gazette. https://montrealgazette.com/opinion/columnists/allison-hanes-prems-driving-new-doctors-out-of-public-health-system

Haneuse, S., VanderWeele, T. J., & Arterburn, D. (2019). Using the E-Value to assess the potential effect of unmeasured confounding in observational studies. *JAMA*, *321*(6), 602. https://doi.org/10.1001/jama.2018.21554

Hanson, L. C., Zimmerman, S., Song, M.-K., Lin, F.-C., Rosemond, C., Carey, T. S., & Mitchell, S. L. (2017). Effect of the goals of care intervention for advanced dementia: A randomized clinical trial. *JAMA Internal Medicine*, *177*(1), 24. https://doi.org/10.1001/jamainternmed.2016.7031

Hendry, L. (2021, October 21). Patients fear their health will decline while they wait for Quebec family doctor. *CBC News*. https://www.cbc.ca/news/canada/montreal/quebec-waiting-list-family-doctors-1.6217030#:~:text=At%20the%20end%20of%20August%202021%2C%20nearly%20169%2C000%20Montrealers%20were,in%20neighbourhoods%20such%20as%20Verdun.

Hennen, B. K. (1975). Continuity of care in family practice. Part 1: Dimensions of continuity. *The Journal of Family Practice*, *2*(5), 371–372.

Hernán, M. A., & Robins, J. M. (2016). Using big data to emulate a target trial when a randomized trial is not available: Table 1. *American Journal of Epidemiology*, *183*(8), 758–764. https://doi.org/10.1093/aje/kwv254

Hernán, M., & Robins, J. (2020). *Causal inference: What if*. Boca Raton: Chapman & Hall/CRC.

Hilliard, R., & Brindamour, M. (2020). *Caring for kids new to Canada—Health insurance for immigrant and refugee families*. https://kidsnewtocanada.ca/care/insurance

Hsieh, V. C.-R., Hsieh, M.-L., Chiang, J.-H., Chien, A., & Hsieh, M.-S. (2019). Emergency department visits and disease burden attributable to ambulatory care sensitive conditions in elderly adults. *Scientific Reports*, *9*(1), 3811. https://doi.org/10.1038/s41598-019-40206-4

Huntley, A., Lasserson, D., Wye, L., Morris, R., Checkland, K., England, H., Salisbury, C., & Purdy, S. (2014). Which features of primary care affect unscheduled secondary care use? A systematic review. *BMJ Open*, *4*(5), e004746. https://doi.org/10.1136/bmjopen-2013-004746

Hutchison, B., Levesque, J.-F., Strumpf, E., & Coyle, N. (2011). Primary health care in Canada: Systems in motion. *Milbank Quarterly*, *89*(2), 256–288. https://doi.org/10.1111/j.1468-0009.2011.00628.x

Ionescu-Ittu, R., McCusker, J., Ciampi, A., Vadeboncoeur, A.-M., Roberge, D., Larouche, D., Verdon, J., & Pineault, R. (2007). Continuity of primary care and emergency department utilization among elderly people. *Canadian Medical Association Journal*, *177*(11), 1362–1368. https://doi.org/10.1503/cmaj.061615

James, S. A., Van Hoewyk, J., Belli, R. F., Strogatz, D. S., Williams, D. R., & Raghunathan, T. E. (2006). Life-course socioeconomic position and hypertension in African American men: The Pitt County Study. *American Journal of Public Health*, *96*(5), 812–817. https://doi.org/10.2105/AJPH.2005.076158

Jatrana, S., Richardson, K., & Pasupuleti, S. S. R. (2018). Investigating the dynamics of migration and health in Australia: A longitudinal study. *European Journal of Population*, *34*(4), 519–565. https://doi.org/10.1007/s10680-017-9439-z

Joo, J. Y. (2023). Fragmented care and chronic illness patient outcomes: A systematic review. *Nursing Open*, *10*(6), 3460–3473. https://doi.org/10.1002/nop2.1607

Jimenez, G., Matchar, D., Koh, G. C. H., Tyagi, S., Van Der Kleij, R. M. J. J., Chavannes, N. H., & Car, J. (2021). Revisiting the four core functions (4Cs) of primary care: Operational definitions and complexities. *Primary Health Care Research & Development*, *22*, e68. https://doi.org/10.1017/S1463423621000669

Jin, J. (2022). Routine checkups for adults. *JAMA*, *327*(14), 1410. https://doi.org/10.1001/jama.2022.1775

Jones, A., Bronskill, S. E., Seow, H., Junek, M., Feeny, D., & Costa, A. P. (2020). Associations between continuity of primary and specialty physician care and use of hospital-based care among community-dwelling older adults with complex care needs. *PLOS ONE*, *15*(6), e0234205. https://doi.org/10.1371/journal.pone.0234205

Kabisch, M., Ruckes, C., Seibert-Grafe, M., & Blettner, M. (2011). Randomized controlled trials. *Deutsches Ärzteblatt International*. https://doi.org/10.3238/arztebl.2011.0663

Khan, Y., Glazier, R. H., Moineddin, R., & Schull, M. J. (2011). A population-based study of the association between socioeconomic status and emergency department utilization in Ontario, Canada. *Academic Emergency Medicine*, *18*(8), 836–843. https://doi.org/10.1111/j.1553-2712.2011.01127.x

Knight, J. C., Dowden, J. J., Worrall, G. J., Gadag, V. G., & Murphy, M. M. (2009). Does higher continuity of family physician care reduce hospitalizations in elderly people with diabetes? *Population Health Management*, *12*(2), 81–86. https://doi.org/10.1089/pop.2008.0020

Laberge, M., & Gaudreault, M. (2019). Promoting access to family medicine in Québec, Canada: Analysis of Bill 20, enacted in November 2015. *Health Policy*, *123*(10), 901–905. https://doi.org/10.1016/j.healthpol.2019.08.003

Laroche, M. (2000). Health status and health services utilization of Canada's immigrant and non-immigrant populations. *Canadian Public Policy / Analyse de Politiques*, *26*(1), 51. https://doi.org/10.2307/3552256

Lebrun, L. A. (2012). Effects of length of stay and language proficiency on health care experiences among Immigrants in Canada and the United States. *Social Science & Medicine*, *74*(7), 1062–1072. https://doi.org/10.1016/j.socscimed.2011.11.031

Lee, S. K., Rowe, B. H., & Mahl, S. K. (2021). Increased private healthcare for Canada: Is that the right solution? *Healthcare Policy = Politiques De Sante*, *16*(3), 30–42. https://doi.org/10.12927/hcpol.2021.26435

Lesser, A., Israni, J., Lo, A. X., & Ko, K. J. (2020). Older adult visits to the emergency department for ambulatory care sensitive conditions. *Journal of the American College of Emergency Physicians Open*, *1*(5), 824–828. https://doi.org/10.1002/emp2.12164

Levesque, J.-F., Harris, M. F., & Russell, G. (2013). Patient-centred access to health care: Conceptualising access at the interface of health systems and populations. *International Journal for Equity in Health*, *12*(1), 18. https://doi.org/10.1186/1475-9276-12-18

Levoy, K., Rivera, E., McHugh, M., Hanlon, A., Hirschman, K. B., & Naylor, M. D. (2022). Caregiver engagement enhances outcomes among randomized control trials of transitional care interventions: A systematic review and meta-analysis. *Medical Care*, *60*(7), 519–529. https://doi.org/10.1097/MLR.0000000000001728

Lin, P.-J., Zhong, Y., Fillit, H. M., Cohen, J. T., & Neumann, P. J. (2017). Hospitalizations for ambulatory care sensitive conditions and unplanned readmissions among Medicare beneficiaries with Alzheimer's disease. *Alzheimer's & Dementia: The Journal of the Alzheimer's Association*, *13*(10), 1174–1178. https://doi.org/10.1016/j.jalz.2017.08.010

Macnaughton, E., Nelson, G., & Goering, P. (2013). Bringing politics and evidence together: Policy entrepreneurship and the conception of the At Home/Chez Soi Housing First Initiative for addressing homelessness and mental illness in Canada. *Social Science & Medicine*, *82*, 100–107. https://doi.org/10.1016/j.socscimed.2013.01.033

Mahmoudi, E., Kamdar, N., Furgal, A., Sen, A., Zazove, P., & Bynum, J. (2020). Potentially preventable hospitalizations among older adults: 2010-2014. *The Annals of Family Medicine*, *18*(6), 511–519. https://doi.org/10.1370/afm.2605

McCoy, C. E. (2017). Understanding the intention-to-treat principle in randomized controlled trials. *The Western Journal of Emergency Medicine*, *18*(6), 1075–1078. https://doi.org/10.5811/westjem.2017.8.35985

McWhinney, I. R. (1975). Continuity of care in family practice. Part 2: Implications of continuity. *The Journal of Family Practice*, *2*(5), 373–374.

Moucarry, M. (2023, October 4). *The Department of Family Medicine adopts Joyce's principle*. McGill Health E-news. https://healthenews.mcgill.ca/the-department-of-family-medicine-adopts-joyces-principle/#:~:text=Joyce's%20Principle%20aims%20to%20guarantee,mental%2C%20emotional%20and%20spiritual%20health.

Nakayama, G., Masumoto, S., Haruta, J., & Maeno, T. (2023). Association between family caregivers' primary care experience when they report as patients and their stress related to caregiving: A pilot cross-sectional study. *Journal of General and Family Medicine*, *24*(4), 231–239. https://doi.org/10.1002/jgf2.631

Naseem, T. (2015). *Access to healthcare for precarious immigration status persons: Humans first, status later*. York University.

National Research Council. (2001). Preparing for an aging world: The case for cross-national research. Washington (DC): In *:(US) Panel on a Research Agenda and New Data for an Aging World.* National Academies Press (US. The Health of Aging Populations. Available from:https://www.ncbi.nlm.nih.gov/books/NBK98373/.

Nationale du Québec, A. (2017). Projet de loi no 20: Loi édictant la Loi favorisant l'accès aux services de médecine de famille et de médecine spécialisée et modifiant diverses dispositions législatives en matière de procréation assistée. 2015.

Nielsen, M., D'Agostino, D., & Gregory, P. (2017). Addressing rural health challenges head on. *Missouri Medicine*, *114*(5), 363–366.

Nyweide, D. J., Anthony, D. L., Bynum, J. P. W., Strawderman, R. L., Weeks, W. B., Casalino, Lawrence. P., & Fisher, E. S. (2013). Continuity of care and the risk of preventable hospitalization in older adults. *JAMA Internal Medicine*, *173*(20), 1879. https://doi.org/10.1001/jamainternmed.2013.10059

O'Connor, P. J., Sperl-Hillen, J. M., Johnson, P. E., Rush, W. A., & Biltz, G. (2005). Clinical inertia and outpatient medical errors. *Advances in Patient Safety:From Research to Implementation*, *2*, 16.

Olah, M. E., Gaisano, G., & Hwang, S. W. (2013). The effect of socioeconomic status on access to primary care: An audit study. *Canadian Medical Association Journal*, *185*(6), E263–E269. https://doi.org/10.1503/cmaj.121383

Oliver, D., Deal, K., Howard, M., Qian, H., Agarwal, G., & Guenter, D. (2019). Patient trade-offs between continuity and access in primary care interprofessional teaching clinics in Canada: A cross-sectional survey using discrete choice experiment. *BMJ Open*, *9*(3), e023578. https://doi.org/10.1136/bmjopen-2018-023578

Pollack, C. E., Hussey, P. S., Rudin, R. S., Fox, D. S., Lai, J., & Schneider, E. C. (2016). Measuring care continuity: A comparison of claims-based methods. *Medical Care*, *54*(5), e30–e34. https://doi.org/10.1097/MLR.0000000000000018

Pourhoseingholi, M. A., Baghestani, A. R., & Vahedi, M. (2012). How to control confounding effects by statistical analysis. *Gastroenterology and Hepatology from Bed to Bench*, *5*(2), 79–83.

Powell, W., Richmond, J., Mohottige, D., Yen, I., Joslyn, A., & Corbie-Smith, G. (2019). Medical mistrust, racism, and delays in preventive health screening among African-American men. *Behavioral Medicine*, *45*(2), 102–117. https://doi.org/10.1080/08964289.2019.1585327

Public Health Agency of Canada. (2020). *Aging and chronic diseases: A profile of Canadian seniors*. Public Health Agency of Canada = Agence de la santé publique du Canada.

Purdy, S., Griffin, T., Salisbury, C., & Sharp, D. (2009). Ambulatory care sensitive conditions: Terminology and disease coding need to be more specific to aid policy makers and clinicians. *Public Health*, *123*(2), 169–173. https://doi.org/10.1016/j.puhe.2008.11.001

Quesnel-Vallée, A., Willson, A., & Reiter-Campeau, S. (2015). Health inequalities among older adults In developed countries: Reconciling theories and policy approaches. *Population Change and Lifecourse Strategic Knowledge Cluster Discussion Paper Series/ Un Réseau Stratégique de Connaissances Changements de Population et Parcours de Vie Document de Travail*, *3*(1), Article 6. https://ir.lib.uwo.ca/pclc/vol3/iss1/6

Ramraj, C., Shahidi, F. V., Darity, W., Kawachi, I., Zuberi, D., & Siddiqi, A. (2016). Equally inequitable? A cross-national comparative study of racial health inequalities in the United States and Canada. *Social Science & Medicine*, *161*, 19–26. https://doi.org/10.1016/j.socscimed.2016.05.028

Ravichandiran, N., Mathews, M., & Ryan, B. L. (2022). Utilization of healthcare by immigrants in Canada: A cross-sectional analysis of the Canadian Community Health Survey. *BMC Primary Care*, *23*(1), 69. https://doi.org/10.1186/s12875-022-01682-2

Reed, Richard. L., Isherwood, L., & Ben-Tovim, D. (2015). Why do older people with multi-morbidity experience unplanned hospital admissions from the community: A root cause analysis. *BMC Health Services Research*, *15*(1), 525. https://doi.org/10.1186/s12913-015-1170-z

Ridge, A., Peterson, G. M., & Nash, R. (2022). risk factors associated with preventable hospitalisation among rural community-dwelling patients: A systematic review. *International Journal of Environmental Research and Public Health*, *19*(24), 16487. https://doi.org/10.3390/ijerph192416487

Ridic, G., Gleason, S., & Ridic, O. (2012). Comparisons of health care systems in the United States, Germany and Canada. *Materia Socio Medica*, *24*(2), 112. https://doi.org/10.5455/msm.2012.24.112-120

Rogers, J., & Curtis, P. (1980). The concept and measurement of continuity in primary care. *American Journal of Public Health*, *70*(2), 122–127. https://doi.org/10.2105/AJPH.70.2.122

Roser, M., Ortiz-Ospina, E., & Ritchie, H. (2013). *Life expectancy*. Our World in Data. https://ourworldindata.org/life-expectancy

Rudoler, D., Peterson, S., Stock, D., Taylor, C., Wilton, D., Blackie, D., Burge, F., Glazier, R. H., Goldsmith, L., Grudniewicz, A., Hedden, L., Jamieson, M., Katz, A., MacKenzie, A., Marshall, E., McCracken, R., McGrail, K., Scott, I., Wong, S. T., & Lavergne, M. R. (2022). Changes over time in patient visits and continuity of care among graduating cohorts of family physicians in 4 Canadian provinces. *Canadian Medical Association Journal*, *194*(48), E1639–E1646. https://doi.org/10.1503/cmaj.220439

Sanmartin, C. A., Khan, S., & Team, L. R. (2011). *Hospitalizations for ambulatory care sensitive conditions (ACSC): The factors that matter*. Statistics Canada, Health Information and Research Division.

Savoy, M., Hazlett-O'Brien, C., & Rapacciuolo, J. (2017). The role of primary care physicians in managing chronic disease. *Delaware Journal of Public Health*, *3*(1), 86–93. https://doi.org/10.32481/djph.2017.03.012

Shoultz, J., & Hatcher, P. A. (1997). Looking beyond primary care to primary health care: An approach to community-based action. *Nursing Outlook*, *45*(1), 23–26. https://doi.org/10.1016/S0029-6554(97)90054-3

Simard, M., Sirois, C., & Candas, B. (2018). Validation of the Combined Comorbidity Index of Charlson and Elixhauser to predict 30-day mortality across ICD-9 and ICD-10. *Medical Care*, *56*(5), 441–447. https://doi.org/10.1097/MLR.0000000000000905

Sourial, N., Longo, C., Vedel, I., & Schuster, T. (2018). Daring to draw causal claims from non-randomized studies of primary care interventions. *Family Practice*, *35*(5), 639–643. https://doi.org/10.1093/fampra/cmy005

Stange, K. C., Nutting, P. A., Miller, W. L., Jaén, C. R., Crabtree, B. F., Flocke, S. A., & Gill, J. M. (2010). Defining and measuring the patient-centered medical home. *Journal of General Internal Medicine*, *25*(6), 601–612. https://doi.org/10.1007/s11606-010-1291-3

Statistics Canada. (2015). *Canadian Community Health Survey—Annual component (CCHS) detailed information for 2014 [Internet]. Ottawa (ON): Statistics Canada; [updated 2015 Apr 20]*

Statistics Canada. (2018). *Projected population, by projection scenario, age and sex, as of July 1, Canada, Provinces and Territories, annual (x 1,000), [Table 17-10-0057-01] https://www150.statcan.gc.ca/t1/tbl1/en/tv.action?pid=1710005701&request_locale=en*.

Statistics Canada. (2019). *Dental, 2018* (Health Facts Sheets). https://www150.statcan.gc.ca/n1/en/pub/82-625-x/2019001/article/00010-eng.pdf?st=JjHOnQod

Statistics Canada. (2021). *All-cause acute care hospitalization rates of immigrants and the Canadian-born population: A linkage study* [dataset]. Government of Canada. https://doi.org/10.25318/82-003-X202100900001-ENG

Statistics Canada. (2022a). *In the midst of high job vacancies and historically low unemployment, Canada faces record retirements from an aging labour force: Number of seniors aged 65 and older grows six*

times faster than children 0-14. https://www150.statcan.gc.ca/n1/daily-quotidien/220427/dq220427a-eng.htm

Statistics Canada. (2022b). *Older adults and population aging statistics*. https://www.statcan.gc.ca/en/subjects-start/older_adults_and_population_aging

Statistics Canada. (2022c). *Oldest adults in Canada*. https://www12.statcan.gc.ca/census-recensement/2021/as-sa/98-200-X/2021004/98-200-X2021004-eng.cfm

Stephens, D. A. (n.d.). *Propensity score methods, models and adjustment*. https://si.biostat.washington.edu/sites/default/files/modules/SISCER2021-PS-MMA-Color.pdf

Strumpf, E. C. (2022). Racial/ethnic disparities in primary care: The role of physician-patient concordance. *Medical Care Research and Review*, *49*(5), 9.

Strumpf, E. C., Goldsmith, L. J., King, C. E., Lavergne, R., Mccracken, R. K., Mcgrail, K. M., & Simon, L. (2022). *Measuring access to and quality of primary care in Quebec: Insights from research on patient enrolment policies* (2022PE-04). CIRANO.

Supper, I., Catala, O., Lustman, M., Chemla, C., Bourgueil, Y., & Letrilliart, L. (2014). Interprofessional collaboration in primary health care: A review of facilitators and barriers perceived by involved actors. *Journal of Public Health*, fdu102. https://doi.org/10.1093/pubmed/fdu102

Szumilas, M. (2010). Explaining odds ratios. *Journal of the Canadian Academy of Child and Adolescent Psychiatry = Journal De l'Academie Canadienne De Psychiatrie De L'enfant Et De L'adolescent*, *19*(3), 227–229.

Tarlier, D. S., Johnson, J. L., & Whyte, N. B. (2003). Voices from the wilderness: An interpretive study describing the role and practice of outpost nurses. *Canadian Journal of Public Health*, *94*(3), 180–184. https://doi.org/10.1007/BF03405062

Turin, T. C., Rashid, R., Ferdous, M., Naeem, I., Rumana, N., Rahman, A., Rahman, N., & Lasker, M. (2020). Perceived barriers and primary care access experiences among immigrant Bangladeshi men in Canada. *Family Medicine and Community Health*, *8*(4), e000453. https://doi.org/10.1136/fmch-2020-000453

Vaidya, V., Partha, G., & Karmakar, M. (2012). Gender differences in utilization of preventive care services in the United States. *Journal of Women's Health (2002)*, *21*(2), 140–145. https://doi.org/10.1089/jwh.2011.2876

Van Der Pol, M., Olajide, D., Dusheiko, M., Elliott, R., Guthrie, B., Jorm, L., & Leyland, A. H. (2019). The impact of quality and accessibility of primary care on emergency admissions for a range of chronic ambulatory care sensitive conditions (ACSCs) in Scotland: Longitudinal analysis. *BMC Family Practice*, *20*(1), 32. https://doi.org/10.1186/s12875-019-0921-z

Vanasse, A., Chiu, Y. M., Courteau, J., Dorais, M., Bartlett, G., Zawaly, K., & Benigeri, M. (2021). Cohort Profile: The Care Trajectories—Enriched Data (TorSaDE) cohort. *International Journal of Epidemiology*, *50*(4), 1066–1066h. https://doi.org/10.1093/ije/dyaa167

VanderWeele, T. J., & Ding, P. (2017). Sensitivity analysis in observational research: Introducing the E-Value. *Annals of Internal Medicine*, *167*(4), 268. https://doi.org/10.7326/M16-2607

Viera, A. J., Thorpe, J. M., & Garrett, J. M. (2006). Effects of sex, age, and visits on receipt of preventive healthcare services: A secondary analysis of national data. *BMC Health Services Research*, *6*, 15. https://doi.org/10.1186/1472-6963-6-15

Von Elm, E., Altman, D. G., Egger, M., Pocock, S. J., Gøtzsche, P. C., Vandenbroucke, J. P., & for the STROBE Initiative. (2007). The Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) Statement: Guidelines for reporting observational studies. *Annals of Internal Medicine*, *147*(8), 573. https://doi.org/10.7326/0003-4819-147-8-200710160-00010

Waldron, I., Hughes, M. E., & Brooks, T. L. (1996). Marriage protection and marriage selection—Prospective evidence for reciprocal effects of marital status and health. *Social Science & Medicine*, *43*(1), 113–123. https://doi.org/10.1016/0277-9536(95)00347-9

Walsh, E. G., Wiener, J. M., Haber, S., Bragg, A., Freiman, M., & Ouslander, J. G. (2012). Potentially avoidable hospitalizations of dually eligible medicare and medicaid beneficiaries from nursing facility and home-community-based services waiver programs. *Journal of the American Geriatrics Society*, *60*(5), 821–829. https://doi.org/10.1111/j.1532-5415.2012.03920.x

Wankah, P., Breton, M., Lukey, A., Gaboury, I., Smithman, M. A., Malo, M.-É., & Oelke, N. (2022). Shaping primary health care teams and integrated care in Québec: An overview of policies (2000-2020). *Health Reform Observer - Observatoire Des Réformes de Santé*, *10*(1). https://doi.org/10.13162/hro-ors.v10i1.4691

Weatherill, S. (2007). *Laying the groundwork for culture change: The legacy of the Primary Health Care Transition Fund*. Health Canada, Primary Health Care Transition Fund.

Wilson, C. R., Rourke, J., Oandasan, I. F., & Bosco, C. (2020). Progress made on access to rural health care in Canada. *Canadian Family Physician*, *66*(1), 31–36.

World Health Organization. (1978). *declaration of Alma-Ata. International Conference on Primary Health Care; 1978; Alma-Ata, USSR*.

World Health Organization WHO. (2021). *Aging and health*. https://www.who.int/news-room/fact-sheets/detail/ageing-and-health

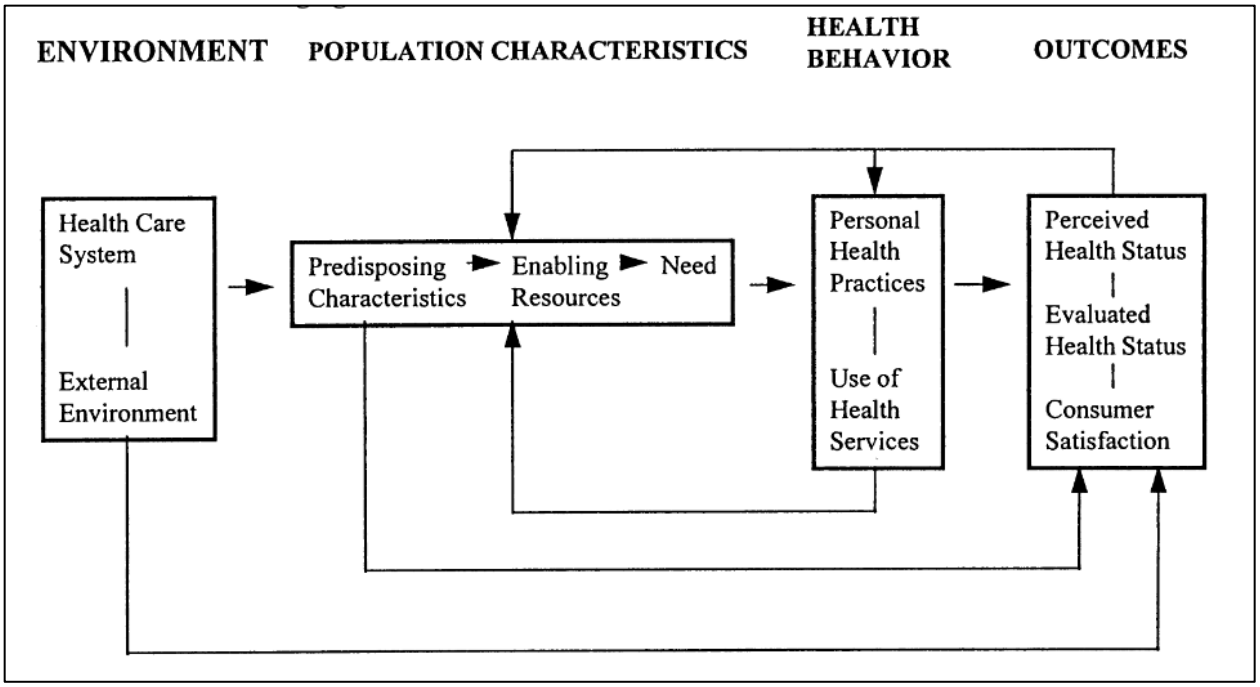
Young, H. (2015). Proposed reforms delay Quebec's Bill 20. *Canadian Medical Association Journal*, *187*(10), E303–E303. https://doi.org/10.1503/cmaj.109-5086

Chapter 8: Appendix

8.1 Figures

Figure 1

Andersen's Behaviour Model of Health Services Use



Note. (Andersen, 1995)

Figure 2

Study population flow chart

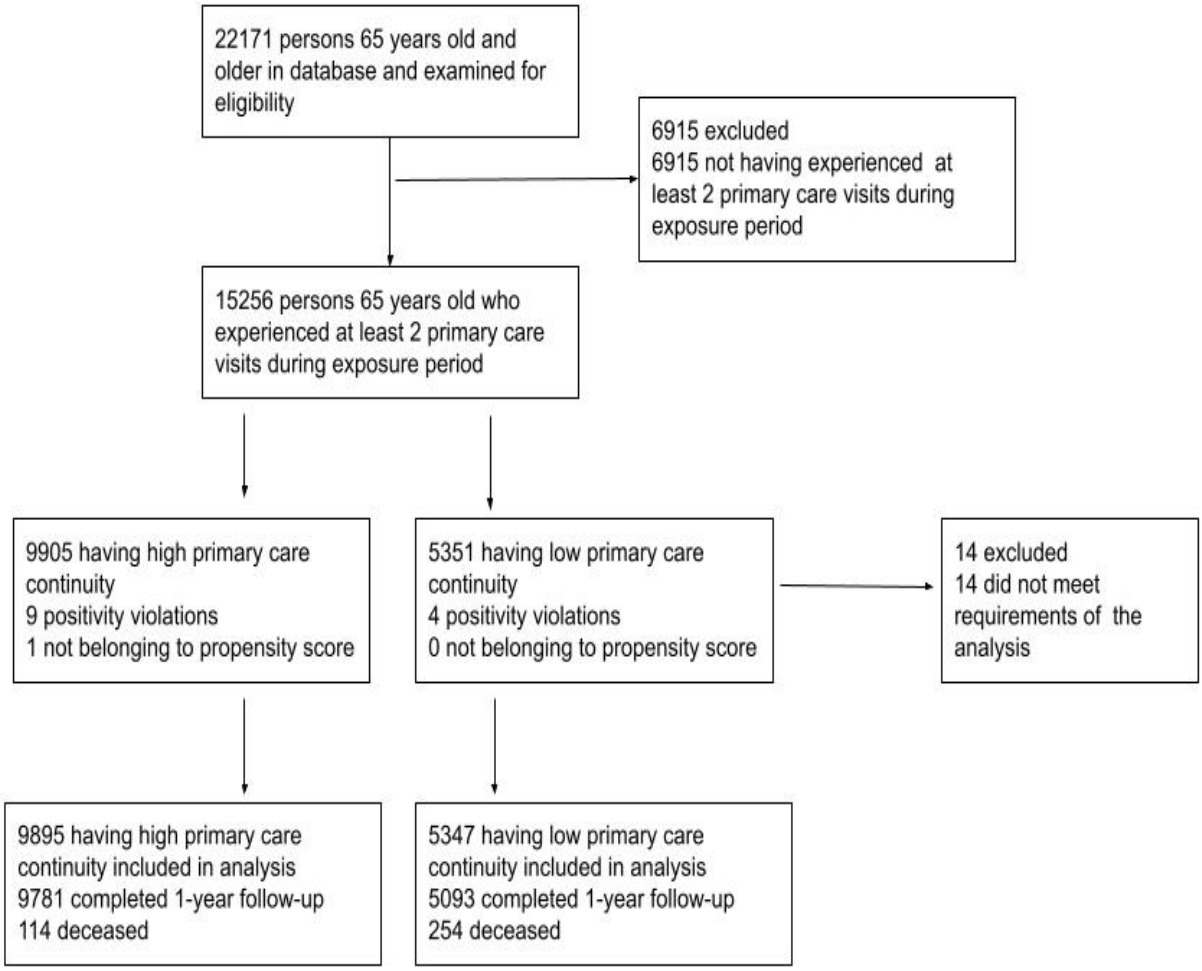
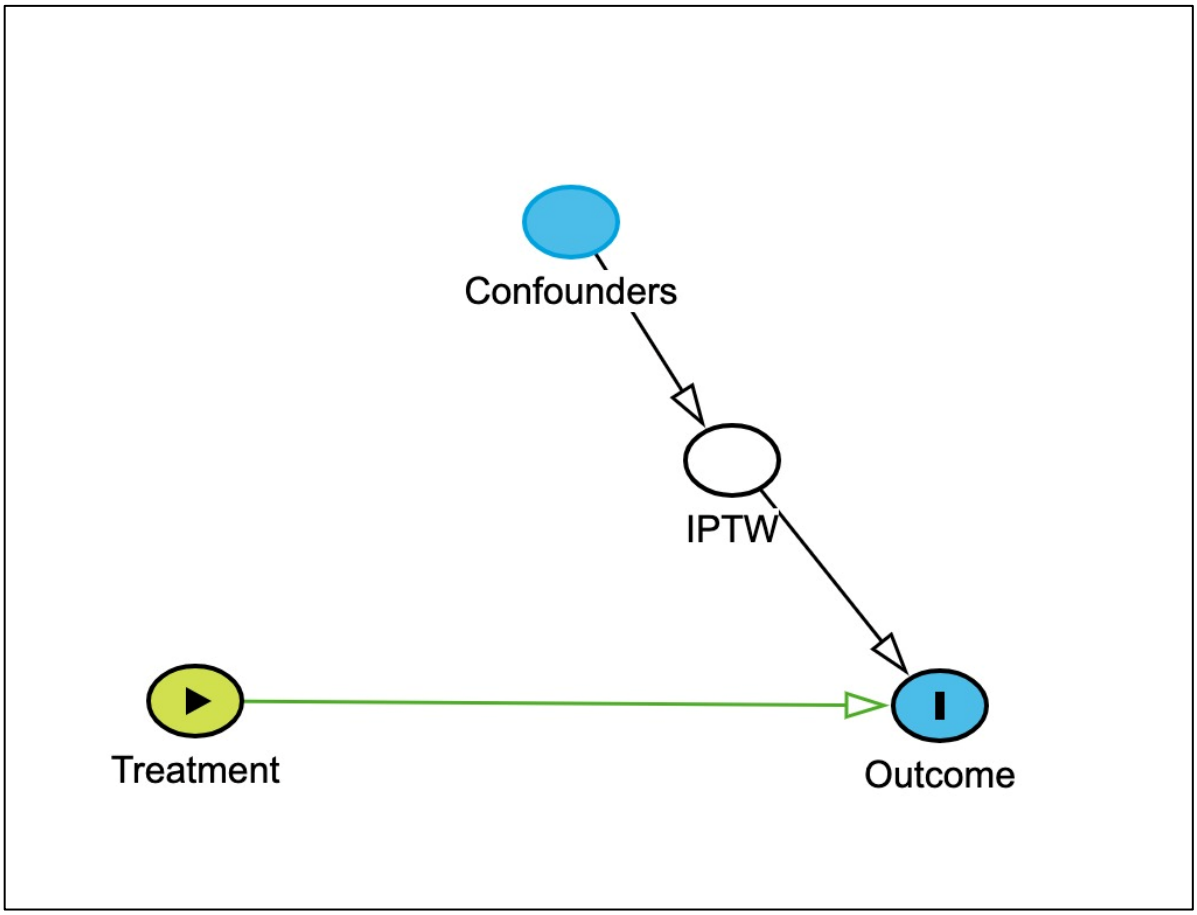


Figure 3

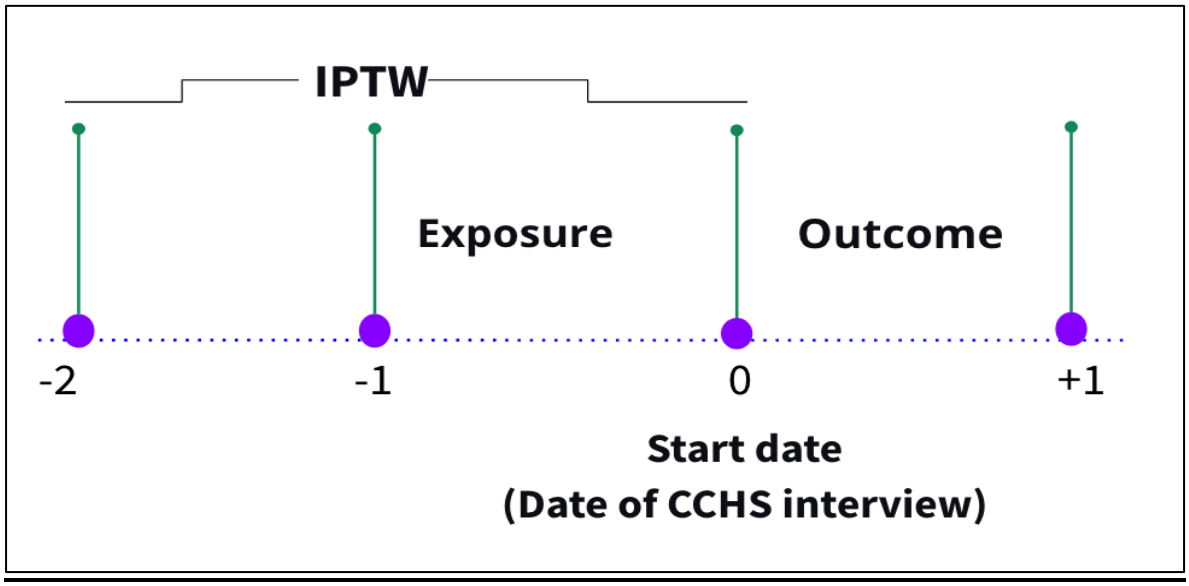
Directed Acyclic Graph



Note. The directed acyclic graph shows the relationship between treatment, outcome, confounders, and inverse probability of treatment weighting (IPTW). There is a causal relationship between treatment and outcome. Confounding is balanced using the inverse probability of treatment weighting. Thus, the confounding pathway is blocked. This directed acyclic graph is inspired by an example provided in a lecture by Dr. David A. Stephens (Stephens, n.d.).

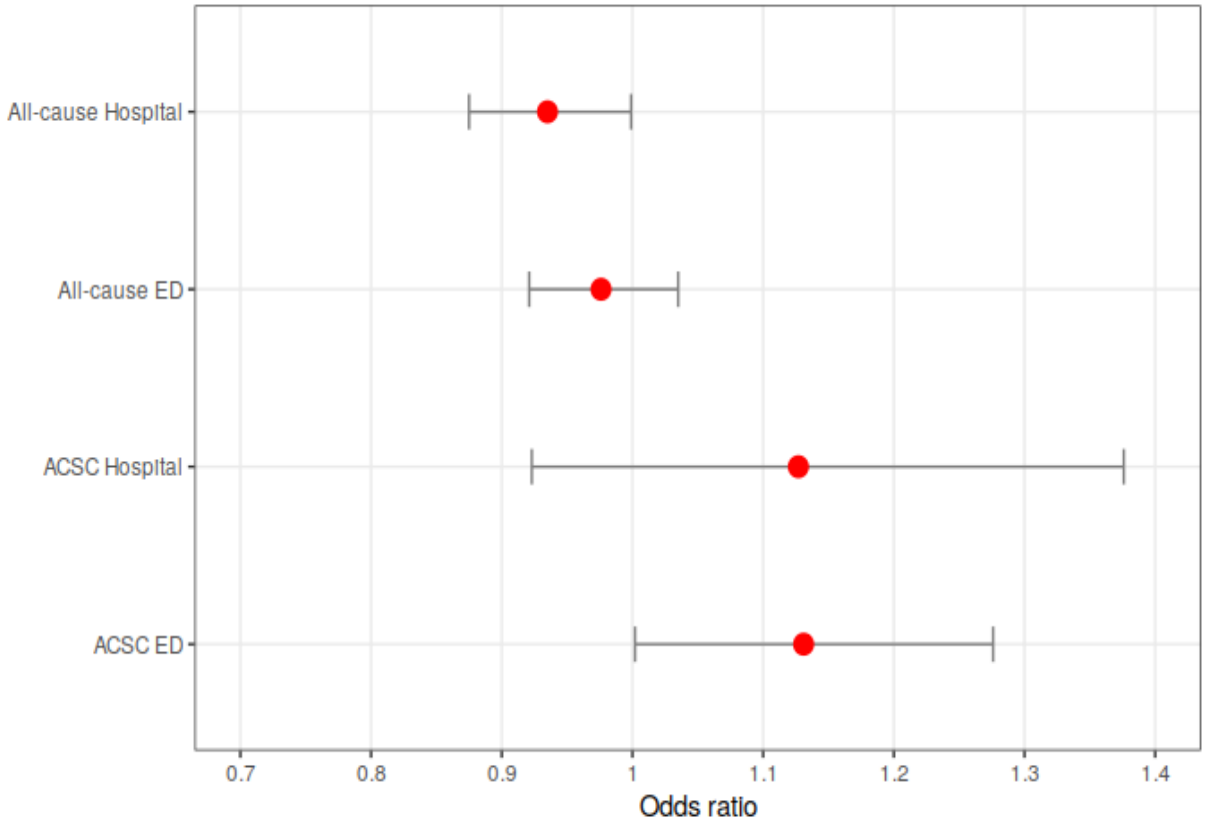
Figure 4

Study design



Note. Variables for the inverse probability treatment weighting (IPTW) were measured during the 2 years before the study start date (date that the Canadian Community Health Survey (CCHS) was completed). Exposure was captured during the one year before the study start date to avoid target trial emulation failure (M. A. Hernán & Robins, 2016). The outcome was measured during the 1 year after the study start date.

Figure 5
Forest plot of weighted odds ratios and corresponding 95% confidence intervals of high primary care continuity on all-cause emergency department visits, all-cause hospitalizations, ACSC emergency department visits, and ACSC hospitalizations.



ED= emergency department. ACSC= Ambulatory Care Sensitive Condition.

8.2 Tables

Table 1
Algorithm for the identification of Ambulatory Care Sensitive Conditions (ACSC) for older adults

Primary diagnosis	ICD-9	ICD-10
Asthma	493 / 493.01 / 493.02 / 493.10 / 493.11 / 493.12 / 493.20 / 493.21 / 493.22 / 493.81 / 493.82 / 493.90 / 493.91 / 493.92	J45.20 / J45.22 / J45.21 / J44.9 / J44.0 / J44.1 / J45.990 / J45.991 / J45.909 / J45.998 / J45.902 / J45.901
Cardiac heart failure / Congestive heart failure (CHF)	428 / 518.4 398.91 / 402.11 / 402.91 / 404.11 / 404.13 / 404.91 / 404.93 / 428.0 / / 428.1 / 428.20 / 428.21 / 428.22 / 428.23 / 428.30 / 428.31 / 428.32 / 428.33 / 428.40 / 428.41 / 428.42 / 428.43 / 428.9 / 518.4	I50.9 / I50.1 / I50.20 / I50.21 / I50.22 / I50.23 / I50.30 / I50.31 / I50.32 / I50.33 / I50.40 / I50.41 / I50.42 / I50.43 / J81.0 / I09.81 / I11.0 / I13.0 / I13.2
Chronic obstructive pulmonary disorder (COPD), Chronic bronchitis	491 / 492 / 494 / 496 466.0 / 466.11 / 466.19 / 490. / 491.1 / 491.20 / 491.21 / 491.8 / 491.9 / 492.0 / 492.8 / 494.0 / 494.1	J41.0 / J41.1 / J44.9 / J44.1 / J41.8 / J42 / J43.9 / J47.9 / J47.1 / J20.9 / J21.0 / J21.8 / J40
Diabetes/Poor glycemic control/ hyper- and hypoglycemia: diabetes mellitus with ketoacidosis or hyperosmolar coma	250.0 / 250.1 / 250.2 / 250.8 / 250.02 / 250.03 / 250.10 / 250.11 / 250.12 / 250.13 / 250.20 / 250.21 / 250.22 / 250.23 / 250.30 / 250.31 / 250.32 / 250.33 / 251.0 / 251.2 / 790.29	E11.9 / E10.9 / E11.65 / E10.65 / E11.01 / E11.69 / E13.10 / E10.10 / E11.00 / E11.641 / E10.641 / E10.618 / E10.620 / E10.621 / E10.622 / E10.628 / E10.630 / E10.638 / E10.649 / E11.618 / E11.620 / E11.621 / E11.622 / E11.628 / E11.630 / E11.638 / E11.649 / E15 / E16.2 / R73.03 / R73.09 / E10.69 / E10.11
Hypertension	401.0 / 401.9 / 402.0 / 402.1 / 402.9 / / 403.10 / 403.90 / 404.10 / 404.90	I10 / I16.9 / I11.9 / I11.0 / I13.10 / I20.0 / I12.9
Angina	411.1 / 411.8 / 413	I20.0 / I24.0 / I24.8 / I20.8 / I20.1 / I20.9
Hypotension	458.0 / 458 / 458.8.1 / 458.21 /458.29 / 458.9	I95.1 / I95.89 / I95.3 / I95.2 / I95.81 / I95.9
Dehydration, volume depletion acute renal failure hypokalemia hyponatremia	276.5 / 276.8 / 584.5 / 584.6 / 584.7 / 584.8 / 584.9 / 588.81 / 588.89 / 588.9 / 276.1 / 276.8	E87.1 / E86.9 / E86.0 / E86.1 / E87.6 / N17.0 / N17.1 / N17.2 / N17.8 / N17.9 / N25.81 / N25.89 / N25.9

Seizures (Grand mal status and other epileptic convulsions)	345 / 345.01 / 345.10 / 345.11 / 345.2 / 345.3 / 345.40 / 345.41345.50 / 345.51 / 345.60 / 345.61 / 345.70 / 345.71 / 345.80 / 345.81 / 345.90 / 345.91436. / 780.31 / 780.39	G40.401 / G40.409 / G40.311 / G10.411 / G40.419 / G40.A01 / G40.A09 / G40.A11 / G40.A19 / G40.301 / G40.201 / G40.209 / G40.211 / G40.219 / G40.101 / G40.109 / G40.111 / G40.119 / G40.821 / G40.822 / G40.823 / G40.824 / G40.501 / G40.509 / G40.802 / G40.804 / G40.901 / G40.909 / G40.911 / G40.919 / I67.89 / R56.00 / R56.9
Pneumonia (Lower respiratory: pneumonia & bronchitis)	480.0 / 480.1 / 480.2 / 480.3 / 480.8 / 480.9 / 481. / 482.0 / 482.1 / 482.2 / 482.30 / 482.31 / 482.32 / 482.39 / 482.40 / 482.41 / 482.49 / 482.81 / 482.82 / 482.83 / 482.84 / 482.89 / 482.9 / 483.0 / 483.1 / 483.8 / 485. / 486. / 507.0	J12.0 / J12.1 / J12.2 / J12.81 / J12.89 / J12.9 / J13 / J18.1 / J15.0 / J15.1 / J14 / J15.4 / J15.3 / J15.20 / J15.211 / J15.29 / J15.8 / J15.5 / J15.6 / A48.1 / J15.9 / J15.7 / J16.0 / J16.8 / J18.0 / J18.9 / J69.0
Urinary Tract Infection	590.10 / 590.11 / 590.80 / 590.81 / 590.9 / 595.0 / 595.1 / 595.2 / 595.4 / 595.89 / 595.9 / 597.0 / 598.00 / 598.01 / 599.0 / 601.0 / 601.1 / 601.2 / 601.3 / 601.4 / 601.8 / 601.9	N10 / N12 / N16 / N15.9 / N30.00 / N30.01 / N30.10 / N30.11 / N30.20 / N20.21 / N30.80 / N30.81 / N30.90 / N30.91 / N34.0 / N35.111 / N37 / N39.0 / N41.0 / N41.1 / N41.2 / N41.3 / N51 / N41.4 / N41.8 / N41.9
Constipation /fecal impaction/obstipation	560.39 / 564.00 / 564.01 / 564.09	K56.49 / K59.00 / K59.01 / K59.03 / K59.04 / K59.09
Skin ulcers	707.00 / 707.01 / 707.02 / 707.03 / 707.04 / 707.05/707.06 / 707.07 / 707.09 / 707.10 / 707.11 / 707.12 / 707.13 / 707.14 / 707.9 / 707.15 / 707.19 / 707.8	L89.90 / L89.009 / L89.119 / L89.129 / L89.139 / L89.149 / L89.159 / L89.209 / L89.309 / L89.509 / L89.609 / L89.819 / L89.899 / L97.909 / L97.109 / L97.209 / L97.309 / L97.409 / L97.509 / L97.809 / L98.419 / L98.429 / L98.499
Weight loss adult failure to thrive	783.21 / 783.22 / 783.3 / 783.7	R63.4 / R63.6 / R63.3 / R62.7
Nutritional deficiency	260. / 261. / 262 / 263.0. / 263.1 / 263.2 / 263.8 / 263.9 / 268.0 / 268.1	E40 / E41 / E43 / E44.0 / E44.1 / E45 / E46 / E55.0 / E64.3

Note. This list was inspired by CIHI and Walsh and colleagues(Canadian Institute for Health Information, 2023; Walsh et al., 2012). This list was used in other studies such as one by Godard-Sebillotte and colleagues (Godard-Sebillotee et al., 2021).

Table 2

Variables used to compute propensity score

Domain	Construct	Indicator(s)	Data source
Predisposing factors	Gender	Sex (binary): man woman	CCHS: self-report. Sex is used as an approximation for gender
	Ethnicity	Racial/cultural groups (binary): White Non-white	CCHS: self-report. Recoded categorical variable to binary variable.
		Indigenous status (binary) Yes No	CCHS: self-report
	Citizenship	Citizenship (categorical): Canadian born Recent immigrant (<10 year) Established immigrant (≥ 10 years	CCHS: self-report. Variable recoded from two questions. One about being born in Canada and another about years since immigration.
Enabling factors	Socioeconomic position	Educational attainment (binary): less than secondary At least secondary	CCHS: derived based on self-reported level of completion of high school
		Household income in past 12 months (categorical) <20,000 20,000 – 39,999 40,000 – 59,999 60,000 – 79,999 >80,000	CCHS: self-report
		Marital status (categorical) Married Common law Never married Separated Divorced Widowed	CCHS: self-report

	Urbanicity/ rurality	Population centre or rural area classification (categorical): population centre rural area	CCHS: derived variable which classifies respondents based on the residential population density of the region of residence based on Canadian Census data (using self-reported postal code)
Medical need	Age	Chronological age (continuous)	CCHS: self-reported date of birth (dd/mm/yyyy)
	Health status	Perceived overall health (Likert scale) Excellent Very good Good Ok Poor	CCHS: self-reported
	Health status Previous hospitalization	Combined Charlson and Elixhauser Comorbidity Index (ICD 10) (Scores range from 0-32)	RAMQ: pre-coded algorithm calculating comorbidity index 2 years and 1 year prior to index
	Previous hospital and ED use	Number of days in hospital (continuous)	Total number of days hospitalized 1 year prior to CCHS interview date (Discharge date -Admission date except 1 if Discharge date=Admission date)
		Number of hospitalizations (continuous)	Number of hospitalizations 1 year prior to CCHS interview date (hospital transfers are considered part of the same hospitalization)
		Number of emergency department visits (continuous)	Number of ED visits 1 year prior to CCHS interview date (2 ED visits are considered separate if they are at least one day apart)

Note. The validated Combined Charlson and Elixhauser Comorbidity index takes into account 32 conditions, weighted to obtain an individual score. It was validated in Québec administrative data to predict 30-day mortality. The index is a weighted average of the presence or absence of each condition. Each weight represents the risk of a 30-day mortality associated with each condition. These weights range from 0 to 5 and 14 conditions have a weight of zero in the ICD 10 classification. The scores range from 0 to 32(Simard et al., 2018).

Table 3

Odds ratios, confidences intervals, Wald Chi-Squared Test, standard error, and p-values of outcomes using the unweighted, partially weighted, and weighted samples

Outcome	Model	Chi	p-value	point estimate	LCI	UCI	Standard error
All-cause hospitalization	unweighted	1.240	0.270	0.956	0.883	1.035	0.041
	Partially weighted	3.762	0.052	0.936	0.876	1.001	0.034
	Weighted	3.942	0.047*	0.935**	0.875	0.999	0.034
All-cause ED	unweighted	0.002	0.966	1.002	0.934	1.074	0.036
	Partially weighted	0.554	0.457	0.978	0.922	1.037	0.030
	Weighted	0.644	0.422	0.976	0.921	1.035	0.030
ACSC hospitalization	unweighted	1.185	0.276	1.140	0.898	1.456	0.123
	Partially weighted	1.432	0.231	1.130	0.925	1.379	0.102
	Weighted	1.384	0.240	1.127	0.923	1.376	0.102
ACSC ED	unweighted	3.934	0.047*	1.160**	1.002	1.344	0.075
	Partially weighted	3.958	0.047*	1.130**	1.002	1.277	0.062
	Weighted	3.942	0.047*	1.131**	1.002	1.276	0.062

Note. This table demonstrates the differences in association and statistical significance using different statistical models: unweighted, partially weighted, and weighted. The weighted model differs from the partially weighted model because it includes the removal of positivity violations in addition to inverse probability treatment weights.

ACSC=ambulatory care sensitive condition; ED= emergency department; LCI = lower 95% confidence interval; UCI= upper 95% confidence interval

*p value <0.05 ** Confidence interval for this point estimate does not include the null (1.000)

Table 4

Characteristics of those excluded versus those included in the study

	Less than two primary care visits for one year		Two or more primary care visits for one year		
	n= 6915		n= 15256		SMD
Male (%)	3150	(45.60)	6230	(40.80)	0.095
Age (mean (SD))	72.61	(6.55)	74.41	(6.95)	0.267*
Age category (%)					0.257*
65-74	4681	(67.70)	8442	(55.30)	
75-84	1784	(25.80)	5345	(35.00)	
85+	450	(6.50)	1469	(9.60)	
Comorbidity index 1 year before (mean (SD))	0.42	(1.46)	0.97	(2.11)	0.302*
Comorbidity index 1 year before (%)					0.428*
none	6107	(88.30)	10972	(71.90)	
one	160	(2.30)	1246	(8.20)	
more than one	648	(9.40)	3038	(19.90)	
Comorbidity index 2 years before (mean (SD))	0.16	(0.81)	0.24	(1.01)	0.086
Comorbidity index 2 years before (%)					0.098
none	6552	(94.80)	14089	(92.40)	
one	90	(1.30)	301	(2.00)	
more than one	273	(3.90)	866	(5.70)	
Number of ED visits 1 year before (mean (SD))	0.34	(0.86)	0.62	(1.23)	0.264*
Number of ED visits 1 year before (%)					0.283*
at least one	1406	(20.30)	4986	(32.70)	
Number of ED visits 2 years before (mean (SD))	0.37	(0.90)	0.56	(1.17)	0.176*
Number of ED visits 2 years before (%)					0.189*
at least one	1530	(22.10)	4639	30.40	
Number of hospital visits 1 year before (mean (SD))	0.18	(0.53)	0.31	(0.69)	0.210*
Number of hospital visits 1 year ago categorical (%)					0.222*
none	6036	(87.30)	12067	(79.10)	
one	608	(8.80)	2098	(13.80)	
more than one	271	(3.90)	1091	(7.20)	

Number of hospital visits 2 years before (mean (SD))	0.18	(0.54)	0.27	(0.66)	0.145*
Number of hospital visits 2 years ago categorical (%)					0.158*
none	5990	(86.60)	12328	(80.80)	
one	660	(9.50)	2047	(13.40)	
one or more	265	(3.80)	881	(5.80)	
general health rating (%)					0.328*
excellent	1297	(18.80)	1763	(11.60)	
very good	2215	(32.00)	3799	(24.90)	
good	2397	(34.70)	6028	(39.50)	
ok	813	(11.80)	2983	(19.60)	
poor	193	(2.80)	683	(4.50)	
Rural (%)	2098	(30.30)	3998	(26.20)	0.092
Education less than high school (%)	2922	(42.30)	7353	(48.20)	0.120*
indigenous status (%)					0.025
indigenous	110	(1.60)	206	(1.40)	
missing	269	(3.90)	640	(4.20)	
non-indigenous	6536	(94.50)	14410	(94.50)	
Race- white (%)	6805	(98.40)	15042	(98.60)	0.015
Citizenship (%)					0.019
Born in Canada	6445	(93.20)	14164	(92.80)	
Immigrant (10 or more years)	433	(6.30)	1019	(6.70)	
Immigrant (less than 10 years)	37	(0.50)	73	(0.50)	
Marital status (%)					0.127*
civil	389	(5.60)	764	(5.00)	
divorced	847	(12.20)	619	(10.60)	
married	3048	(44.10)	6723	(44.10)	
separated	198	(2.90)	407	(2.70)	
single	625	(9.00)	1057	(6.90)	
widow	1808	(26.10)	4686	(30.70)	
Household income in past 12 months					0.115*
<$20,000	2620	(37.90)	6253	(41.00)	
$20,000- 39,999	1621	(23.40)	3855	(25.30)	
$40,000-59,999	1373	(19.90)	2851	(18.70)	
$60,000-79,999	648	(9.40)	1191	(7.80)	

$80,000 or more	653	(9.40)	11.06	(7.20)

Note. Standard mean difference less than or equal to 0.10 is considered negligible (Austin, 2011)
SD= Standard deviation; SMD= standard mean difference; ED= emergency department
*Standard mean differences greater than 0.1 and less than 0.5 are considered small.

Table 5
Sociodemographic, health, and service use characteristics of the total sample of included persons

Characteristics	N= 15256	
Number of visits with an general physician1 year before (mean (SD))	4.36	(3.17)
Percentage of visits with the same general physician(mean (SD))	0.87	(0.20)
Male (%)	6230	(40.8)
Age (mean (SD))	74.41	(6.95)
Age category (%)		
65-74	8442	(55.3)
75-84	5345	(35.0)
85+	1469	(9.6)
Comorbidity index 1 year before (mean (SD))	0.97	(2.11)
Comorbidity index 1 year before (%)		
none	10972	(71.9)
one	1246	(8.2)
more than one	3038	(19.9)
Comorbidity index 2 years before (mean (SD))	0.24	(1.01)
Comorbidity index 2 years before (%)		
none	14089	(92.4)
one	301	(2.0)
more than one	866	(5.7)
Number of ED visits 1 year before (mean (SD))	0.62	(1.23)
Number of ED visits 1 year before (%)		
at least one	4986	(32.7)
Number of ED visits 2 years before (mean (SD))	0.56	(1.17)
Number of ED visits 2 years before (%)		
At least one	4639	(30.4)
Number of hospital visits 1 year before (mean (SD))	0.31	(0.69)
Number of hospital visits 1 year ago categorical (%)		
none	12067	(79.1)
one	2098	(13.8)
more than one	1091	(7.2)
Number of hospital visits 2 years before (mean (SD))	0.27	(0.66)
Number of hospital visits 2 years ago categorical (%)		
none	12328	(80.8)
one	2047	(13.4)

one or more	881	(5.8)
general health rating (%)		
excellent	1763	(11.6)
very good	3799	(24.9)
good	6028.00	(39.50)
ok	2983	(19.6)
poor	683	(4.5)
Rural (%)	3998	(26.2)
Education less than high school (%)	7353	(48.2)
indigenous status (%)		
indigenous	206	(1.4)
missing	640	(4.2)
non-indigenous	14410	(94.5)
Race- white (%)	15042	(98.6)
Citizenship (%)		
Born in Canada	14164	(92.8)
Immigrant (10 or more years)	1019	(6.7)
Immigrant (less than 10 years)	73	(0.5)
Marital status (%)		
civil	764	(5.0)
divorced	1619	(10.6)
married	6723	(44.1)
separated	407	(2.7)
single	1057	(6.9)
widow	4686	(30.7)
Household income in past 12 months		
<$20,000	6253	(41.0)
$20,000- 39,999	3855	(25.3)
$40,000-59,999	2851	(18.7)
$60,000-79,999	1191	(7.8)
$80,000 or more	1106	(7.2)

SD= Standard deviation; ED= emergency department

Table 6

Characteristics of the control group compared to the treatment group in the unweighted sample

	Low primary care continuity		High primary care continuity		SMD
	n=5351		n=9905		
Number of visits with a general physician1 year before (mean (SD))	5.28	(3.43)	3.86	(2.89)	0.446*
percentage of visits with the same general physician (mean (SD))	0.63	(0.16)	1	(0.00)	n/a
Male (%)	2003	(37.40)	4227	(42.70)	0.107*
Age (mean (SD))	73.99	(6.85)	74.6	(7.00)	0.093
Age category (%)					0.098
65-74	3124	(58.40)	5318	(53.70)	
75-84	1771	(33.10)	3574	(36.10)	
85+	456	(8.50)	1013	(10.20)	
Comorbidity index 1 year before (mean (SD))	1.08	(2.26)	0.92	(2.02)	0.075
Comorbidity index 1 year before (%)					0.064
none	3750	(70.10)	7222	(72.90)	
one	478	(8.90)	768	(7.80)	
more than one	1123	(21.00)	1915	(19.30)	
Comorbidity index 2 years before (mean (SD))	0.23	(1.01)	0.24	(1.00)	0.004
Comorbidity index 2 years before (%)					0.005
none	4946	(92.40)	9143	(92.30)	
one	105	(2.00)	196	(2.00)	
more than one	300	(5.60)	566	(5.70)	
Number of ED visits 1 year before (mean (SD))	0.69	(1.29)	0.57	(1.19)	0.096
Number of ED visits 1 year before (%)					
at least one	1955	(36.50)	3031	(30.60)	0.126*
Number of ED visits 2 years before (mean (SD))	0.53	(1.11)	0.57	(1.21)	0.034
Number of ED visits 2 years before (%)					
at least one	1610	(30.10)	3029	(30.60)	0.011
Number of hospital visits 1 year before (mean (SD))	0.34	(0.73)	0.29	(0.68)	0.079

Number of hospital visits 1 year ago categorical (%)					0.089
none	4105	(76.70)	7962	(80.40)	
one	818	(15.30)	1280	(12.90)	
more than one	428	(8.00)	663	(6.70)	
Number of hospital visits 2 years before (mean (SD))	0.27	(0.67)	0.27	(0.65)	0.007
Number of hospital visits 2 years ago categorical (%)					0.019
none	4309	(80.50)	8019	(81.00)	
one	739	(13.80)	1308	(13.20)	
one or more	303	(5.70)	578	(5.80)	
general health rating (%)					0.047
excellent	643	(12.00)	1120	(11.30)	
very good	1361	(25.40)	2438	(24.60)	
good	2117	(39.60)	3911	(39.50)	
ok	987	(18.40)	1996	(20.20)	
poor	243	(4.50)	440	(4.40)	
Rural (%)	1196	(22.40)	2802	(28.30)	0.137*
Education less than high school (%)	2413	(45.10)	4940	(49.90)	0.096
indigenous status (%)					0.041
indigenous	64	(1.20)	142	(1.40)	
missing	250	(4.70)	390	(3.90)	
non-indigenous	5037	(94.10)	9373	(94.60)	
Race- white (%)	5256	(98.20)	9786	(98.80)	0.047
Citizenship (%)					0.084
Born in Canada	4894	(91.50)	9270	(93.60)	
Immigrant (10 or more years)	421	(7.90)	598	(6.00)	
Immigrant (less than 10 years)	36	(0.70)	37	(0.40)	
Marital status (%)					0.062
civil	289	(5.40)	475	(4.80)	
divorced	621	(11.60)	998	(10.10)	
married	2325	(43.40)	4398	(44.40)	
separated	150	(2.80)	257	(2.60)	
single	358	(6.70)	699	(7.10)	
widow	1608	(30.10)	3078	(31.10)	
Household income in past 12 months					0.078
<$20,000	2125	(39.70)	4128	(41.70)	

$20,000- 39,999	1306	(24.40)	2549	(25.70)
$40,000-59,999	1036	(19.40)	1815	(18.30)
$60,000-79,999	441	(8.20)	750	(7.60)
$80,000 or more	443	(8.30)	663	(6.70)

SD= Standard deviation; SMD= standard mean difference; ED= emergency department
Note: Standard mean difference less than or equal to 0.10 is considered negligible (Austin, 2011)
*Standard mean differences greater than 0.1 and less than 0.5 are considered small.

Table 7

Characteristics of the control group compared to the treatment group in the weighted sample

	Low primary care continuity		High primary care continuity		SMD
	n=9892[a]		n=9895		
Male (%)	4217	(42.60)	4224	(42.70)	0.001
Age (mean (SD))	74.63	(7.01)	74.62	(6.97)	0.002
Comorbidity index 1 year before (mean (SD))	0.92	(2.01)	0.91	(2.01)	0.003
Comorbidity index 2 years before (mean (SD))	0.23	(0.99)	0.24	(1.00)	0.002
Number of hospital visits 1 year before (mean (SD))	0.29	(0.65)	0.29	(0.67)	0.006
Number of hospital visits 2 years before (mean (SD))	0.27	(0.63)	0.27	(0.64)	0.002
general health rating (%)					0.013
excellent	1152.1	(11.60)	1119	(11.30)	
very good	3871.4	(39.10)	3907	(39.50)	
good	1974.7	(20.00)	1993	(20.10)	
ok	448.1	(4.50)	440	(4.40)	
poor	2445.7	(24.70)	2436	(24.60)	
Rural (%)	2783	(28.10)	2799	(28.30)	0.003
Education less than high school (%)	4939.6	(49.90)	4934	(49.90)	0.001
indigenous status (%)					0.018
indigenous	139.8	(1.40)	142	(1.40)	
missing	356.3	(3.60)	390	(3.90)	
non-indigenous	9395.9	(95.00)	9363	(94.60)	
Race- white (%)	9763.4	(98.70)	9776	(98.80)	0.009
Citizenship (%)					0.025
Born in Canada	9255.6	(93.60)	9260	(93.60)	
Immigrant (10 or more years)	583.1	(5.90)	598	(6.00)	
Immigrant (less than 10 years)	53.2	(0.50)	37	(0.40)	
Marital status (%)					0.043
civil	521.7	(5.30)	473	(4.80)	
divorced	1060.9	(10.70)	998	(10.10)	
married	4398.8	(44.50)	4398	(44.40)	
separated	273.5	(2.80)	257	(2.60)	
single	629.3	(6.40)	698	(7.10)	

widow	3007.8	(30.40)	3071	(31.00)	
Household income in past 12 months					0.032
<$20,000	4179.6	(42.30)	4123	(41.70)	
$20,000- 39,999	2496.2	(25.20)	2546	(25.70)	
$40,000-59,999	1752.3	(17.70)	1814	(18.30)	
$60,000-79,999	736.5	(7.40)	749	(7.60)	
$80,000 or more	727.4	(7.40)	663	(6.70)	

SD= Standard deviation; SMD= standard mean difference; ED= emergency department

Note. Standard mean difference less than or equal to 0.10 is considered negligible (Austin, 2011) Samples size without whole integers are due the influence of weighting.

[a] The number of participants in the low primary care continuity group does not reflect the actual number of participants. These values have been adjusted by the inverse probability of treatment weight to reflect a similar distribution of participants as the high primary care continuity group.

Table 8

Frequency and percentage of outcomes in the control group compared to the treatment group

Outcomes	Low primary care continuity n= 5351	High primary care continuity N= 9905	SMD
At least one hospitalization (%)	1224 (22.9)	2188 (22.1)	0.019*
At least one ED (%)	1822 (34.0)	3376 (34.1)	0.001*
At least one ACSC hospitalization (%)	99 (1.9)	209 (2.1)	0.019*
At least one ACSC ED (%)	276 (5.2)	588 (5.9)	0.034*
Number of days in hospital (mean (SD))	2.44 (9.86)	2.59 (10.97)	0.015*
Death during outcome period [a]	114(2.1)	254(2.6)	0.029*

[a]Death recorded if it occurred before the participant experienced the main outcome or if the participant didn't experience a main outcome but died during the one-year outcome period.

*SMD (standard mean difference) less than or equal to 0.10 is considered negligible (Austin, 2011).

Table 9

Frequency and percentage of ACSC hospitalizations and emergency department visits.

Ambulatory care sensitive condition (ACSC)	Number of ACSC hospitalizations (%) n=542	Number of ACSC emergency department visits (%) n=1186
Asthma	60 (11)	33(3)
Cardiac heart failure / Congestive heart failure (CHF)	61 (11)	121(10)
Chronic obstructive pulmonary disorder (COPD), Chronic bronchitis	50 (9)	144(12)
Diabetes/Poor glycemic control/ hyper- and hypoglycemia: diabetes mellitus with ketoacidosis or hyperosmolar coma	NR	73(6)
Hypertension	45(8)	142(12)
Angina	74(13)	64(5)
Hypotension	NR	22(2)
Dehydration, volume depletion acute renal failure hypokalemia hyponatremia	25(5)	21(2)
Seizures (Grand mal status and other epileptic convulsions)	NR	NR
Pneumonia (Lower respiratory: pneumonia & bronchitis)	88(16)	138(12)
Urinary Tract Infection	34(6)	204(17)
Constipation /fecal impaction/obstipation	NR	NR
Skin ulcers	NR	NR
Weight loss adult failure to thrive	NR	NR

Nutritional deficiency	NR	NR

NR= not reported. Some conditions were not reported because their values were too low.
for variables with missing data less than 3 percent of the sample size

Table 10

Odds ratios, confidences intervals, Wald Chi-Squared Test, and p-values of outcomes using the weighted sample

Outcome	point estimate (OR)	LCI	UCI	Chi	p-value
all cause hospitalization	0.935	0.875	0.999	3.942	0.047*
all cause ED	0.976	0.921	1.035	0.644	0.422
ACSC hospitalization	1.127	0.923	1.376	1.384	0.240
ACSC ED	1.131	1.002	1.276	3.942	0.047*

CI: Confidence interval; ACSC: Ambulatory Care Sensitive Conditions; ED: Emergency Department; OR= Odds ratio; LCI= lower 95% confidence interval; UCI= upper 95% confidence interval

*p-value <0.05

Table 11

E-values for both estimated Odds ratios, and limits of their confidence intervals closest to the null

Outcome	point estimate (OR)	LCI	UCI	e value	null value
all cause hospitalization	0.935	0.875	0.999	1.222	1.613
all cause ED	0.976	0.921	1.035	1.123	1.738
ACSC hosp	1.127	0.923	1.376	1.505	2.168
ACSC ED	1.131	1.002	1.276	1.516	2.179

CI: Confidence interval; ACSC: Ambulatory Care Sensitive Conditions; ED: Emergency Department; OR= Odds ratio; LCI= lower 95% confidence interval; UCI= upper 95% confidence interval

Table 12
Difference in exposure between different cycles of the CCHS included in this study

Cycle of CCHS	Low primary care continuity		High primary care continuity		SMD
	n=5351		n=9905		0.049
2007-2008	1109	(20.7)	2033	(20.5)	
2009-2010	1073	(20.1)	2102	(21.2)	
2011-2012	1134	(21.2)	2201	(22.2)	
2013-2014	1364	(25.5)	2427	(24.5)	
2015-2016	673	(12.6)	1142	(11.5)	

CCHS= Canadian Community Health Survey; SMD= Standardized mean difference
Note: Exposure period ended December 31st, 2015.
Standard mean difference less than or equal to 0.10 is considered negligible (Austin, 2011).