AFTER-HOURS PRIMARY CARE AND NON-URGENT EMERGENCY DEPARTMENT USE BY ADULT PATIENTS FROM ST. JOHN'S, NEWFOUNDLAND & LABRADOR

by

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ABSTRACT

Background: Wait times in Canadian Emergency Departments are among the highest in the industrialized world, and avoidable Emergency Department (ED) visits have been associated with greater costs.

Primary Objective: Describe the relationship between after-hours care by Family Physicians (FPs) and low-acuity ED visits by adult patients from the St. John's Metropolitan Area (SJMA), while controlling for non-modifiable patient characteristics.

Methods: A retrospective cross-sectional observational study utilizing administrative data (2011-2015) was performed.

Residents of the SJMA were assigned to their most frequent provider of primary care services according to Fee-For-Service (FFS) billings and patient records from university-affiliated Academic Family Physicians (AFPs). FPs practicing under the FFS model were categorized according to the percentage of their billings that included a supplementary after-hours fee code (i.e., <5%, 5-14.9%, 15-24.9%, and >25%), which served as a proxy for access to after-hours care. AFPs were in a distinct category because they practice in a unique model, which includes (a) 24/7 access to telephone triage, (b) follow-up that might include an after-hours visit, and (c) no FFS billings. Regression models included a categorical predictor variable, which comprised patients categorized via after-hours billings of FFS FPs, as well as patients of AFPs.

To further clarify the relationship identified above, the relationship between after-hours billings and low-acuity ED visits was examined - with calendar date as the unit of analysis.

Results: Differences in access to after-hours care among patients of FFS FPs were not associated with a difference in low-acuity ED visits, but patients of AFPs made significantly fewer low-acuity

ED visits. With the reference category comprising patients of FFS FPs who had <5% of after-hours billings, the respective Rate Ratios (95% Confidence Intervals) were 0.99 (0.9-1.09) for the 5-14.9% category, 1.05 (0.88-1.27) for the 15-24.9% category, and 0.99 (0.83-1.18) for the >25% category, while it was 0.83 (0.7-0.99) for the category comprising AFPs.

Per calendar date, more after-hours visits to FPs were associated with more low-acuity ED visits.

Conclusion: After-hours care provided by FFS FPs was not associated with a reduction in low-acuity ED visits, but patients of AFPs appeared to make low-acuity ED visits less frequently.

GENERAL SUMMARY

Emergency Departments (EDs) in Canada are often overcrowded, and patients routinely need to wait for long periods of time before they can be seen in those departments. A billing code to incentivize after-hours care by Family Physicians (FPs) in Newfoundland and Labrador was introduced in part to decrease visits to EDs in the province. This particular study was designed to assess the effectiveness of said billing code.

Based on the available data, such a study had to be restricted to the St. John's Metropolitan Area (SJMA), rather than be a province-wide study; the relevant data was also only available for the 2011-2015 timeframe.

The main objective of this study was to determine whether the level of after-hours care provided by FPs was related to the number of non-urgent visits to EDs that were made by patients of those FPs. The study included patients from the SJMA who had valid provincial Medical Care Plan (MCP) cards during the study timeframe – April, 2011 to March, 2015.

FPs were categorized – based on submitted billings - according to the proportion of their patient visits that were made after usual work hours. University-affiliated Academic Family Physicians (AFPs) were included in a separate category because they do not typically submit billings and they offer a unique model of after-hours care, which includes - 24/7 access to telephonic consultations plus after-hours visits when necessary. Each patient in the study was assigned to the one Family Physician that the patient had seen the greatest number of times. Statistical analyses were used to determine whether patients' non-urgent visits to EDs were related to the level/type of after-hours care that was provided by FPs of those patients.

Per submitted billings, there was no difference in non-urgent Emergency Department visit rates between patients of FPs who offered different levels of after-hours care; this was an unexpected result.

However, this study also found that patients of AFPs made fewer non-urgent visits to EDs, compared to patients of FPs who – per billings - provided the lowest level of after-hours services.

Policymakers should examine whether the after-hours billing code is serving its intended purpose.

I (Jerome D. Siromani) am the sole author of this thesis

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LIST OF ABBREVIATIONS AND SYMBOLS

AHIS = After-Hours Intensity Score

CADTH = Canadian Agency for Drugs and Technologies in Health

CBC = Canadian Broadcasting Corporation

CCI = Charlson Comorbidity Index

CIHI = Canadian Institute for Health Information

CIHR = Canadian Institutes for Health Research

COC = Continuity Of Care

COCI = (Bice-Boxerman) Continuity Of Care Index

CTAS = Canadian Triage and Acuity Scale

DA = Dissemination Area

ED = Emergency Department

EM = Emergency Medicine

ER = Emergency Room

FFS = Fee For Service

FHG = Family Health Group

FHN = Family Health Network

FP = Family Physician

HREA = Health Research Ethics Authority

HREB = Health Research Ethics Board

ICD = International Classification of Diseases

ICPC = International Classification of Primary Care

MCP = (Newfoundland & Labrador) Medical Care Plan

MeSH = Medical Subject Headings

NHS = National Health Service (in the UK)

NIH = National Institutes of Health

NL SUPPORT = Newfoundland & Labrador Support for People and Patient-Oriented Research and Trials

NLCHI = Newfoundland & Labrador Centre for Health Information

NLMA = Newfoundland & Labrador Medical Association

OECD = Organization for Economic Co-operation and Development

PAC = Patient Advisory Council

PCCF+ = Postal Code Conversion File Plus (from Statistics Canada)

PCD = Physician Claims Database

PCP = Primary Care Physician

PDAD = Provincial Discharge Abstract Database

PEM = Patient Enrolment Model

PHC = Primary Health Care

PHRU = Primary Healthcare Research Unit (at Memorial University of Newfoundland)

SJCMA = St. John's Census Metropolitan Area

SJMA = St. John's Metropolitan Area

SPOR = Strategy for Patient-Oriented Research

SPSS = (IBM) Statistical Package for Social Sciences (Statistical Software)

UK = United Kingdom

UPCI = Usual Provider Continuity Index

VIF = Variance Inflation Factor

n = Total number

p = Probability value

÷ = Divided by

I. INTRODUCTION

Before describing major aspects of this study – the literature review, methods, results, and discussion – in subsequent chapters, I would like to briefly mention the initial impetus behind this project, as well as the study's rationale, objectives, and main hypothesis. Overviews of both Primary Care and the Emergency Department setting are also provided.

I.1 INITIAL CONSIDERATIONS

A hospital Emergency Department (ED) is set up and equipped to mainly care for patients that need urgent (i.e., immediate or near-immediate) management of their presenting medical condition; this is true in the province of Newfoundland & Labrador and in most jurisdictions around the world. Primary care practices, on the other hand are set up and equipped to care for patients who make first contact with the healthcare system for any medical condition that they have, with the provision of referral services also being a key function of primary care practices. It is not optimal for the healthcare system when a patient presents at an ED with a non-urgent medical condition that would be better addressed (initially, at least) within the setting of a primary care practice. That being said, the World Health Organization indicates that the vast majority of primary care practices worldwide are not open to patients, 24 hours a day[1]; on the other hand, Emergency Departments (EDs) are typically open, 24 hours a day. It is also important to note that primary care practices, for the most part, are headed by physicians who are trained in Family Medicine and who are commonly known as Family Physicians (FPs); this is particularly true in Canada. Similarly, for the most part, physicians who are trained in Emergency Care are required to be the ultimate decision-makers with regards to patient care in EDs. While there is overlap between the

Family Medicine and Emergency Care training programs, there are also key differences, mainly due to a different focus being required in a primary care setting versus an ED setting.

The St. John's Metropolitan Area (SJMA) comprises the provincial capital and is the largest metropolitan area within the province of Newfoundland & Labrador. Within the SJMA, there currently are two general hospital Emergency Departments (EDs) that serve adult (18+ years of age) patients with medical emergencies, while there is only one primary care practice (known as a "walk-in clinic") that is routinely open for extended hours, each day. As per information from the Discipline of Family Medicine at Memorial University and anecdotal evidence, most of the primary care practices within the SJMA are only open to patients between the hours of 9 AM and 4:30-6 PM (Monday through Friday, excluding holidays) and require patients to visit after setting up appointments in advance. A minority of the estimated 200-300 FPs who practice full-time in the region are also known to provide on-call services and/or after-hours services and/or "walk-in" services to their patients, but the frequencies of these care provisions vary between those respective FPs. Ultimately, most of the non-hospitalized population in this region would have no option but to present at an ED if they were to require medical care outside of "normal" working hours (e.g., on weekends, on statutory holidays, and from 6 PM to 9 AM on other days). It is also worth noting that most individuals, except perhaps those with medical backgrounds, may not be able to determine whether their medical-related condition at a certain time requires urgent or non-urgent care, prior to examination by a medical professional. It has to be recognized that most patients who present at EDs believe that their respective symptoms/conditions at the time are worthy of urgent care[2], at least until an examination by a medical professional. The inability to access FPs in a timely manner contributes to patients wanting to present at EDs for conditions that those

patients consider to be urgent. In addition, patients may often expect the same level of care, irrespective of whether they present at a primary care practice or at an ED[2].

When patients present at EDs with conditions that are subsequently deemed to be non-urgent, they still need to be registered and triaged/examined in those EDs under the same guidelines that pertain to urgent care-requiring patients. This then has the potential to lead to overcrowding and a stretching of the resources within EDs; however, other important reasons for ED overcrowding – as will be briefly mentioned, later - have been recently put forward, as well. In any case, stretching of resources in an ED can subsequently lead to sub-optimal care for all presenting patients (not limited to those patients presenting with non-urgent conditions), and multiple adverse patient outcomes could result.

Anecdotal evidence from within the local community (i.e., the SJMA) were also part of the catalyst for this study. This evidence included news reports via the Canadian Broadcasting Corporation (CBC)[3,4,5], which suggested that – (a) overcrowding (i.e., exceeding of the built-for capacity) within EDs in the SJMA is a common occurrence, which has been getting more acute with the passage of time, (b) high stress levels among ED staff are common due to the overcrowding within local EDs, (c) lengthening wait-times within local EDs are linked to the afore-mentioned overcrowding problems, (d) some untoward incidents in local EDs (such as verbal abuse from patients towards ED staff) had apparently resulted from stresses that patients waiting long hours for care in the EDs had felt, and (e) adverse patient outcomes - often related to inadequate treatments - had apparently resulted from the overcrowding and stretching of resources within local EDs.

I.2 RATIONALE

The following chapter will present a focused review of studies from the published literature that pertain to this project. In what follows in this section, some of the other key articles and studies that were considered during the planning/development of this project are described.

According to records collected by the Commonwealth Fund, wait-times in Canadian Emergency Departments are among the longest in the industrialized world[6]. Canada ranked last among 11 surveyed Organization for Economic Co-operation and Development (OECD) countries, in terms of wait-times for patients in EDs - with an average wait-time of over 4 hours[7]. In 2019, wait-times for patients in Canadian EDs were on the rise, with the median wait-time for patients rising from 2.8 hours in 2017-18 to 3.2 hours in 2018-19; and, for 90% of those ED patient visits, wait-times rose from 7.9 hours or less in 2017-18 to 10.9 hours or less in 2018-19[8]. A recent (2019) news report stated that the province of Newfoundland & Labrador is the second worst province in the country for ED wait-times, with the likelihood of waiting 4+ hours for care in an ED in this province being 38.9%[9]. That same news report noted that a relative paucity of FPs in Canada means that about 57% of ailing Canadians cannot secure appointments with their usual FPs on the same day or even on the following day[9].

Approximately half of the patients who presented at Canadian EDs between 2010 and 2011 were (a) classified as low-acuity (i.e., having non-urgent conditions) and (b) not admitted for further care[10]. Of those who presented, 47% were in the low-acuity group and were not admitted, 44% were in the high-acuity group and were not admitted, 1% were in the low-acuity group and were admitted, and 8% were in the high-acuity group and were admitted. This suggested that a large number of patients who present at Canadian EDs do not require the kind of care that EDs are set up to provide.

Studies have suggested that patients would generally prefer after-hours primary care over care in an ED. A survey-based study during 2007 in Ottawa, Ontario reported that 57.4% of survey respondents had indicated that they would visit their Family Physician (FP) and not visit an ED, if their FP was available at the relevant time[11]. This suggested that most patients would choose a Family Medicine clinic over an ED, if more Family Medicine clinics were accessible. Similarly, out-of-hours care that was initiated by primary care physicians in Maastricht, Netherlands significantly reduced the use of hospital emergency care, per the findings of an observational study[12]. In that Dutch study - after the establishment of out-of-hours primary care, the proportion of patients utilizing emergency care decreased by 53% while the proportion of patients utilizing care via primary care physicians increased by 25%[12]. This suggested that the provision of more out-of-hours primary care is an approach that could address the problems, regarding the stretching of ED resources.

Long wait-times in EDs have been shown to be a leading cause of patients leaving EDs without being seen by a relevant medical professional. In a study that focused on two inner-city EDs in Toronto, Ontario – out of the patients who stated in a survey that they had left the EDs without being seen, 60% of them reported leaving because of prolonged wait-times[13]. In total, 67% of the patients who left the EDs without being seen had low-acuity ratings and 39% of them subsequently visited their FP for the same issue that had caused them to present at an ED[13]. Thus, the inferences from this study were – (a) the majority of patients presenting at the EDs did not require urgent care and (b) a large number of the patients presenting at the EDs would have preferred to visit their FP instead.

It has also been suggested that patients who have regular access to a primary care physician are likely to utilize the ED in a more appropriate manner, as compared to patients with limited access

to a primary care physician. Specifically, this was suggested by a survey-based study that was conducted in an ED in San Francisco, California during 1990[14]. This study reported that (a) 45% of those waiting for ED care were in the ED due to difficulties in accessing primary care, (b) 87% of those waiting for ED care had conditions that were not deemed to be appropriate for ED-based care, and (c) 38% of those waiting for ED care were happy to replace their ED visit with an appointment at a primary care clinic, as long as said appointment could occur within the following three days[14]. Therefore, the authors of this study argued that improving access to primary care was one way to reduce inappropriate ED use. Similarly, another study – which was conducted in Ontario between 2003 and 2005 - indicated that ED utilization for non-urgent cases could drop by about 43%, if access to primary healthcare services can be improved for those sections of the population who do not have adequate primary healthcare services available to them[15]. This study also suggested that socio-economic, demographic, and geographic factors play important roles, regarding inadequate access to primary healthcare services; marginalized groups and rural communities appear to face barriers to said services[15]. Therefore, a subsequent study that could explore an advancement of primary healthcare services - while controlling for socio-economic, demographic, and geographic factors - appeared to be a worthwhile project.

Furthermore, it has been suggested that the cost to deliver care for similar issues is higher in EDs than it is in primary care settings. A US-based study – conducted in Charlotte, North Carolina – found that 59% of ED visits were for conditions that could have been adequately addressed in primary care clinics, and this study also explored costs[16]. This study found that monetary savings of 69-86% would have resulted if those ED visits had been primary care clinic visits instead; this was because charges in EDs were 320-728% higher than corresponding charges in primary care clinics[16]. A recent news article in a US-based healthcare publication (Xtelligent Healthcare Media)

also reported that avoidable ED visits – which number approximately 18 million per year among the insured US population - cost the healthcare system 32 billion US Dollars, annually[17]. This article added that a visit to a hospital ED is 12 times more expensive than a visit to a primary care physician[17]. One possible explanation for the increased costs associated with ED care is - the greater use of imaging and laboratory tests in EDs[18]. And, diagnostic imaging investigations in ED settings are continually increasing across North America, Europe, and Asia, per Juliusson et al. in 2019[19]. However, the evidence on whether non-urgent ED care per patient is more expensive on average than primary care per patient has been inconclusive. After adjusting for patient characteristics, diagnoses, and treatments provided, Baker et al. in 1994 suggested that non-urgent ED visits were 2-3 times more expensive than similar visits in non-ED settings[20]. However, Williams in 1996 argued that if patients requiring non-urgent care in EDs were instead seen by primary care physicians, the potential cost savings would likely be negligible when all relevant factors (e.g., staff salaries, referrals, etc.) were considered[21].

Regular follow-up with the same physician or care team (i.e., continuity of care) has been associated with improved health outcomes (e.g., reduced mortality rate, reduced risk of complications, etc.)[22]. Better continuity of care has also been associated with reduced costs to healthcare systems[23]. However, repeated visits to an ED by a patient reduce his/her level of continuity of care. Studies have specifically examined whether increased ED usage is related to a reduction in continuity of care[24,25]. While these observational studies cannot prove cause-and-effect, the consistency of the association across studies from different environments is suggestive of a causal relationship between low continuity of care and high ED use.

Following on from the above two paragraphs, it has been suggested that non-urgent ED visits can lead to (a) excessive costs to the healthcare system, (b) unnecessary investigations and treatment,

and (c) a weaker relationship between patient and primary care physician[26]. These points were specifically suggested, following a robust systematic literature review that was based on American studies published after 1990[26]. Therefore, multiple reasons have been advanced with regards to why non-urgent ED visits could negatively impact both community health and the health of individuals.

Changes in policy are to be suggested whenever the evidence supports the implementation of such change(s). Therefore, the literature was searched for studies that considered policy goals when addressing primary care in relation to non-urgent ED visits. And, a study that was based in California, US utilized data from 1990 to 1998 while including a major focus on policies and policy initiatives[27]. This study suggested that the cost of an ED visit that does not lead to hospital admission is high, and that methods to reduce non-urgent ED visits - and the costs associated with such visits - must be explored further[27]. This study reinforced a conclusion that several other studies had led to (i.e., non-urgent ED visits often strain resources and can lead to inadequate care); the authors also concluded that general policies and procedures, regarding non-urgent care in EDs needed to be reviewed[27].

Despite the arguments against the suitability of non-urgent ED visits, it still must be recognized that patients visiting EDs generally perceive their symptoms at the time to require urgent care[2,28]. This point was emphasized by a qualitative study conducted in Sweden[28]. Therefore, every patient who presents at an ED is expected to be provided with appropriate care in a timely fashion, irrespective of whether the patient requires urgent care or not. The authors of the same Sweden-based study went on to suggest that a high level of patient engagement would be beneficial when exploring whether improved care outside of an ED can help to reduce the numbers of low-acuity (or non-urgent) ED visits[28].

In summary, the studies that have been briefly mentioned above suggested that (a) non-urgent ED visits burden the healthcare systems, (b) many patients who present at EDs do not require urgent care, (c) patients often present at EDs because they have no access to primary care at the relevant time, (d) ways to reduce non-urgent ED visits – such as enhancing access to primary care – ought to be considered, and (e) patient perspectives on non-urgent ED use would be invaluable. Therefore, there was sufficient impetus for a study such as this particular one to be developed.

I.3 OBJECTIVES

The primary objective of this project was to ascertain whether there were significant differences in non-urgent ED visits among adult (18 years of age and above) patients from the SJMA, based on the patients' access to after-hours care from their FPs.

The main approach (re: the primary objective) would involve categorizing patients according to the level of after-hours care that was provided by the patients' usual providers of primary care. The following patient characteristics would need to be controlled for – (a) demographic factors, (b) socio-economic factors, (c) geographical factors, (d) comorbidity scores, and (e) Continuity Of Care (COC) index scores. The patient-level relationship between the non-urgent ED visits and the access to after-hours primary care would then be explored.

The primary objective was also to be addressed by ascertaining whether there was a significant relationship between non-urgent ED visits by adult patients from the SJMA and after-hours billing claims by fee-for-service FPs in the SJMA, with "calendar date" being the unit of analysis; *day of week* and *month of year* would need to be controlled for during this additional approach. The specific relationship between non-urgent ED visits and after-hours billing claims (all per calendar date) would therefore be examined. This approach would help to verify the results obtained via

the main approach – as stated above – while exploring the relationship between non-urgent ED visits by patients and after-hours billing claims by FPs in a more extensive manner. This approach would focus more on the use of the after-hours billing code; it would thus be possible to assess whether greater use of said code was or was not associated with reduced use of EDs for non-urgent reasons.

A secondary objective was to ascertain whether there were significant differences in non-urgent ED visits among adult patients from the SJMA, based on patient COC index scores (which will be described in more detail in a subsequent chapter).

Patient and physician engagement were also important aspects of this project, although the levels of engagement could not be as comprehensive as desired due to this project being dependent upon available historical data. Those aspects will also be described in a subsequent chapter.

In case significant differences (re: non-urgent ED visits by adult patients from the SJMA) would be shown to exist, based on after-hours access to FPs, then modifications in models of care (re: FPs in the SJMA) could potentially be considered by policymakers. Similarly, in case significant relationships between non-urgent ED visits by adult patients from the SJMA and COC index scores would be shown to exist, then modifications in patient behavior could be considered; however, it must be kept in mind that in certain cases, a patient may attend a single clinic on a regular basis but be seen on different occasions by different FPs who all work in that same clinic.

I.4 MAIN HYPOTHESIS

It was hypothesized that the number of non-urgent ED visits made by adult patients from the SJMA who were under the care of FPs that routinely provided after-hours care would be significantly

lower than the number of non-urgent ED visits made by adult patients from the SJMA who were under the care of FPs that provided no/negligible after-hours care.

I.5 PRIMARY CARE

An overview

Primary Care falls under the umbrella of Primary Health Care (PHC) - a concept that was described and elaborated upon in the Declaration of Alma-Ata (1978) document, which was sponsored by and subsequently fully endorsed by the World Health Organization[29]. While PHC is a term that covers the broad determinants, safeguards, and enhancers of health/wellbeing in every jurisdiction, Primary Care is a strategy under PHC that mainly focuses on the provision of healthcare by trained personnel to individuals in need of healthcare at any given time[30].

Primary care refers to the regular healthcare that is provided by a healthcare professional who acts as a respective patient's first point of contact with the healthcare system; under ideal circumstances, this healthcare professional is also (a) the main provider of continuing care for the patient and (b) a coordinator with regards to any further care (i.e., secondary or tertiary care) that the patient may require[31,32]. The healthcare professional who provides this primary care (i.e., the primary care provider) is usually a physician who is designated as a "Family Physician" or "General Practitioner" or "Family Medicine Specialist". However, other healthcare professionals - such as certain specialist physicians (e.g., internists), nurse practitioners, pharmacists, and alternative medicine practitioners - can also serve as primary care providers in certain situations[30]. In Canada and many other countries, a primary care practice usually serves both as a patient's entry point into the healthcare system and as the main point through which any subsequent medical care that the patient requires is accessed/provided[30]. The staffing of a primary care practice is

important, and a primary care physician is generally considered to be an essential part of any primary care practice. The primary care practice should be set up in such a way that the needs of patients with as yet unclassified conditions can be adequately dealt with; therefore, any primary care practice (a) should be easily accessible to members of the community that is being served and (b) should be able to manage most of the presenting conditions of patients without further consultations/referrals. Prevention of disease (by way of vaccinations, for example), health promotion/maintenance/education (by way of family planning, for example), and counselling services are now becoming more intrinsic parts of primary care practices, in addition to the services (i.e., diagnosis and treatment) that primary care practices have traditionally been providing[30,33]. Many chronic illnesses (e.g., diabetes, hypertension, asthma, etc.) are usually treated in primary care settings, and the International Classification of Primary Care (ICPC) is a standardized classification tool that helps to streamline primary care practices while focusing on respective patient complaints (i.e., the patients' "reason for encounter")[34]. Providing referral services for patients (whenever necessary) continues to be an important function of all primary care practices[33,35]. Primary care practices range from individual practices (having only one physician) to group practices (where several physicians practice out of the same location), while the numbers of non-physicians (e.g., receptionists) among the staff also vary from practice to practice.

A primary care physician is usually someone who is specially trained in Family Medicine, and this is true in Canada; in some countries, physicians who have been trained in Internal Medicine or Pediatrics or Gynecology may also provide primary care to certain sections of the population[30]. Even though certain specialist physicians and other care providers - such as nurse practitioners - may provide primary care on occasion for a variety of reasons, the American Academy of Family Physicians suggests that primary care should ideally be provided by FPs[30]. It must be noted that

this suggestion comes from an organization with a vested interest in making that suggestion; there is a growing argument for nurse practitioners to be more involved in providing primary care and to be adequately compensated for doing so[36]. In any case, there is a widely accepted description of a primary care physician (i.e., FP). A primary care physician typically provides care when a patient makes first contact with the healthcare system, and then accepts responsibility for the patient's comprehensive care in the long-term while also trying to ensure that the patient makes the best use of the healthcare system when accessing/receiving care[37].

The way that primary care services are principally funded varies from jurisdiction to jurisdiction. In Canada - patients can receive primary care through provincial health insurance (which is provided in turn by way of collected taxes), or through personal insurance policies and/or out-of-pocket payments for some primary care-related services[38], highlighting the fact that not every aspect of primary care is covered by provincial health insurance across Canada.

Primary care physicians, for their part, are compensated for their services in a variety of ways - also based on the jurisdictions where their respective primary care practices are located. Some of the main forms of (primary care) physician compensation are[39] – 1) straight salary, 2) straight salary plus bonuses or incentives, 3) productivity-based pay (i.e., the fee-for-service model of compensation wherein physicians get paid after they submit billing claims for each of their patient visits), 4) capitation (i.e., pay that is based on the specific group and/or number of patients who are enrolled/rostered[40] with a respective physician), 5) capitation plus productivity-based pay, and 6) equality-based shares (i.e., dividing the revenue at a particular practice over a fixed period of time equally among the physicians within said practice). It may be noted that bonuses and incentives can be offered in certain situations across all of the models of physician compensation. In Canada, not all of the six payment forms – as listed above - exist, and the first four are the most

prevalent[40]; however, in other jurisdictions, there may even be certain combinations of these listed payment forms.

While patients in many jurisdictions can choose the particular primary care physician that they see, patients do not have this freedom to choose in all jurisdictions; in jurisdictions where patients are assigned a primary care physician, it is usually the local government or local health authority that does the assigning[41]. In jurisdictions (such as Canada) where patients can choose the primary care physician that they see, patients are also almost always free to switch from one physician to another; however, (a) finding a physician who is willing and able to accept a new patient and (b) registering with that physician's clinic are also usual requirements for the patient[40]. It is noteworthy that in certain jurisdictions (mostly in the developing world), patients are free to visit specialist physicians without receiving any preceding referral services from primary care physicians; this means that, unlike in Canada, primary care physicians do not function as true "gatekeepers" with regards to the healthcare system[42].

Focus on Newfoundland & Labrador

A brief description of some relevant Canada-wide aspects of healthcare would be helpful, prior to focusing in on the relevant aspects of primary care within the province of Newfoundland & Labrador.

Healthcare in Canada is generally publicly funded (via collected taxes and a single-payer system) and delivered through the nation's respective provinces and territories[43]. The Canada Health Act[44] of 1984 provides the guidelines for overall healthcare in Canada. The healthcare system in Canada (also known as Medicare[45]) provides coverage for all citizens and permanent residents in the country. However, not all healthcare-related services are covered under this system; for example – prescription drugs in many cases, dental services, optometry, physiotherapy, long-term care, and

ambulance services are not covered[46]. Patients may use private (or workplace-based) insurance policies to pay for the healthcare-related services that are not covered by Medicare, or they may pay out-of-pocket for those services. It is estimated that about 30% of healthcare-related costs for Canadians are therefore paid for via the private sector, rather than via Medicare[46]. However, visits to primary care physicians in Canada for medically necessary services are covered under Medicare. With regards to primary care practices in Canada, both individual practices (which have one physician) and group practices (which have multiple physicians) exist. However, even in a group practice, the norm is for each individual patient to be registered as a patient of just one of the physicians within the practice[46].

Canadians and permanent Canadian residents who reside in the province of Newfoundland & Labrador have the costs of medically necessary physician-based care covered by the Newfoundland & Labrador Medical Care Plan (MCP)[47], which is a comprehensive medical insurance plan that is based on Medicare. An individual must hold a valid MCP card before that individual can be covered under the stated plan.

There are four Regional Health Authorities in Newfoundland & Labrador (with each of the bodies administering a different part of the province)[48], as follows –

- Eastern Health;
- Central Health;
- Western Health;
- Labrador-Grenfell Health.

As there is a relative dearth of published literature that pertains to primary care within Newfoundland & Labrador, it must be mentioned that this section is predominantly based on information that has been published by the Newfoundland & Labrador Medical Association

(NLMA)[49,50] and the Newfoundland & Labrador Department of Health & Community Services, as well as on unpublished reports (from other research studies within this province), newsletters, and informal feedback from medical practitioners. In addition, the information within this section is purposefully more relevant to the timeframe of this particular study, rather than to the present day. Also worth mentioning is the fact that the NLMA represents physicians in the province, which means that the physician-related information that they provide may not be unbiased; the details provided by the NLMA – as stated in several sections below – were also not obtained via published research studies but via reports.

The NLMA estimated in 2010 that there were approximately 510 practicing FPs in Newfoundland & Labrador; however, only about 390 of those FPs were practicing on a full-time basis, while about 122 of those FPs were required to staff EDs across this province[50] and some out of those 122 worked in both EDs and primary care clinics. Therefore, during the study timeframe, there would have been approximately 268 physicians providing primary care on a full-time basis in this province, and the majority of those physicians would have been practicing in the SJMA[50].

The NLMA estimated in 2010 that 100-150 more practicing primary care physicians were required in this province, based on the province's resident population (just over 500,000) at the time and the fact that the estimated 1900 patients per primary care physician in the province was much higher than the national average[50]. This trend has continued; a recent report – conducted by a national healthcare consultant named Dr. David Peachey – indicated that there were 431 FPs in Newfoundland & Labrador who were practicing full-time in 2019. The report forecast that an additional 243 FPs would be required in the province over the decade (starting in 2019) to make up for the current shortage of FPs in the province and to keep up with population needs in the province[51].

The NLMA also had several specific concerns pertaining to primary care physicians (i.e., FPs) in Newfoundland & Labrador at the time, as follows[50] –

- FPs in the province were working long hours (53.5 hours on average per week with 36.2 hours on average dedicated to direct patient care; these figures were respectively the second highest and the highest when compared with all other Canadian provinces, although it should be mentioned that the figures were self-reported by FPs in the province).
- About two-thirds of practicing FPs in the province were doing on-call work, in addition to their regular work, with about one-fifth of those physicians doing more than 240 hours of on-call work per month (and these figures – which were based on self-reporting, too - were also among the highest when compared with FP work hours across all Canadian provinces).
- More than a quarter of the practicing FPs in the province at the time were approaching the age of retirement eligibility (which was a particular concern because newer medical graduates reportedly work fewer hours, compared to older medical graduates).

The NLMA at the same time also expressed concerns about patient access to primary care in Newfoundland & Labrador because of the following[50] –

- Almost 13% of people in the province who were over 12 years of age did not have a regular FP (and this was another high figure when compared with other Canadian provinces); this figure was (and is) continuing to rise, and an estimated 24% of the provincial population currently do not have an FP.
- About a quarter of practicing FPs in the province were not accepting new patients.
- Patients (even those who did have an FP) expressed difficulties in accessing primary care, especially with regards to “immediate” care, and long wait-times for appointments was a common reason given for this.

With regards to FPs in Newfoundland & Labrador, the NLMA described the following concerns/issues that the FPs themselves had expressed[50] –

- Having to do a lot of paperwork and having to navigate many bureaucratic hurdles.
- Not having sufficient funding and/or trained personnel.
- Having to deal with the increasing complexities of patient populations under their care, with the management of chronic illnesses being exceptionally challenging.
- Having to deal adequately with the ageing of patient populations under their care.
- Having to deal with greater patient expectations.

Other problems that the NLMA stated with regards to primary care provisions in Newfoundland & Labrador were, as follows[50] –

- Wait-times (from FP referral to first appointment with a specialist and to definitive treatment) were increasing in this province and were the highest among all Canadian provinces at the time.
- The recruitment and retention of FPs in this province were long-standing challenges/problems, as shown by several assessments (with these migration-related problems being more acute, regarding physicians who were International Medical Graduates and physicians who had graduated medical school in other Canadian provinces).
- The numbers of new medical graduates emerging from the Family Medicine Program at Memorial University were declining, year-over-year.
- The cost of medical education had been steadily increasing at Memorial University (just like at most other Canadian universities).

- Practicing Family Medicine (especially in rural parts of this province) was becoming less attractive to new medical graduates, mainly due to the increasing workloads and the need to care for older and more complex patients.

A documented vision for PHC across Newfoundland & Labrador (2015-2025) that was set out in 2014[52] stated several goals and objectives with regards to improving primary care across the province, and the principles behind these goals and objectives were –

- Adequate access must always be provided;
- Continuity of care must be encouraged;
- Care must be person-focused;
- Care must be collaborative and based on team efforts;
- Communities must be engaged;
- Care must be coordinated;
- Care and services must be monitored and evaluated for quality improvements;
- Care and services should be comprehensive.

With regards to primary care practices/clinics in the SJMA, there are both individual practices and group practices, and there is also an extended-hours primary care practice in the city, which is known as a "walk-in clinic". In addition, there are Family Medicine clinics in the city that come under the auspices of Memorial University; the practicing physicians in these clinics are all affiliated with the Discipline of Family Medicine[53] at Memorial University's Faculty of Medicine. FPs in the SJMA are free to provide after-hours and/or on-call care, and those FPs who are paid via the fee-for-service model can bill extra for any patient that is seen outside of regular work hours (i.e., if the patient is seen on a Saturday, Sunday, holiday, or between 6 PM and 12 AM on a regular weekday); this billing option is as per the regulations in the MCP Medical Payment

Schedule[54]. The specified walk-in clinic in the SJMA is basically an extended-hours primary care practice where a patient can go for care without the need for a previously scheduled appointment and without the need to be registered with any physician practicing in that clinic. Apart from such a designated walk-in clinic, any FP may also operate his/her clinic as a walk-in clinic during a particular pre-announced time period. Those FPs who practice in the Memorial University-affiliated Family Medicine clinics are also known as Academic FPs and, with regards to them, it is important to note that – (a) their remuneration is fixed (as opposed to the other FPs in the SJMA who are all paid under the fee-for-service model), (b) they regularly have medical residents and students working under them (unlike most of the other FPs in the city), (c) they, on occasion, work in Family Medicine clinics that are specifically created to care for sub-groups of the population (e.g., government-assisted refugees, adult patients with developmental disabilities, inner city populations, etc.), and (d) the average number of patients registered with each Academic FP is lower than the average number of patients registered with each of the FPs who practice in the SJMA under the fee-for-service compensation model, primarily due to each Academic FP having additional teaching, research, and administrative responsibilities. With regards to the model of after-hours care that the Academic FPs provide to their patients, it is worth noting that (a) a medical resident is typically always available to take an initial phone call from a patient and provide telephonic advice/triage, (b) an FP is always on call to provide further telephonic advice and prescriptions if necessary, and (c) the FP on call could also see a patient urgently in clinic if necessary.

The after-hours billing code (i.e., Fee Code 139) was initially introduced, in order to recognize FPs that open their clinics to patients for regular services on weekday evenings (6 PM to 12 AM), on weekends, and on observed statutory holidays, thus helping to relieve demands on EDs[54]. This

after-hours billing code can be submitted by an FP – in addition to a billing code pertaining to the specific kind of patient care provided at the time - for each patient consultation during the afore-mentioned times[54].

Whatever the characteristics of different primary care practices may be, lack of satisfactory access to primary care is a driver of increasing numbers of non-urgent ED visits by patients. This point has been indicated by the literature described in a preceding part of this chapter and will be further explored in the following chapter.

It is also appropriate to point out that since primary care practices in Canada are supposed to be "gatekeepers" with regards to the healthcare system, primary care practices have a role in providing adequate care to patients who do not actually require urgent care in EDs for their presenting conditions. Therefore, helping to prevent non-urgent ED visits is a logical function of primary care practices, too.

Strategies in other jurisdictions

Other jurisdictions have implemented improvements to primary care with the aim of preventing ED overuse. Examples of such strategies that might be worth considering within this province include –

- Improving after-hours accessibility to primary care by way of increasing the numbers of extended-hours walk-in FP clinics[55]. However, this strategy requires there to be – (a) sufficient numbers of trained (and amenable) personnel for the staffing of such clinics, (b) easy access to patient files in such clinics, even though (unlike in practices where only registered patients are seen) patients at walk-in clinics are more likely to be first-time visitors, and (c) acceptance by the community that the care provided in such clinics is adequate. There are also criticisms of walk-in clinics; evidence pertaining to the

effectiveness of walk-in clinics has not been conclusive and such clinics provide fragmented care that hinders continuity of care[56].

- Patient rostering - a model that can improve continuity of care, and therefore, indirectly help to reduce non-urgent ED visits. This is a model wherein each respective patient in the community voluntarily commits to receive care from one of the primary care physicians in the community while each respective primary care physician commits to providing comprehensive care to only his/her rostered (i.e., enrolled) patients[57]. Physician compensation is often tied in some way to the number of rostered patients, although this may not always be ideal when different FPs in the same community have rostered patient groups that are markedly different from each other in terms of number or characteristics. To elaborate on the preceding sentence with an example – a certain FP may have a rostered patient group that has much more co-morbidities in total, compared to the rostered patient group of another FP in the area, and even adjustments to the capitation pay - based on the comorbidities of the respective patient groups - may not fully rectify an imbalance in compensation.
- Patient education[25,58,59]. This includes - (a) convincing patients that seeing a primary care physician is preferable to going to an ED when the presenting condition is clearly a "minor" condition (e.g., mild trauma, upper respiratory tract symptoms, etc.), (b) informing patients about self-care options, (c) encouraging every patient to register with one of the primary care physicians in the community, and (d) encouraging every patient (whenever care is required) to consistently visit just one of the primary care physicians/practices in the community, so that the continuity of care (re: patients) is maintained at a high level.

- Incentivizing more individual primary care physicians to provide on-call services outside of normal working hours[60]. These services include (uniquely or in combination) – (a) in-clinic consultations, (b) visits to homes of patients when necessary, and (c) virtual (including telephonic and videoconference) consultations/triages/referrals, which would also involve diverting patients away from hospital EDs whenever such diversions are appropriate.
- Placing barriers to ED access[61]. Examples of this are – (a) requiring patients who wish to visit an ED to first visit a primary care walk-in clinic where they are triaged, and then, only sent onward to the ED if that is the best avenue for care at the given time (i.e., the walk-in clinic performs a "gatekeeping" function), (b) requiring patients who wish to visit an ED to first have a virtual consultation with a medical practitioner (e.g., with a nurse practitioner via the 811 phone number in Canada) who can advise them on the best avenue for care, and (c) forcing patients to pay something (out-of-pocket or via private insurance) for care received in an ED, while any care received in a primary care practice remains fully covered by government-funded insurance.
- Strengthening primary care within the community[62]. This may be achieved by (among several options) – (a) improving coordination between all healthcare providers in the community, (b) improving the levels of community engagement with the healthcare system, and (c) following an inter-disciplinary approach to patient care.

The strategies listed above would be important to consider when the implications of the results of this study and relevant policy recommendations for the future are discussed.

I.6 THE EMERGENCY DEPARTMENT

An overview

An ED is responsible for providing care (medical or surgical) to patients who require immediate care when they arrive at hospital[63]. An ED may also be known as an Emergency Room (ER)[63].

The Canadian Institute for Health Information (CIHI)[64] explains - "Emergency Departments were primarily established to treat seriously ill and injured patients who need immediate care, 24 hours a day, seven days a week; in practice, however, Emergency Departments strive to provide timely care to all patients regardless of why they are seeking care."

"Emergency Medicine (EM) is a medical specialty that is dedicated to the evaluation, diagnosis, and management of unforeseen illness/injury, and professionals who are specifically trained in EM (physicians, nurses, paramedics, etc.) are required to provide the care in EDs."[65] Some other expected functions of EM professionals include – coordination of care with other medical practitioners/settings, administrative work within EDs, and planning/oversight with regards to health systems and community emergencies (e.g., natural disasters, mass shootings, etc.)[64].

EDs may exist within hospitals (which is typical in Canada), or be freestanding, which is now a trend in some US states (e.g., Colorado and Texas)[64]. Patients may present at EDs on their own, or by way of ambulances. In Canada, registration of the presenting patient at the ED is necessary; this requires a provincial health card (or, at least, a personal health insurance policy number) to be provided by the patient, along with said patient's name, date of birth, address, and their primary care physician's name[66]. It is advisable for patients who present at EDs to be ready to provide important details about their medical histories, medications being taken, etc., as well[65]. A triage is usually performed by a nurse, after the patient's registration, in order to assess the level of urgency that the patient's condition warrants[67]. Since wait-times within EDs in Canada are well known to

be very long, many health authorities across the country warn potential ED patients about this with as much specificity as possible, as well as recommend that patients come to the ED with a close relative/friend (who, if necessary, could also provide interpreting/translating services in the ED)[65,66]. Certain websites of Canadian health authorities also mention some of the conditions for which emergency care is truly needed (e.g., persistent severe chest pain, breathing difficulties, etc.), as well as suggest possible other options for patient care (e.g., walk-in clinics and urgent-care centers). Nonetheless, it is also often mentioned that EDs are open at all hours and that - with regards to ED visits - no appointments, referrals, or fees are required[66].

It has been suggested that long wait-times in Canadian EDs are due in part to ED overcrowding, and one of the postulated reasons for ED overcrowding is a high number of non-urgent patient visits to those EDs[68]. It is estimated that about 16 million ED visits are made by Canadians, each year, although only slightly more than 1 million of those visits lead to hospitalizations[11]. However, hospitalizations via EDs also often strain ED resources because beds in the relevant wards may be unavailable, leading to ED beds being occupied for much longer than appropriate[69]. ED overcrowding is defined in the Canadian Agency for Drugs and Technologies in Health (CADTH) Assessment Series as[70] - "A situation in which the demand for emergency services exceeds the ability to provide care within a reasonable time." There have been several strategies proposed/implemented in Canada and elsewhere to address the problem of ED overcrowding plus long wait-times in EDs; some of those strategies will be briefly discussed, later in this section. The implementation of a triage system in EDs across Canada has helped to prioritize ED patients, based on their presentations. The triage system used in Canadian EDs is based on the Canadian Triage and Acuity Scale (CTAS)[71]; this scale includes five levels, as follows –

- Level I: Resuscitation (e.g., cardiac arrest) - an immediate response from the physician is ideal.
- Level II: Emergent (e.g., chest pain) - a response from the physician within 15 minutes is ideal.
- Level III: Urgent (e.g., moderate asthma) - a response from the physician within 30 minutes is ideal.
- Level IV: Less Urgent (e.g., minor trauma) - a response from the physician within 1 hour is ideal.
- Level V: Non-Urgent (e.g., common cold) - a response from the physician within 2 hours is ideal.

* It is generally accepted that Levels IV and V both indicate non-urgency[72], and it is therefore assumed that patients classified as such are appropriate for primary care. However, this assumption is not perfect because - as some of a few examples - wounds that require suturing and fractures that require casting are often triaged as Levels IV or V in EDs, even though primary care clinics are rarely equipped to manage such injuries.

Focus on Newfoundland & Labrador

Specific to the province of Newfoundland & Labrador, there are some important points that the NLMA published in 2010 (close to the timeframe, regarding this project), which are as follows[71] –

- It was estimated at the time that there were approximately 420,000 patient visits to EDs in this province per year, out of which approximately 213,000 occurred in the area administered by Eastern Health (which includes the SJMA).

- In the province, EDs are classified into Category A site EDs (which have 24/7/365 coverage within the site) and Category B site EDs; the two main EDs that are relevant to this project (i.e., the EDs at the Health Sciences Centre and the St. Clare's Mercy Hospital, both in the city of St. John's) are both Category A site EDs and these are the two EDs in the province that regularly see the highest volume of patients.
- EDs are ideally staffed by ED specialists; however, FPs also work in EDs across the province, and the EDs in St. John's are almost exclusively staffed by FPs who have an additional certification in Emergency Medicine (i.e., a further year of training in Emergency Medicine, following a Family Medicine residency).
- It was projected at the time that the province needed 122 full-time physicians to work in the EDs of this province, with 30 of those to be located within the two previously mentioned EDs in St. John's; those two EDs were also required to have a minimum of 100 hours of funded coverage per day, rather than the 80 hours of funded coverage per day that they had at the time.

In 2010, the NLMA also published the following important points with regards to ED wait-times and ED overcrowding in the province[71] –

- Patients tend to have longer wait-times in those EDs that regularly see high patient volumes, such as the two previously mentioned EDs in St. John's.
- A standardized triage protocol was helping with patient flows within EDs, but patients with conditions that required urgent care were also often staying for too long in the EDs after being seen by a physician (even if they did not have to wait too long between initial triage and examination by physician); this was due to additional tests being needed, a shortage of hospital beds, and other reasons.

- As the average age of patients visiting EDs in this province was increasing (which was occurring in large part because this province had - and has - a rapidly ageing population), the ED wait-times across the province appeared to be increasing, too.
- ED overcrowding, in addition to increasing ED wait-times for patients, was also leading to increased patient suffering, worsening service levels, and worsening of patients' conditions.
- Some of the reasons that were suggested as being behind ED overcrowding in the province included – not enough trained staff in the EDs, not enough acute care beds in the hospitals, not enough alternative care resources within the communities, and the lack of an integrated approach involving communities and healthcare providers.
- Setting more benchmarks – such as providing a province-wide maximum ED wait-time target, as is done in Ontario – was suggested as something that the provincial government could consider.

The above points – regarding EDs across Newfoundland & Labrador and specifically in St. John's - are important to remember because they indicate that attempts to reduce the overuse of EDs in St. John's would be beneficial.

Suggested strategies to improve patient care in Emergency Departments

Several ideas have been put forward in various jurisdictions with regards to addressing the issues of ED overcrowding and long ED wait-times, and these ideas include[73] – (a) implementing flexible staffing schedules in EDs while taking anticipated "high traffic" times into account, (b) redeploying nursing staff between different duties in the EDs, as and when required, rather than having each nurse work at one station throughout his/her shift, and (c) allowing physicians who

are not trained in either Emergency Medicine or Family Medicine to work in EDs, at least on a part-time basis.

In Canada specifically, other ideas that have been put forward with regards to addressing the issues of ED overcrowding and long ED wait-times include[67] – (a) requiring every health authority to post on its website (and regularly update throughout the day) the estimated wait-time for patients in each of the EDs that come under the health authority's purview and (b) facilitating speedier and easier transportation between EDs in the same community whenever, for instance, one ED in the community is congested while another is not. However, the latter idea appears to be difficult to implement in many jurisdictions due to funding limitations, even though attempts to divert ambulances between EDs are still generally made in urban communities whenever necessary[74]. As for the former idea – there are consistent reports from the jurisdictions where it is followed (e.g., Toronto, Ontario), which suggest that the posted wait-times are rarely accurate and which also suggest that sudden changes in patient traffic into an ED can throw off any estimated wait-times by wide margins[67].

In any case, there appears to be broad agreement that communities at large, policymakers, and primary care physicians have the most important roles to play, as far as reducing ED overcrowding and shortening ED wait-times for patients are concerned[67]. Those roles are therefore vital in terms of improving the care in the EDs, too[67]. It would be important to keep each of those roles in mind when discussing the implications of the results of this study.

II. LITERATURE REVIEW

In the preceding chapter, a general review of the existing literature - which helped with the outlining of this study - was described. In this chapter, prior studies that specifically investigated the relationship(s) between after-hours primary care accessibility and Emergency Department (ED) patient visits – especially avoidable ED patient visits - will be described. This chapter will therefore comprise a more focused review in which the foundation for the current study is further elaborated upon.

The focus was mainly on studies conducted in Canada; however, studies in other jurisdictions with healthcare systems similar to those in Canada were also included and summarized. Annual multinational comparisons of healthcare data are regularly performed across the 38 member nations of the Organisation for Economic Co-operation and Development (OECD), given a good level of concordance among healthcare systems in those 38 nations[75]. Since Canada is an OECD member nation, relevant studies involving jurisdictions in one or more of those 38 nations were of particular interest during this literature review, as well.

Apart from the jurisdiction where a study might have taken place, those studies wherein the primary objective pertained to the relationship between after-hours primary care and non-urgent ED patient visits would be prioritized over other studies wherein that same relationship was explored in a more peripheral manner.

II.1 SEARCH STRATEGY AND CRITERIA

The help of a librarian at Memorial University's Health Sciences Library was utilized during the searches within health databases. The search for relevant publications was first conducted in the NIH National Library of Medicine (PubMed) health database[76], as per the following steps –

1. A Medical Subject Headings (MeSH) search[77] was performed using the term "after hours care"; 2,047 publications were retrieved.
2. A subsequent search - with regards to only the titles and/or abstracts of publications – was performed using the text-word terms of "after hours" OR "out of hours" OR "on call" OR "practitioner co-operative"; 7,062 publications were retrieved.
3. A combined search was performed using the MeSH term in Step 1 plus the Titles/Abstracts terms in Step 2 (with the operator "OR" between each of the terms); 8,001 publications were retrieved (i.e., the same 1,108 publications were retrieved by Step 1 and Step 2).
4. A MeSH search was performed using the terms of "family practice" OR "family practices" OR "general practice" OR "general practitioner" OR "general practitioners" OR "primary health care" OR "primary healthcare" OR "primary care" OR "physician, primary care" OR "physicians, primary care"; 253,199 publications were retrieved.
5. A subsequent search – with regards to only the titles and/or abstracts of publications – was performed using the text-word terms of "family practice" OR "family practices" OR "family physician" OR "family physicians" OR "family practitioner" OR "family practitioners" OR "family medicine" OR "general practice" OR "general practitioner" OR "general practitioners" OR "primary care"; 220,726 publications were retrieved.
6. A combined search was performed using the MeSH terms in Step 4 plus the Titles/Abstracts terms in Step 5 (with the operator "OR" between each of the terms); 365,996 publications were retrieved (i.e., the same 107,929 publications were retrieved by Step 4 and Step 5).
7. A search was performed after inserting the operator "AND" between the bracketed terms in Step 3 (which each remained separated by the operator "OR") and the bracketed terms

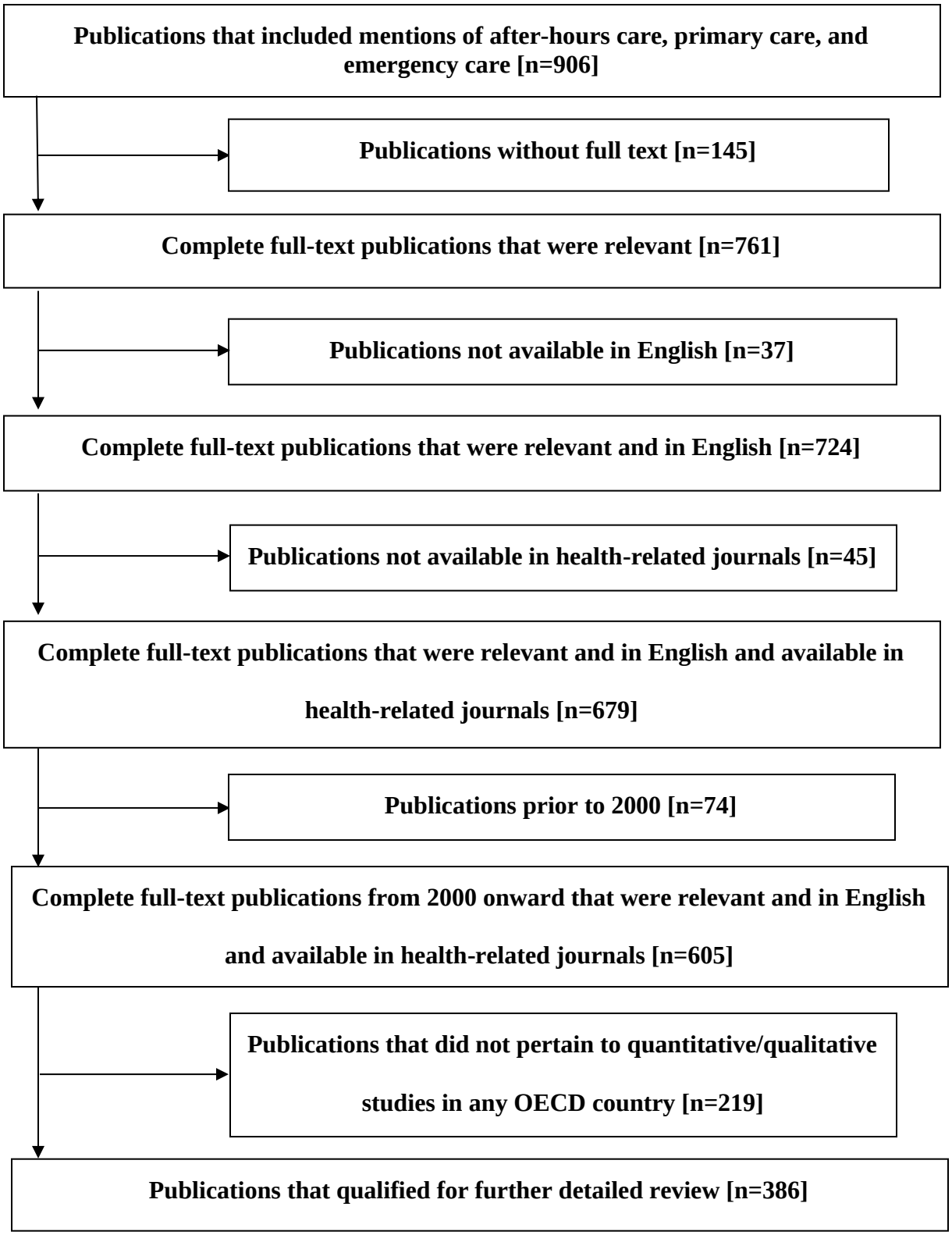
in Step 6 (which each remained separated by the operator "OR"); 2,162 publications remained.

8. A MeSH search was performed using the terms of "emergency service, hospital" OR "emergency service, medical" OR "emergency care" OR "care, urgent" OR "emergencies"; 348,963 publications were retrieved.
9. A subsequent search – with regards to only the titles and/or abstracts of publications – was performed using the terms of "emergency room" OR "emergency rooms" OR "emergency department" OR "emergency departments" OR "emergency service" OR "emergency services"; 133,328 publications were retrieved.
10. A combined search was performed using the MeSH terms in Step 8 plus the Titles/Abstracts terms in Step 9 (with the operator "OR" between each of the terms); 416,994 publications were retrieved (i.e., the same 65,297 publications were retrieved by Step 8 and Step 9).
11. A search was performed after inserting the operator "AND" between the bracketed terms in Step 7 (with the operators "OR" and "AND" remaining as they were in that step) and the bracketed terms in Step 10 (which each remained separated by the operator "OR"); 906 publications remained.
12. A filter was subsequently applied to only include publications for which the full text was available; 761 publications remained.
13. A filter was subsequently applied to only include publications for which the full text was available in English; 724 publications remained.

14. A filter was subsequently applied to only include publications which were in health-related journals, however, if cited in a relevant publication in a health-related journal, an article in a non-health-related journal was still sought after; 679 publications remained.
15. Since healthcare systems constantly evolve in different countries, a filter was subsequently applied to only include publications during this century (i.e., from January 1, 2000 onward); 605 publications remained.

A detailed review of the abstracts of the 605 publications led to 219 of those publications being filtered out because they did not pertain to qualitative or quantitative studies that were conducted in one or more of the OECD countries. To elaborate on that - 158 of the 219 publications pertained to research studies and/or reports that were not based on data from any OECD country, while the remaining 61 publications were case reports, editorials, and other such pieces. 386 publications therefore remained for more detailed perusal and review.

FIGURE II.1: Summary of key study selection via the literature searches



Of the 386 publications that were reviewed in detail, 11 publications specifically pertained to studies with objectives that were similar to the objectives of this particular study; those 11 publications will be described in greater detail. However, several other publications – apart from those 11 – among the stated 386 publications merited brief descriptions, as well.

Out of the 386 publications, 3 publications pertained to studies in Canada with a primary objective of exploring the specific relationship between after-hours primary care provisions and low-acuity (or non-urgent) ED visits by patients; these three studies were therefore of most interest and would be prioritized. A further 3 publications pertained to studies in Canada wherein the relationship between after-hours primary care provision and ED visits by patients (in general, and not based on levels of urgency) was a primary objective; these three studies were also of interest, but they would be discussed in a slightly briefer manner, compared to the previously mentioned three studies. A further 5 publications pertained to studies conducted in one or more of the OECD nations wherein the relationship between after-hours primary care and ED utilization by patients was considered, directly or indirectly; these five studies would be briefly discussed, as well. Each study summary in this chapter will include the most relevant points from the referenced publication about the respective study.

Using the same search terms (and the same operator) that were used in the PubMed health database search, similar advanced Boolean searches were also performed in the EMBASE[78], COCHRANE LIBRARY[79], and UPTODATE[80] health databases; however, no additional studies of relevance were discovered.

Finally, a Boolean search with the afore-mentioned search terms was performed while using Google Scholar[81], which is not restricted to healthcare-based publications; no additional studies of relevance were discovered via Google Scholar.

After the 386 publications were identified, certain criteria were employed to determine whether each of those publications was relevant to this particular study; publications were deemed to be relevant using the following guidelines –

Studies that looked at relationships between alternate types of care and ED utilization would not be able to inform this particular study in a comprehensive manner, unless after-hours primary care was one of the alternate types of care being explored. Therefore, as an example, studies that looked only at the relationship between ED utilization and walk-in clinics that bore no resemblance to the walk-in clinic in the St. John's Metropolitan Area (SJMA) would not be reviewed in detail; however, any relevant points would still be extracted from those studies. It is notable that, in the relevant literature, most of the described walk-in clinics functioned like EDs and/or were staffed by ED physicians and/or were connected to EDs; the walk-in clinic in the SJMA is a primary care clinic, which is staffed by Family Physicians (FPs) and is not directly linked to any ED.

Studies that looked specifically at the cost benefits of providing after-hours primary care were not explored in depth since cost analyses would not be a part of this particular study. However, if the relationship between after-hours primary care provisions and ED utilization was described in a publication as part of a cost analysis, that section of the publication was deemed to be useful.

Studies that looked at the effects of different models of primary care on ED utilization were deemed to not be relevant unless after-hours primary care was studied in some way (i.e., in relation to ED utilization). However, primary care-related factors in general were still investigated across the literature to help with the subsequent interpretations of the results of this study.

Studies that looked at specific population groups (e.g., those over 60 years of age, military veterans, etc.) when comparing after-hours primary care provisions and ED utilization were generally not deemed to be relevant because results from such studies would not be easily

transferrable to the general populace. However, such studies were still reviewed briefly, in order to (a) determine if a certain sub-group (e.g., those who were unemployed) were studied as they would be studied in this particular study and (b) ascertain if any aspects of the methodology employed could be pertinent to this particular study.

Even if a study was done in an OECD country with an objective similar to that of this study, such a study was deemed to be less relevant if it was undertaken in a jurisdiction where the models of care were totally different from the main models of care in the SJMA (e.g., a model wherein the same physician routinely works in both an outpatient primary care setting and in an ED, as is seen in some rural locations in Canada). It should be mentioned that, in the SJMA, there are some physicians who work in both primary care clinics and EDs; however, this is not regular practice and those physicians make up a small minority of the primary care physicians in the community.

Priority was given to studies that were published during or after 2010. However, any relevant publications from 2000 to 2009 were not excluded from this review.

Publications about theoretical modeling (re: after-hours primary care and ED usage) were not reviewed in detail. However, such publications were briefly reviewed to determine whether any theoretical predictions were comparable to results from relevant real-world research studies.

Even if the authors of a publication were based in an OECD country, any publication regarding a study that was conducted in a non-OECD country was not reviewed in detail due to the understanding that the healthcare system in a non-OECD country would likely be different from the healthcare system in Canada by several degrees.

Unless a full English translation was available, publications in other languages were not considered.

Case reports and case series were not considered.

As a result of the points described up to this point, and as previously stated - a total of 11 studies met the inclusion criteria and will be discussed in detail. These 11 studies are in addition to several other studies from the stated 386 publications that (a) were described in brief in the preceding chapter, (b) will be described in brief in a latter section of this chapter, and (c) will be described in brief in a subsequent chapter during the discussion of the results from this study.

II.2 AFTER-HOURS PRIMARY CARE AND EMERGENCY DEPARTMENT VISITS

Based on the retrieved publications, the literature indicates that researchers have focused on three main aspects, in order to investigate whether after-hours primary care may help to reduce ED visits/caseloads. Those three aspects (re: the relationship between after-hours primary care and ED visits) will be examined in this section.

Creation of an after-hours primary care center

Certain studies investigated whether the creation/implementation of an after-hours primary care clinic had an impact on ED usage.

A Canadian study[82] used an interrupted time series analysis to explore the effect that an after-hours primary care clinic (i.e., the intervention) had on the number of low-acuity ED visits in a single jurisdiction. The study looked at the effect of the after-hours clinic from 2006 to 2017 and involved 11,368 patients from a relatively small catchment population of about 85,000. The catchment population was in Stony Plain, Spruce Grove, and Parkland County, Alberta. The after-hours clinic was staffed by one physician and one medical office assistant, and the hours of operation were 6 PM to 10 PM, Monday through Friday. The clinic was a collaborative initiative between FPs and

ED Physicians, and the clinic functioned as a walk-in clinic. Patients were surveyed as they attended the after-hours clinic, in order to find out whether they would have gone to an ED if the after-hours clinic was not available to them. After-hours clinic visit data and ED visit data were collected. Regarding the ED visits - Canadian Triage and Acuity Scale (CTAS) levels 4-5 were deemed to be indicative of non-urgent visits. The study results indicated a significant reduction in low-acuity (i.e., non-urgent) ED visits after the creation of the after-hours clinic; there were 40,046 avoided ED visits, based on survey responses. In addition, subsequent to the creation of the after-hours clinic, there appeared to be (a) greater attachment (i.e., stronger relationship) between patient and Family Physician (FP), (b) significant reduction - during hours of intake at the after-hours clinic - in the number of CTAS 4-5 ED visits that did not lead to admission, and (c) increased cost savings.

This Alberta-based study was instructive because it (a) used a standardized survey tool, (b) utilized prospective patient-level data collection, (c) was based in a Canadian jurisdiction where there was a single isolated ED, (d) covered a relatively broad timeframe, (e) explored cost and patient-physician attachment, in addition to the primary objective, (f) designated CTAS levels 4-5 as being indicative of non-urgency at ED triage, and (g) indicated that only 43% of Canadian primary care physicians at the time had reported providing after-hours access to patients. However, it may also be noted that (a) specific results from the time-series analysis were not provided in detail within the publication, (b) the number of avoided ED visits were based exclusively on survey responses, which may have been prone to personal biases, (c) causal relationships could not be inferred due to the observational study design, (d) a second after-hours clinic was present in the jurisdiction for part of the study timeframe before it was closed due to budgetary constraints, but similarities and differences between the two clinics were not explained, and (e) the cost-based data did not take

private insurance and general societal costs into account, and were also completely unavailable for part of the study timeframe.

A Netherlands-based study[12] published in 2005 was a retrospective observational study – using existing medical records - with a pre-post intervention design. This study explored the effect that the implementation of an out-of-hours Primary Care Physician (PCP) cooperative in 2000 had on the ED caseload in the jurisdiction of Maastricht. The cooperative was run by locum primary care physicians who organized themselves into small groups to provide the after-hours care at different times of operation. The cooperative and the ED were both at the same physical location and were both open at all hours; referrals to the ED from the cooperative were made when necessary. The ED visits were described, three weeks prior to and three weeks following the creation of the cooperative. The results of the study indicated a significant ($p<0.001$) decrease (by 53%) in the proportion of patients utilizing emergency care after the creation of the cooperative. In addition, following the creation of the cooperative, there was a significant ($p<0.001$) increase (by 25%) in the proportion of patients utilizing primary care, as well as fewer hospital admissions, fewer referrals to specialists, and no changes in mortality.

This Netherlands-based study was instructive because it (a) explored the immediate impact of the PCP cooperative on ED usage, (b) focused on out-of-hours care at the cooperative while there was no other out-of-hours primary care facility in the city, (c) led to the conclusion that over half of the patients who present at the ED could be adequately managed at a primary care facility, (d) was able to show that the introduction of the cooperative did not lead to an increased use of overall healthcare services, (e) led to the conclusion that a "gatekeeping" primary care facility could help to reduce ED use, and (f) included surveys of medical personnel and patients, which suggested that there was general satisfaction with the functioning of the cooperative. However, it may also

be noted that (a) ED visits in general were addressed, rather than classifiable non-urgent ED visits, (b) no cost analysis was included, although cost savings were indirectly assessed via hospital budgets before and after initiation of the cooperative, (c) causal relationships could not be inferred due to the observational study design, and (d) both the ED and the cooperative were in the same building, which meant that patients could easily be diverted from one to the other; however, this sort of proximity is not practical in all jurisdictions.

Both of the above studies provide similar conclusions and suggest that implementing an after-hours primary care clinic could help to reduce ED visits. Both of the above studies also suggest that informing the community about after-hours primary care initiatives is important, in terms of reducing avoidable ED visits. The similarity of the respective conclusions was noteworthy because (a) the jurisdictions in which each study was conducted were different from each other in several ways (e.g., population characteristics, models of primary care, etc.), (b) each study spanned a different length of time (i.e., years versus weeks), and (c) the study designs (including strengths and limitations) were different. However, it may be emphasized that the latter study focused on ED visits in general while the former study specifically focused on low-acuity ED visits.

After-hours access to existing primary care practices

Certain studies investigated whether the level of accessibility to existing primary care practices was significantly related to ED usage; the level of accessibility was assessed by way of obtainable medical records and/or patients' perceptions of accessibility.

A Canada-based retrospective cohort study[83] used linked administrative data to assess whether enrollment in a medical home that provided after-hours care was associated with reduced Emergency Department (ED) use. This study involved 2,945,087 subjects (i.e., adult Ontarians enrolled in a medical home between April 1, 2005 and March 31, 2012). The study timeframe was

– Fiscal Year 2005 to Fiscal Year 2011. The study only included residents of urban centers in Ontario who were eligible for Ontario health insurance coverage and who were 19 years of age or older. The primary analysis involved subjects who had enrolled in a medical home between Fiscal Year 2005 and Fiscal Year 2011 and who had a minimum of 3 years of outcome data both before and after enrollment. Submitted billing codes were used to determine the level of after-hours care provided by FPs. Patient characteristics (e.g., demographic factors, comorbidities, etc.) were controlled for. The primary outcome was the ED visit rate, calculated over a one-year period. Following regression modeling, the results indicated that (a) the ED visit rate increased by 0.8% (*95% Confidence Interval: 0.7-0.9%*) per year before medical home enrollment and by 1.5% (*95% Confidence Interval: 1.4-1.5%)* per year after the transition, (b) enrollment in a medical home was associated with an increase in the proportion of primary care visits that occurred on weekends, but a decrease in the overall primary care visit rate, and (c) enrollment in a medical home was associated with slightly improved Continuity Of Care (COC). To explain why patient enrollment in a primary care medical home offering after-hours care did not appear to be associated with a reduction in ED use, the authors put forward these possible reasons – (a) a reduction in conventional work hours by FPs while FP after-hours work increased, (b) the fueling of patient demand for more healthcare services that the introduction of the medical homes had stimulated, (c) a financial penalty for any FP whose patient had visited another primary care clinic, but no penalty if said patient had visited an ED, and (d) the study's limitations (e.g., the lack of a control group, the reliance on administrative data, the inability to ascertain the exact nature of the after-hours care provided, and the inability to ascertain specifics of the financial incentives for FPs in the medical homes).

This Ontario-based study was instructive because it (a) used billing codes to determine after-hours FP coverage, (b) controlled for several patient characteristics, (c) included COC as an outcome variable, (d) included patients who had each made, at least, one FP visit in the two years prior to medical home enrollment, (e) used provincial health insurance eligibility as an inclusion criterion, and (f) excluded rural residents because models of care in rural Ontario differ from those in urban Ontario. These six points each helped during the design of the current study. However, in addition to the limitations stated by the authors, it may be noted that (a) there was no differentiation between urgent and non-urgent ED visits, (b) medical home enrollment was an indirect method of capturing after-hours primary care access, and there was no mention of whether all patients were informed about the access being part of the enrollment, (c) causal relationships could not be inferred due to the observational study design, and (d) patients who died during the study period were excluded.

A systematic review[84] comprised studies from various OECD jurisdictions; each of those studies had looked into the effectiveness of one or more interventions that were employed to reduce ED visits. Forty-eight publications were included and comprised the following study designs – time series, cross-sectional & repeated cross-sectional studies, longitudinal studies, quasi-experimental studies, and randomized trials. Findings suggested that increasing accessibility to primary care (by adding primary care physicians and/or by adding primary care centers and/or by increasing primary care physicians' hours of service) reduced ED use. Another factor that appeared to reduce ED use was cost-sharing (i.e., requiring a patient who visited an ED to pay for the visit, either out-of-pocket or via private insurance). However, educational interventions and barrier interventions (e.g., gatekeeping by way of a referral center, just before entry to an ED) did not appear to have an impact on ED use.

This systematic review was noteworthy for several strengths - (a) it included searches of the gray literature, as well as direct contacts with experts in the field, (b) it explored interventions that addressed the accessibility of services, the supply of services, and the demand for services, (c) it attempted to account for differences in models of care across the various nations, (d) no publication was excluded due to study design and there were no language-based restrictions, (e) it only included studies involving adult patients, and (f) three researchers were jointly involved in the reviews. Limitations of this systematic review included – (a) the identification/selection bias was accentuated because of the variations in study design, and especially so since all of the designs were observational in nature, (b) the majority of the included studies had utilized administrative data, (c) the majority of the included studies did not control for potential confounding variables (e.g., age, sex, comorbidity, etc.), (d) ED visits in general were explored with no specific consideration of non-urgent ED visits, and (e) the differences in health delivery systems across the various nations made it difficult to generalize the findings and conclusions.

A survey-based study[85] spanning 34 nations (31 European nations, plus Australia, New Zealand, and Canada) used survey data collected from both patients and primary care physicians from 2011 to 2013 - as part of the Quality and Costs in Primary Care (QUALICOPC) project. Responses from 60,991 patients and 7,005 physicians (from 7,005 primary care practices) were utilized. Patients needed to have visited a primary care practice to be surveyed. Analyses of the survey responses indicated that better accessibility of primary care was inversely related to ED visits. Additionally, patients who had a regular primary care physician were less likely to visit an ED. Difficulties in accessing primary care appeared to be related to restricted hours of operation of primary care clinics and/or long travel distances to primary care clinics plus transportation issues and/or a lack of home visits by primary care physicians. Of the surveyed patients who had visited an ED at any

time during the preceding 12 months, only a third indicated that the main reason for the visit(s) was that their complaint could not be treated by a general practitioner.

This survey-based study was noteworthy for several strengths - (a) it included a relatively large number of primary care practices across multiple nations, (b) it specifically investigated the relationship between COC and the likelihood of using an ED, (c) it explored the propensity to seek care among surveyed patients, and found that a greater propensity was associated with increased ED use, and (d) it controlled for several patient characteristics, and found that increased ED use was associated with lower education, more comorbidities, lower age, and the male sex. Limitations of this study included – (a) many healthy patients and patients who faced difficulties in accessing primary care were likely excluded (as patients needed to visit an FP to be surveyed), (b) survey responses in general include inherent subjectivity and potential recall bias, (c) "ED visit by patient" was analyzed as a dichotomous (yes/no) variable, and did not take into account multiple ED visits by a patient, (d) although country-specific differences among the survey responses were noted, the reasons for those differences were not explored further, (e) causal relationships could not be inferred due to the observational study design, (f) ED visits in general were explored with no specific consideration of non-urgent ED visits, and (g) the differences in health delivery systems across the various nations made it difficult to generalize the findings and conclusions.

A cross-sectional population-based study[86] examined 7,856 separate primary care practices across England over a one-year period (2010-11). Those practices had 54,225,700 patients registered at them in total; 4,537,622 self-referred ED visits that did not lead to admission were made by that patient population during the study timeframe. In a negative binomial regression model, measures of patient-reported access to those primary care practices were the predictor variables while the number of self-referred discharged ED visits by the registered patient population at each practice

was the outcome; patient characteristics were controlled for. Data for each predictor variable were obtained from responses to a United Kingdom (UK) government-administered survey, which pertained to patient visits to (and experiences at) respective FP practices. Those individual responses were aggregated to the level of the FP practice and weighted by age and sex. Data for the outcome and control variables were obtained from National Health Service (NHS) databases and other UK government databases. The regression analysis indicated that practices that provided more timely access to primary care had fewer self-referred discharged ED visits per registered patient. Despite also considering several other measures initially, "timely access to primary care" was defined in the final regression model as – "the ability to make an appointment with a primary care physician within two weekdays".

This cross-sectional study was instructive because it (a) accounted for approximately 95% of FP practices in England, (b) indirectly attempted to capture non-urgent ED visits because such visits are usually self-referred and do not lead to admission[10], (c) controlled for patient characteristics (i.e., age, sex, ethnicity, socio-economic status, health status, rural/urban profile, and average travel time to FP practice versus nearest ED), (d) controlled for the number of FPs at each practice, and (e) suggested that timely access to primary care was the stronger predictor of reduced ED use, as compared to the other predictors of reduced ED use in the model (e.g., higher socio-economic status, better health status, etc.). However, it may also be noted that (a) the study was dependent on administrative data, (b) the study timeframe of one year was relatively short, (c) survey responses in general include inherent subjectivity and potential recall bias, (d) causal relationships could not be inferred due to the observational study design, and (e) potential financial pressures on patients were not accounted for and no cost-based analysis was performed.

Health Tracking Household Survey data from 2010 in the US were utilized for a cross-sectional study[87] that was published in 2013. The data had been obtained by telephone from a cross-section of US households. There were 9,577 patients who reported having a usual source of primary care and who had answered questions on after-hours primary care. These patients had also answered questions on ED use and hospitalizations during the 12-month period. Among patients who reported having a usual source of primary care, about 40% reported that their primary care practice offered extended hours of care and was accessible on nights and weekends. The results indicated that patients who reported less difficulty in contacting a primary care physician after regular work hours made significantly fewer ED visits, compared to patients who reported more difficulty (30.4% versus 37.7%, regarding ED visits among the two patient groups). In addition, the former group of patients appeared to have significantly lower rates of unmet medical need, compared to the latter group of patients (6.1% versus 13.7%, regarding unmet medical need among the two patient groups).

This cross-sectional study was instructive because it (a) controlled for age, sex, ethnicity, insurance status, self-reported health status, and urban/suburban/rural location of patients, (b) utilized data that had been collected via both landline phone calls and cell phone calls, (c) included a sub-group analysis to further investigate patients who had actually tried to use after-hours primary care in the 12-month period, and (d) included a sensitivity analysis to explore potential differences between those who had no after-hours FP access via their usual provider of care and those who had such access but never made use of it. However, it may also be noted that (a) the study was dependent on survey-based data from an administrative database, (b) several potentially confounding variables (e.g., variables related to socio-economic status) were not controlled for, (c) the study timeframe of one year was relatively short, (d) survey responses in general include inherent

subjectivity and potential recall bias, (e) causal relationships could not be inferred due to the observational study design, (f) certain FP practice-level characteristics (e.g., the percentage of uninsured patients) were unavailable, and (g) the response rate (re: the survey in question) for the relevant year (2010) was lower than it had been in preceding years.

A patient survey-based study[11] in Canada was described in a 2009 publication. This study was based in two Ottawa hospitals and focused on ambulatory patients who visited the hospital EDs after usual work hours. The surveys were administered over 18 days in 2007. The survey questionnaire aimed to determine (a) the patients' motivation for seeking after-hours care in an ED, (b) the patients' perceived urgency of their medical complaints, and (c) the patients' willingness to seek care from their primary care physicians had the physicians been available at the time. Of the 141 patients who responded to the survey, about 57% indicated that they would have chosen to visit their primary care physician – and not visit an ED – if their primary care physician had been available at the time. There was no difference in perceived urgency between patients who were willing to see a primary care physician (if possible) and patients who were unwilling to see a primary care physician.

This survey-based study had several strengths – (a) only patients who had come to the ED via their own means of transportation were included, (b) the patients were surveyed, soon after they entered the ED because patients who had waited for long periods in the ED would have likely preferred to receive care elsewhere, (c) each patient's perception of urgency was assessed via multiple survey questions, and (d) patient opinions on what an appropriate ED wait-time should be were obtained via the survey and related to the patient's CTAS level. However, this study had multiple limitations, too – (a) the sample was relatively small, (b) the surveys were administered in hospitals where – per the authors - ED wait-times were higher than in other similar hospitals in the province

of Ontario, (c) the data were collected over a short period in mid-summer when seasonal factors (e.g., greater incidences of outdoor sports injuries) may have contributed to more ED visits, (d) the actual patient diagnoses were not part of the study, (e) age and sex were the only details collected, with regards to patient characteristics, (f) it is unclear if surveyed patients were aware of the study objectives, and (g) some pediatric patients were included, as long as their accompanying adult gave informed consent.

Despite the above six studies being different from each other in several ways (i.e., jurisdiction, study design, timeframe, etc.), the two main emerging themes from five of them appeared to be that (a) patients would prefer to have access to primary care after normal work hours and (b) patients of primary care practices that allow for after-hours care/consultations make fewer ED visits, compared to patients of primary care practices that do not offer after-hours care/consultations. The one study wherein the results were not consistent with the results from the other studies was the first study in this section (i.e., the study by Kiran et al.[83]); however, that study did suggest that conventional FP work hours decreased while after-hours FP work increased, which may help to explain why increased after-hours FP access was not associated with reduced (overall) ED use in that case.

Incentives for primary care physicians to provide after-hours care

Certain studies examined whether the provision of financial incentives for after-hours work (along with regular remuneration) to primary care physicians had an effect on ED usage. The most relevant of these studies were based in Ontario and will be briefly discussed in this section. It may be noted that studies in other jurisdictions, which explored the relationship between after-hours primary care incentives and ED usage arrived at conclusions that were similar to those of these Ontario-based studies.

A retrospective cohort observational study[88] – based in Ontario, Canada and published in 2021 - investigated the relationship between the after-hours premium (i.e., a financial incentive for primary care physicians to provide after-hours patient care, which adds onto regular compensation) and patient visits to EDs that were deemed to be "less urgent". This study involved a main cohort of 586,534 patients (timeframe: 2002-2006), along with a sub-cohort of 201,594 patients (timeframe: 2005-2016). The main cohort was examined for the impact - on less urgent ED visits - of (a) the introduction of the after-hours premium and (b) the first increase of said premium, while the sub-cohort was examined for the impact - on less urgent ED visits - of subsequent increases of said premium. Primary care physician-related and patient-related data were linked with ED visit data. CTAS levels 4 and 5 were deemed to be indicative of less urgent ED visits. Any visits to primary care physicians outside of 8 AM – 5 PM on non-holiday weekdays were deemed to be after-hours visits. Patients were assigned to primary care physicians (i.e., usual providers of care), based on billing submissions from the physicians during the preceding years, and patients were categorized by their physicians' eligibility to bill for the after-hours premium. There were two groups of patients – (a) patients pf physicians who were practicing under the fee-for-service model, and (b) patients of physicians who were practicing under Patient Enrolment Models (PEMs) wherein physicians were eligible for performance-based incentives. Fee-for-service physicians were not eligible for the after-hours premium, while physicians practicing under PEMs were eligible; the latter group (a) cared for enrolled patients, (b) were in group-based practices, and (c) were compensated by blended capitation[89]. Patient characteristics and physician characteristics were included in the regression models, along with an adjustment for seasonal effects (re: patient visits). The outcome variable was the number of ED visits per patient per month, stratified by urgency and timing. The results indicated that the introduction of the after-hours

premium was associated with a reduction in less urgent ED visits. This reduction was more pronounced outside of regular work hours, while subsequent increases in the after-hours premium were associated with further small decreases in less urgent ED visits. However, the introduction of the after-hours premium - and subsequent increases of it - were associated with small increases in more urgent (i.e., CTAS levels 1-3) ED visits.

This observational study was instructive because it (a) included a relatively large cohort (i.e., a random sample of about 10% of Ontario residents), plus a relatively large sub-cohort that was followed forward for 11 years, (b) designated CTAS levels 4-5 as being indicative of "less urgent" ED visits, (c) controlled for patient age, sex, income, and comorbidity, (d) controlled for physician characteristics (i.e., age, sex, international medical graduate status, experience, and practice group size), (e) used fixed effects regression models to control for patient confounding factors that do not vary over time, (f) clustered patients within physicians, in order to obtain valid standard errors, (f) attempted to ensure that the two groups of patients (i.e., patients of fee-for-service physicians and patients of physicians who were part of PEMs) had similar characteristics before the after-hours incentive was introduced, (g) additionally examined the effect of the after-hours premium among a sub-sample of patients whose physicians had billed the premium, at least once a month, and (h) only included patients from urban Ontario because models of care in rural Ontario differ from those in the urban centers. The study had certain limitations, as well – (a) the study was dependent on administrative data, (b) individual-level socio-economic factors were not accounted for, (c) after 2006, other incentives for Ontario physicians were introduced, which were not accounted for and may have subsequently modified the effect of the after-hours premium, (d) 25% of the sample was subsequently excluded due to incomplete data and/or death, (e) the role of walk-in clinics was not considered, (f) there was no differentiation between patients who self-referred

themselves to an ED and patients who were referred to an ED by a physician, (g) patients across all age groups were included, even though pediatric care in general is different from adult care, (h) specific details of the after-hours primary care provided was unavailable, and (i) causal relationships could not be inferred due to the observational study design.

A retrospective observational study[90] – based in Ontario, Canada and published in 2020 - utilized administrative data to examine if (and why) incentives for primary care physicians to work after-hours affected ED use. This study made use of existing data on both ED visits and FP office visits during the 2003-2007 timeframe. Only full-time practicing FPs who had submitted billings for after-hours care (i.e., billed for the after-hours premium) were included in the study. There were 1,321 FPs in the study, and only patients who had been enrolled at an FP practice were included. The average roster size per FP practice was 1,774 patients. Unlike the previously described study in this section, patients of fee-for-service FPs were not considered; however, certain data used for this study and the previously described study were identical. Submitted billing claims determined the usual provider of care for each patient and determined the number of after-hours visits per FP office. ED visits were categorized according to the triage levels with CTAS levels 4-5 deemed to be indicative of less urgent ED visits. Patient characteristics (e.g., demographic factors, health status, urban/rural area of residence, etc.) were ascertained and aggregated for each FP practice; these practice-level variables were controlled for during the analyses. The results of the physician practice-level analyses indicated that over the study timeframe, the number of regular-hours FP visits per 1,000 patients gradually decreased while the number of after-hours FP visits per 1,000 patients increased before plateauing. During the same timeframe, the number of urgent ED visits increased while the number of non-urgent ED visits decreased. The study also found that the total healthcare costs per 1,000 patients over the study timeframe decreased substantially, even though

the total costs for after-hours care over the same period increased. Other noteworthy findings from the study were – fewer ED visits were respectively made by (a) patients of female FPs, (b) patients of International Medical Graduates, (c) patients of FPs who worked in larger practices, (d) patients of FPs who had younger patient populations, and (e) patients of FPs who had fewer patients from rural areas. These listed findings were similar to those of the preceding study described in this section. The authors also argued that the regulatory framework in Ontario guarded against FPs "gaming" the system (i.e., encouraging their patients to make after-hours visits instead of regular-hours visits, just so that the after-hours premium could be billed for), and the trends in the study results supported the inference that "gaming" by FPs was not a major issue.

This observational study was instructive because it (a) indicated that less urgent ED visits (i.e., those with CTAS levels 4-5) – which were reduced after the after-hours premium was introduced - stem predominantly from primary care practices with relatively healthier enrolled patients, (b) indicated that, even while accounting for other physician incentives, each increase in the after-hours premium was associated with further reductions in less urgent ED visits, (c) indicated that each increase in the after-hours premium was associated with greater provision of after-hours primary care services, (d) examined overall costs to the system, as well as the specific costs pertaining to after-hours primary care provision and ED care, (e) controlled for a relatively wide variety of physician characteristics, and (f) indicated that an incentive that varies according to the rostered patient population would be more cost-effective than a constant incentive. The limitations of the study included – (a) the dependence on administrative data, (b) the exclusion of fee-for-service FPs and their patients, (c) the non-availability of individual patient characteristics, (d) the non-availability of socio-economic information on the FPs, and (e) the fact that causal relationships could not be inferred due to the observational study design.

A patient survey-based study[91] in Canada examined how different models of primary care (each with differing after-hours care arrangements and differing physician incentives) impacted patients' use of EDs. Recruitment of patients and physicians for this study took place over 3 months (December 2004 – February 2005) in Thunder Bay, Ontario. This study surveyed patients of 8 Family Health Networks (FHNs), 16 Family Health Groups (FHGs), and 12 Fee-For-Service (FFS) FPs. Patients who had made, at least, one visit to a primary care physician during the past year were randomly selected and 5,884 out of 9,373 patients responded to the mailed survey. Self-reported ED use and self-reported walk-in clinic use (each within a six-month period) were the outcome variables. Rostered patients of the FHNs and FHGs had access to after-hours care and telephonic triage while patients of the FFS FPs did not. In addition, physicians who were part of the FHNs or FHGs received practice incentives (based on their rostered patients, and their after-hours services) while FFS FPs did not. It may also be noted that FHNs were required to roster their patients through a formal enrolment process and were paid by a blended capitation funding model for a basket of services, with quota-based incentives for preventive services. On the other hand, FHGs were fee-for-service funded with additional bonuses for achieving targets (re: specific services); there was no limit to fee-for-service billings, and they (FHGs) were encouraged - but not required - to roster patients. Regarding FFS FPs - patients were not rostered, there were no limits on services billed or the number of patients seen, and there were no contractual obligations to provide after-hours or telephonic coverage. The results indicated that ED use and walk-in clinic use differed, based on which model of care the patients had been under. Patients who were part of FHNs were significantly less likely to visit an ED, compared to patients who were under the other two models of care. And, patients of FFS FPs were much more likely to visit a walk-in clinic, compared to patients under the other two models of care. The authors concluded that, regarding

primary care providers, different incentives and different after-hours care provisions impacted ED use differently. The results suggested that patients who were more likely to receive after-hours primary care made fewer ED visits; similarly, patients of primary care physicians who were more likely to receive incentives for providing after-hours care made fewer ED visits.

This survey-based study had several strengths - (a) it included three distinct patient groups, (b) FPs had to consent to join the study and 36 out of the 41 approached FPs agreed to join, which was a relatively high proportion, (c) the overall patient response rate (re: participation in the survey) was 62.3%, which was also satisfactory, (d) the investigators attempted to match the FHN physicians to the FHG and FFS physicians as closely as possible, regarding year of graduation, (e) patient age, sex, self-reported health, and income were controlled for, (f) both ED and walk-in clinic visits were included, (g) clustering of the outcome within FPs was accounted for by inflating the sample size by a factor of 1.15, and (h) younger age, poorer self-reported health, and lower income were associated with greater ED use, which was similar to findings from most other relevant studies. The study also had several limitations – (a) ED visits in general were included with no information about the diagnoses in the ED or the appropriateness of the ED visits, (b) sampling of patients was based on rostering in the FHN model and billing in the other two models, (c) the FHN patients were likely healthier than patients in the other two models due to the streamlined selection of patients into FHN rosters for capitated payment, (d) imputation was performed to create complete data sets when incomplete patient responses led to missing data, (e) survey responses in general include inherent subjectivity and potential recall bias, and (f) causal relationships could not be inferred due to the observational study design.

The above three studies suggest that incentivizing primary care physicians to provide after-hours care has had a positive effect in Ontario, in terms of reducing non-urgent ED visits. However,

other factors (e.g., the rostering/enrollment process, the nature and level of the incentives, the patient and physician characteristics, etc.) may have contributed to the results of these studies, as well. It is also worth reiterating that all of the described studies were observational/survey-based studies, and therefore, only associations could be drawn out of them, rather than causality.

II.3 OTHER NOTEWORTHY STUDIES

Brief mentions about certain other publications are also warranted. These other publications were retrieved during the described literature search and are notable because (a) they are each cited in one or more of the studies already described in this chapter and (b) they help to support the main conclusions from the studies already described in this chapter and/or add more context around those conclusions. However, it may be noted that none of these other publications are about quantitative or qualitative studies that directly examined the relationship between after-hours primary care and ED visits.

An observational study - using administrative health data – in a large tertiary care hospital in Austria led to the conclusion that introducing a walk-in clinic in the same hospital where an ED exists could help to reduce ED visits[92]. In this study, the introduction of a walk-in clinic was associated with a significant decline in ED usage, and that decline remained stable for two years. The main conclusion from this study is similar to that from the Netherlands-based study[12], which has been described in this chapter. The Netherlands-based study also involved a hospital-integrated facility - in close proximity to an ED - functioning as both a walk-in primary care clinic and a "gatekeeping" center. However, a key difference between the Austria-based study and the Netherlands-based study is - in the former study, the physicians working in the walk-in clinic were

not exclusively primary care physicians. In terms of its design and conclusions, this Austria-based study is similar to other studies that explored the relationship between walk-in primary care clinics (inclusive of extended-hours primary care clinics that allowed both routine and urgent appointments during extended hours) and ED use, such as an American study that was undertaken in Pennsylvania (Baughman et al.)[93]. It may be noted that the American study involved a standard primary care practice that allowed walk-in patients (i.e., non-regular patients at the practice) to be seen during certain regular work hours, rather than during after-hours.

A theoretical model was developed to examine how after-hours incentives for primary care physicians would affect ED utilization by changing physician behavior[94]. The model predicted that the incentives would induce the physicians to do more after-hours work but would also induce them to reduce their work during regular hours; therefore, the predicted effect on ED use was ambiguous. However, after comparing the model's predictions with administrative data (2004-2013) in Ontario, Canada, the authors concluded that certain modifiable after-hours primary care incentives could reduce total ED visits, non-urgent ED visits, and net costs, while also improving community health. That conclusion was consistent with those of the studies described in the preceding section of this chapter.

Another study in Ontario, Canada examined whether increased access to after-hours primary care would have an effect on the association between home nursing visits for home care patients and same-day ED use by those patients[95]. There has been shown to be an increased risk of home care patients making ED visits on the same day when they receive a home nursing visit[95]. This study compared home care patients who had access to after-hours primary care with those who did not. It was concluded that greater access to after-hours primary care could prevent some less urgent ED visits by this sub-group of patients but would not reduce the overall number of ED visits by

said sub-group. This finding is generally consistent with findings from several studies described in preceding sections of this chapter. And, the findings of this Ontario-based study are similar to those from other studies/reports that explored the relationship between after-hours primary care and ED use among specific subsections of the population. Similar findings from similar studies are described in a report by the Canadian Institute for Health Information (CIHI)[96], as well.

Certain articles/reports have suggested that incentives for after-hours primary care cannot alone reduce the burden on EDs and that such incentives need to be administered on a flexible basis and be subject to constant reviews and updates (e.g., modify the premium amounts according to different times of day, regularly study how the premium is working, and periodically increase the premium amounts). A report in Australia suggested this[97], as did an article that was based on trends in the US[98].

II.4 INFERENCES FROM THE MOST RELEVANT STUDIES

The eleven extensively described studies in this chapter are the most relevant – in terms of location and objective – when compared with the current study; with this in mind, it is beneficial to look at the key takeaway messages from those studies.

There appears to be a lot of overlap between those studies when the post-study recommendations of the respective authors are considered; further research utilizing more robust study designs has been a consistent recommendation - in order for more definitive conclusions to be drawn. Unlike the recommendations, the results of each of those studies do not have as broad an overlap. The results from all but one of the studies suggest that ED use may be reduced by creating more after-hours primary care centers and/or improving access to after-hours primary care and/or incentivizing primary care physicians to provide after-hours care. However, among those studies,

the strength of the effect on ED use by any of the listed interventions appears to vary, perhaps because of the following factors that vary between the studies - jurisdiction, patient population, physician population, existing models of primary care, sample size, study design, and length of study timeframe. In addition, the study by Kiran et al.[83] suggests that a level of equipoise exists in Ontario, regarding the relationship between after-hours primary care access and ED usage.

It is important to note that no relevant prior study has been performed in Newfoundland & Labrador, and it would be unwise to wholly extrapolate findings from other jurisdictions to the SJMA (where this particular study is focused), even though certain similar findings could be expected from a local study.

Even though this particular study is a cross-sectional study, it also has features of a cohort study; it therefore has certain strengths when compared to the other studies noted in this chapter. Those strengths will be described in greater detail in a subsequent chapter, but it is worth noting at this point that this study included a large – and representative - patient sample, as well as a large number of physicians. Since a large majority of those physicians were practicing under the fee-for-service model, physicians were categorized according to after-hours care provision, in order to better interpret the results. This categorization was based upon methods used in some of the described studies from Ontario.

The above studies also provided other useful information, regarding the appropriate methodology to follow during this study (e.g., using billing records to determine physician consultations, and considering CTAS levels 4-5 as indicative of non-urgency), as will also be described further in a subsequent chapter.

III. DATA

This chapter provides brief descriptions of the respective databases that contributed data into the final datasets used for analyses. These descriptions help explain the evolution and characteristics of the final datasets, as well as lead into the following chapter, which describes the study methodology.

III.1. DATABASES

The following databases were each accessed by the Newfoundland & Labrador Centre for Health Information (NLCHI) who then extracted the requested data. NLCHI also de-identified the requested data before providing that data in SPSS format for the purposes of this study. All of the databases described below were directly available at NLCHI, except for two databases, which NLCHI subsequently received – prior to data extraction and linkage - from Eastern Health and from the Memorial University Faculty of Medicine (Discipline of Family Medicine), respectively.

Medical Care Plan (MCP) Beneficiary Registration Database:

This is a registry database under the custodianship of NLCHI. It is primarily used by NLCHI to confirm demographic and administrative data in other databases that are maintained by NLCHI, while also being used for research and surveillance when required[99].

This database includes administrative and demographic information about clients eligible for services under the provincial Medical Care Plan (MCP). It therefore includes information about individuals insured by the program, and it is a "snapshot" of registrants' information at a point in time - usually December 31 of a particular year[100].

This database includes the specific MCP number for each individual in the database, and this number was used by NLCHI to link to the other databases that were required for this study. The MCP number of each individual was coded into a random "common patient identifier" number, prior to NLCHI providing the data for this study.

This database was used to define the study population/cohort – all individuals who were 18 years (or older) on April 1, 2011 and who were residing in the St. John's Census Metropolitan Area (SJCMA or SJMA) with a valid MCP number between April 1, 2011 and March 31, 2015. NLCHI provided us with this information via this database, having (a) used Statistics Canada's 2017 Postal Code Conversion File + (PCCF+)[101] to only include residents of the SJMA, (b) excluded non-adult individuals, and (c) excluded individuals who did not have MCP coverage throughout the study timeframe and/or did not live in the SJMA throughout the study timeframe.

The breakdown of unique records from this database – per each fiscal year in the study timeframe - that NLCHI provided for this study was as follows –

- Fiscal Year 2011: 118,667 individual records
- Fiscal Year 2012: 118,202 individual records
- Fiscal Year 2013: 117,910 individual records
- Fiscal Year 2014: 117,761 individual records

Provincial Discharge Abstract Database (PDAD):

This database is maintained by NLCHI, and it contains demographic, administrative, and clinical data collected at hospitals when patients are discharged from inpatient and/or surgical day care services[100].

This database includes the MCP number of each individual who has been released from hospital care, as well as the demographic information of each such individual. In addition, the name of the

hospital where care (re: each episode of each patient) has been provided and the relevant ICD-10-CA[102] diagnosis codes are also included. Similar to what was done with data from the MCP Beneficiary Registration Database, NLCHI converted each individual's MCP number into the relevant "common patient identifier" number, after linkage via the MCP number and before providing the data for this study.

This database provided data, regarding the hospitalizations – at any hospital in this province – of residents of the SJMA during the study timeframe. Therefore, this database – along with two other databases that will be described - was used to calculate the Charlson Comorbidity Index (CCI) score for each individual in our study population.

The breakdown of unique records from this database – per each fiscal year in the study timeframe - that NLCHI provided for this study was as follows –

- Fiscal Year 2011: 63,184 individual records
- Fiscal Year 2012: 70,138 individual records
- Fiscal Year 2013: 78,488 individual records
- Fiscal Year 2014: 87,028 individual records

MCP Fee-For-Service Physician Claims Database:

The MCP Fee-For-Service database is maintained by NLCHI. This database includes clinical and administrative information submitted by physicians who treat beneficiaries of the province's Medical Care Plan (MCP); the information is submitted to allow physicians to be compensated for their services[100]. The included information pertains to services claimed under the Newfoundland Medical Care Insurance Act[103]. Relevant data within this database comprise – (a) the date of service, (b) the place of service (i.e., city/town), (c) the ID of the primary care provider (i.e., FP), and (d) the diagnostic and fee codes used to describe procedures/services performed[100].

This database was used to determine (a) each visit by a patient to an FP clinic (and if any such visit was an after-hours visit), (b) each visit by an FP to a patient home (and if any such visit was an after-hours visit), and (c) the patient's ICD-10-CA diagnosis code, regarding each visit that fell under either (a) or (b). The stated information could be ascertained via the respective fee/billing codes – as recorded in this database - that had been submitted by FPs during the study timeframe for the purpose of compensation. This database was of greatest importance, in terms of allotting each individual in the study population to a usual provider of care. In addition, billing claim submissions by FPs that included the special fee code for after-hours care were of particular interest during this study. That was because the level of after-hours care that each relevant FP had provided during the study timeframe needed to be determined. The date of each patient-FP consultation is recorded in this database, as well. And, date-based records were important, as the total number of after-hours FP consultations per day – regarding the whole study population - needed to be computed during this study, too. It should be noted that the provided data from this database comprised residents of the SJMA who had had an office or home FP consultation during the study timeframe, as required for this study. However, other FP-related consultations – which were not relevant to this study - were included in the provided data, too. That provided data also included FPs from any part of the province, as long as they had submitted one or more billing claims (during the study timeframe) that could be associated with a patient from the SJMA. And, as with the PDAD, the recorded ICD-10-CA diagnosis codes in this database helped with the calculation of the CCI score of each individual in the study population. The procedure to compute the CCI scores – and the limitations therein – will be described in subsequent parts of this thesis.

Similar to what NLCHI did with the patient population, each FP in this database was de-identified and was assigned a random "common provider identifier" before the data from this database were provided for this study.

The breakdown of unique records from this database – per each fiscal year in the study timeframe - that NLCHI provided for this study was as follows –

- Fiscal Year 2011: 1,489,763 individual records
- Fiscal Year 2012: 1,508,150 individual records
- Fiscal Year 2013: 1,536,339 individual records
- Fiscal Year 2014: 1,565,506 individual records

Emergency Department (ED) Visit/Triage Database:

This database is maintained by Eastern Health, and it was accessed by NLCHI to extract the data relevant to this study. It may be noted that visits by residents of the SJMA to EDs outside the area administered by Eastern Health were incorporated into this database, per a request from NLCHI and prior to the data being accessed by NLCHI. This database includes (a) the name of the hospital where each patient ED visit occurred, (b) the triage level - as per the Canadian Triage and Acuity Scale (CTAS) - pertaining to each patient presentation at the ED, and (c) the date and time of each ED triage[100].

Data from this database were required to ascertain the primary outcome of this study - ED visits that (a) had been triaged as CTAS level 4 or 5 and (b) had been made by a resident of the SJMA during the study timeframe. To ensure that no such ED visits could be overlooked, ED visits to any hospital in the province (as long as they were made by a resident of the SJMA) were included; this was mainly done because patients of the Academic FPs could have potentially received virtual (i.e., telephonic) primary care, even if they were away from the SJMA.

Via the MCP numbers, NLCHI was able to link the required data from this database to the required data from the other relevant databases. This was done, prior to converting all MCP numbers into "common patient identifier" numbers for the purpose of de-identification. Following that, the data were provided for this study.

The breakdown of unique records from this database – per each fiscal year in the study timeframe - that NLCHI provided for this study was as follows –

- Fiscal Year 2011: 55,638 individual records
- Fiscal Year 2012: 57,944 individual records
- Fiscal Year 2013: 57,348 individual records
- Fiscal Year 2014: 59,123 individual records

Academic Family Physicians' Electronic Records Database:

This database is maintained by the Discipline of Family Medicine at the Faculty of Medicine, Memorial University. These data were sent to NLCHI where the data were linked to the required data from the other relevant databases. Signed consent was obtained from the FPs who had practiced as Academic FPs during the study timeframe, prior to the Discipline of Family Medicine sending over the required data to NLCHI.

This database includes (a) the date of service, (b) the ID of the primary care provider (i.e., FP), (c) the patient's ICD-10-CA diagnostic code, regarding each FP consultation, and (d) a brief description of the patient's diagnosis at each visit (which expands on the stated ICD-10-CA diagnostic code and therefore provides more detail)[100].

Data from this database were required for similar reasons that data from the MCP Fee-For-Service Physician Claims Database were required; if an individual's usual provider of care was an Academic FP, this database would be required to indicate that. Since Academic FPs are salaried

and do not submit billing claims, the relevant information regarding these FPs could not be obtained from the MCP Fee-For-Service Physician Claims Database.

As was the norm, NLCHI converted each MCP number from this database into a "common patient identifier" number and each provider ID from this database into a "common provider identifier" number – all for the purpose of de-identification, prior to providing the required data for this study. NLCHI received 35,913 individual records from the Discipline of Family Medicine (re: this database), out of which 7,572 records could not be linked to the MCP Beneficiary Registration Database. This left a total of 28,341 individual records that were linkable. The relatively high number of non-linkable records may have been due to the fact that government-assisted refugees in the jurisdiction – who are predominantly seen by Academic FPs - usually do not have MCP numbers for periods of time after arrival.

It should also be noted that the required data pertaining to the Academic FPs were provided in a single file, unlike the required data from the previously mentioned databases, which were provided in separate fiscal year-based files. The data pertaining to the Academic FPs covered the calendar years of 2011, 2012, 2013, 2014, and 2015.

III.2 PUBLICLY AVAILABLE DATA

In addition to the data obtained from NLCHI, Dissemination Area-level data pertaining to the SJMA are freely available via the Statistics Canada website. The most recent census-based data at the time of data collection were from the 2016 Census.

With the help of librarians at Memorial University's Queen Elizabeth II library, Dissemination Area (DA)-level data for the SJMA – as obtained via the 2016 Census[104] - were extracted; there

were 318 Dissemination Areas (re: the SJMA) in total. It should be noted that the 2016 census-based data were derived via long-form Census Questionnaires, unlike the 2011 census-based data; the latter therefore included a large proportion of missing data points.

The census-related variables of interest were - (a) income level, (b) employment/unemployment percentage, and (c) education level. Since there was no way to determine the income level, employment/unemployment percentage, and education level at individual level, the most feasible option was to assign the relevant DA-level values to each individual, based on the DA where the individual had resided throughout (or through most of) the study timeframe; this option was suggested by the existing literature, too[83].

The methods by which the final datasets that were used for analyses were constructed from the data obtained from the above databases will be described in detail in the following chapter.

IV. METHODS

The primary objective of this study was to determine the association between after-hours care provided by Family Physicians (FPs) in the St. John's Metropolitan Area (SJMA) and non-urgent visits to Emergency Departments (EDs) made by adult (18+) patients residing in the SJMA – from Fiscal Year 2011 to Fiscal Year 2014. Two complementary approaches to achieve this objective were, as follows –

(i) Examine the relationship between different levels of after-hours care provided by regularly practicing FPs in the SJMA - as indicated by a derived "After Hours Intensity" score for each Family Physician (FP) - and non-urgent visits to EDs made by adult (18+) patients residing in the SJMA who were regular patients of said FPs.

(ii) Examine the relationship between billing claims for after-hours care submitted by fee-for-service FPs in the SJMA and non-urgent visits to EDs made by adult (18+) patients residing in the SJMA, with the calendar date as the unit of analysis.

Note: The second approach mentioned above would help to clarify (and add more context around) the results obtained via the first approach mentioned above - by exploring a specific relationship between after-hours billing claim submissions by FPs and non-urgent visits to EDs by patients.

The secondary objective of this study was to determine the following –

- The relationship between Continuity Of Care index scores of adult (18+) patients residing in the SJMA and non-urgent visits to EDs made by those patients – from Fiscal Year 2011 to Fiscal Year 2014.

With the study objectives in mind, it is worth mentioning that a cross-sectional study can prove/disprove associations, but it cannot prove/disprove any cause-and-effect.

IV.1 SETTING

As mentioned previously, relevant data beyond the 2015 Fiscal Year were unavailable for this study when the data were requested. As a result, certain contextual considerations had to be borne in mind by the investigator before the data request, and these were as follows –

(i) According to the 2011 Census (as per Statistics Canada) – the population of the SJMA was approximately 197,000 (with 15-18% of those being children under 18 years of age), and this figure is most relevant with regards to the study timeframe.

(ii) A news release from the Newfoundland & Labrador Department of Health and Community Services in February, 2012 stated that there were 520,000 visits to the 33 EDs in the province during 2011[105]; furthermore, news reports from around the same time suggested that there were about 85,000 visits per year to EDs in the SJMA[106].

(iii) Throughout the study timeframe (as is still the case), there were two adult general hospital EDs in the SJMA – at the Health Sciences Center and the St. Clare's Mercy Hospital – which were meant to serve patients with non-psychiatric and non-pediatric medical emergencies.

(iv) Reports (mostly anecdotal) suggested that there were 200-250 FPs practicing as full-time primary care physicians in the SJMA during the study timeframe; as now, the overwhelming majority of those FPs were providing care under the fee-for-service model.

(v) Records at the Discipline of Family Medicine (Memorial University of Newfoundland) suggested that there were 15-20 Academic FPs practicing as primary care physicians in university-affiliated Family Medicine clinics during the study timeframe; as has been

described in a prior chapter, these FPs were (and are) practicing under a different model of care, compared to the FPs practicing under the fee-for-service model.

(vi) Based on anecdotal accounts, there was one after-hours walk-in FP clinic in the SJMA during the study timeframe, but that clinic no longer exists; at present in the SJMA, there is one after-hours walk-in FP clinic - a different one that has existed since 2018[107].

(vii) As will be described in a subsequent section of this chapter - an official document on the government of Newfoundland & Labrador website describes the respective billing codes that can be submitted by FPs who provide care under the fee-for-service model in this province[54]; these codes (within the requested data) would be mainly required to help us understand how many times after-hours care was provided by a given FP during the study timeframe.

IV.2 OBTAINING THE DATA

Between January 2016 and September 2017, the following steps were followed, in order to receive the appropriate data -

1) Ethics approval from the Health Research Ethics Board (HREB) - which is under the Newfoundland & Labrador Health Research Ethics Authority (HREA) – was obtained for this study via a specific application for secondary use of de-identified data; the HREB File Number was 2017.021, and the Researcher Portal File Number was 20171551. (*See Appendix I for HREB Approval*).
2) Approval was granted from the Newfoundland & Labrador Centre for Health Information (NLCHI), regarding the formal application (File Number: IM111691) to NLCHI to (a) extract the required data from the databases that were available to them, (b) de-identify the

required data, (c) retain only the relevant variables, (d) provide the definitions of each relevant variable within a specific Data Dictionary, (e) ensure that the separate datasets could be linked to each other via one or more common variables, and (f) provide the requested/required data via a secure process. (*See Appendix II for NLCHI Approval*).

3) The relevant data from the following databases were ultimately provided by NLCHI in the form of SPSS files – (a) The Medical Care Plan (MCP) Beneficiary Registration Files Database for Fiscal Years 2011, 2012, 2013, and 2014, (b) The Provincial Discharge Abstract Database (PDAD) for Fiscal Years 2011, 2012, 2013, and 2014, (c) The MCP Fee-For-Service Physician Claims Database (PCD) for Fiscal Years 2011, 2012, 2013, and 2014, (d) Emergency Department (ED) Visits/Triage Database (limited to visits from residents of the SJMA to any ED in the province) for Fiscal Years 2011, 2012, 2013, and 2014, and (e) Academic Family Physicians' Records Database - from Calendar Year 2011 to Calendar Year 2015. [Note: While the relevant data from three of the listed databases - (a) to (c) - were readily available at NLCHI, the data pertaining to ED visits were obtained by NLCHI from the respective Regional Health Authorities, and the data pertaining to the Academic FPs were obtained from the Discipline of Family Medicine at Memorial University; the relevant data pertaining to ED visits and the Academic FPs were then de-identified by NLCHI before being provided for this study].

4) With the help of librarians at the university's Queen Elizabeth II library and by utilizing the freely accessible Statistics Canada website[104], the relevant socio-economic data points from the publicly available 2016 Census Database were extracted into an SPSS file; it was possible to manually extract data (re: variables like Median Household Income, Unemployment Percentage, etc.) that pertained to each Dissemination Area (DA) within

the St. John's Census Metropolitan Area (SJCMA), and then link those variables to each patient according to the patient's DA of residence. [Note: Since the data from the MCP Beneficiary Registration Files Database – as provided by NLCHI - included each patient's DA of residence, linking the census-based DA-level data to each patient was possible].

5) Previously collected data – available at the Primary Healthcare Research Unit (PHRU) of Memorial University - provided the approximate distance from the centroid of each DA (within the SJMA) to the nearest ED, as per 2011 calculations; these data were also utilized for this study. [Note: The distances had been calculated using ArcMap Geographic Information System software (available from the Environmental Systems Research Institute in Redlands, California) during a prior unrelated research study that was carried out at the PHRU; distances had been calculated from the centroid of each Postal Code in the SJMA to the nearest ED before then being converted into DA-level data points].

IV.3 PRIMARY OBJECTIVE

Creating A Final Dataset For Analysis – Part 1

The following steps pertain to the first approach towards the primary objective - the relationship between the different levels of after-hours care provided by regularly practicing FPs in the SJMA (as indicated by a derived "After Hours Intensity" score for each FP) and non-urgent visits to EDs made by adult (18+) patients residing in the SJMA who were usual patients of said FPs, within the study timeframe.

The data for each of the four fiscal years - from the four respective MCP Beneficiary Registration Files Databases - were merged into a single dataset while ensuring that (a) every patient in the merged dataset had been registered as an MCP beneficiary during each of the four fiscal years, (b)

every patient in the merged dataset had a DA within the SJMA listed as their DA of residence for each of the four fiscal years, and (c) every patient in the merged dataset was allotted the age in years that they had attained on their 2011 birthday. In the merged dataset - any patient who had not been resident throughout the four fiscal years in one particular DA was allotted to the DA in which they had resided during a majority of the study timeframe (and, in case a patient's DA of residence during a majority portion of the study timeframe could not be clearly ascertained, they were allotted to the DA in which they had resided during the first fiscal year of the study, which was 2011); this was a necessary limitation that applied to 10.1% of the study sample.

The data for each of the four fiscal years - from the four respective Provincial Discharge Abstract Databases (re: hospitalizations) - were merged into a single dataset.

The data for each of the four fiscal years – from the four respective MCP Fee-For-Service Physician Claims Databases – were merged into a single dataset while ensuring that no billing claims submitted for specialist medical care and/or hospital-based care were included. And, only billing submissions by FPs for the following were included - (a) patient visits to FP clinics, (b) FP visits to patient homes, and (c) after-hours care by FPs at FP clinics or patient homes. As per the MCP Payment Schedule[108], FPs in this particular dataset were designated by the numeric code "001", while billing codes submitted by these FPs that began with "1" and "2" designated patient visits to FP clinics and FP visits to patient homes, respectively. In addition, submitted billing codes that began with "139" designated billing claims for after-hours work by these (i.e., fee-for-service) FPs. By way of concatenation (re: codes "1", "2", and "139"), it was possible to extract only the information pertaining to those three relevant codes. Henceforth, "FP consultations" will refer to (and comprise) both patient visits to FP clinics and FP visits to patient homes.

The data for each of the four fiscal years - from the four respective Emergency Department Visits/Triage Databases (which included visits to all EDs across this province, as long as the visits were made by residents of the SJMA) - were merged into a single dataset. In the merged dataset, only ED visits that were categorized as Canadian Triage and Acuity Scale (CTAS) levels 4 and 5 - as defined in Chapter 1 - were retained and a total count of those CTAS level 4-5 visits was computed for each patient.

With regards to defining the primary outcome variable(s), the following points may be kept in mind –

(i) The "Count of Non-Urgent ED Visits" variable was created for each patient, in addition to the "The Count of Non-Urgent ED Visits made outside of usual FP work hours" variable.

(ii) It was possible to create the "The Count of Non-Urgent ED Visits made outside of usual FP work hours" variable because the date and time of each ED visit were available in the relevant database (re: ED visits/triage); this variable comprised non-urgent ED visits on Saturdays, Sundays, and calendar-indicated statutory holidays, plus non-urgent ED visits outside of 9 AM to 6 PM on non-holiday weekdays.

(iii) Non-urgent ED visits that had been made to any ED in Newfoundland & Labrador were of interest, as long as they had been made by residents of the SJMA during the study timeframe. Including visits to any ED in the province was done because the Academic FPs could have provided telephonic after-hours care for their patients when necessary, even if those patients were away from the SJMA. However, such non-urgent ED visits in other parts of the province made up only 0.03% of those non-urgent ED visits by SJMA residents.

The data from the Academic Family Physicians' Records Database was received as a single dataset, which covered the period from January 1, 2011 to December 31, 2015; however, since the

respective patient visits to the Academic FPs were recorded with the dates of each visit, it was possible to eliminate those visits that were made outside the study timeframe while only retaining visits that were made between April 1, 2011 and March 31, 2015.

The data from the Academic Family Physicians' Records Database was then merged with the MCP Fee-For-Service Physician Claims dataset (which covered the whole of the study timeframe); this newly merged dataset will henceforth be known as the Family Physician Visits dataset.

After ensuring that the disease condition codes in both the Family Physician Visits dataset and the merged PDAD dataset were compatible (i.e., in terms of following the coding format of the International Classification of Diseases (ICD)[109] - 10), the Charlson Comorbidity Index[110] (CCI) score was calculated for each patient in those two datasets; this calculation was necessary, in order to control for patient comorbidities. Subsequently, the respective calculated CCI scores were linked to the respective unique patient identifier numbers (which had been designated as "SIDs" by NLCHI) in the merged MCP Beneficiary Registration Files dataset. The original databases that contributed towards the calculation of CCI scores were – the Academic Family Physicians' Records database, the MCP Fee-For-Service Physician Claims database, and the PDAD database. With some exceptions, a patient in the final dataset used for analyses would be unlikely to be in all three of those source databases since a patient with a fee-for-service FP as a usual provider of care would be unlikely to have visited an Academic FP, and vice versa. Ultimately, the fact that the CCI score for every patient in the final dataset could not be calculated via the exact same source database(s) could be a cause of bias and was a limitation. (*See Appendix III for the CCI calculation method*).

Using the Family Physician Visits dataset and examining the billing claims submitted by the respective FPs, it was possible to determine the number of consultations that each patient had had

with each FP. Billing claims submitted by each FP per date were examined. While understanding that the billing claim(s) submitted by a respective FP for a respective patient on any given date constituted one patient consultation, a count of total unique FP consultations per patient was derived. More than one billing code could be rightfully submitted by an FP during one patient consultation since more than one service can be provided at a time; however, the exact same billing code cannot be submitted more than once per consultation. Therefore, a manual check was subsequently performed to ensure that if the exact same billing code (such as that for an FP clinic consultation) was submitted more than once for the same patient on a certain date, multiple FP consultations for the particular patient on that date would be inferred and would be counted as such.

Using the Family Physician Visits dataset, the Usual Provider Continuity Index (UPCI) score was calculated for each patient in that dataset (i.e., as a patient-level variable); the denominator was the total number of FP consultations during the study timeframe, and the numerator was the total number of consultations during the study timeframe with only the patient's most-frequently seen FP. It may be noted that UPCI measures the concentration of FP-related visits for a patient with regards to the patient's usual provider of care. (*See Appendix IV for a UPCI calculation example*).

Using the Family Physician Visits dataset and considering the earlier transformation of billing submissions by FPs into patient consultations with FPs, the Bice-Boxerman Continuity of Care Index (COCI)[111] score was calculated for each patient in that dataset (i.e., as a patient-level variable); this score was calculated via this formula –

$$COC=((SUM(n_j^2))-n)/(n(n-1))) \text{ from } j = 1 \text{ to } j = s)$$

where n was the total number of FP-related visits, n_j was the number of visits to the FP j, and s was the total number of FPs seen. (*See Appendix V for a COCI calculation example*).

[Note: COCI measures the dispersion of FP visits/consultations for a patient among all FPs, and it is therefore more informative than the UPCI while also being relevant to the available data; however, the COCI score can only be calculated for patients with 2 or more physician visits/consultations in a given time period and it is an unstable measure for patients with only 2-3 such visits/consultations[111], which meant that COCI scores were missing for 1.81% of the study sample and unstable for another 8.72% of the study sample].

Using the Family Physician Visits dataset, an After-Hours Intensity (AHI) score was calculated for each FP in that dataset; this was done by dividing the total number of billing claims for after-hours care that the FP had submitted during the study timeframe (numerator) by the total number of patient consultations – regarding that same FP - during the study timeframe (denominator). It may be noted that the billing code for after-hours care – beginning with "139" – could only be submitted once per each patient consultation; that code could also only be submitted in tandem with one of the other codes that indicated clinic or home patient consultation, as per the MCP Payment Schedule[54] rules. (*See Appendix VI for the AHI score calculation method*).

The AHI score variable was converted into a categorical variable. Therefore, (a) patients of the fee-for-service FPs were categorized according to the proportion of after-hours billing claims submitted by their respective FPs (i.e., usual providers of care) during the study timeframe and (b) patients of the university-affiliated Academic FPs were in a distinct separate category because these FPs provide care under a different model, compared to the other FPs within the study. Regarding patients of the fee-for-service FPs - the categorization was done, such that patients were (a) patients of FPs who submitted minimal or zero after-hours billing claims (i.e., <5% of total billing claims were for after-hours care), or (b) patients of FPs who submitted few but regular after-hours billing claims (i.e., 5-14.9% of total billing claims were for after-hours care), or (c)

patients of FPs who submitted a moderate number of after-hours billing claims (i.e., 15-24.9% of total billing claims were for after-hours care), or (d) patients of FPs who submitted a high number of after-hours billing claims (i.e., >25% of total billing claims were for after-hours care). This categorization was performed after consultation with members of the research team who were/are primary care providers in the SJMA and who therefore have general information about primary care practices in the SJMA.

A new dataset was created, which included (a) the SID (i.e., the unique identifier number for each patient), (b) the Provider Number (i.e., the unique identifier number for each FP), (c) the CCI score for each patient, (d) the UPCI score for each patient, (e) the COCI score for each patient, (f) the most frequently seen FP for each patient (i.e., Provider Number of each patient's usual provider of care), and (g) the AHI score for every usual provider of care, with this AHI score variable also being categorized. This dataset will henceforth be known as the Derived Variables dataset.

In order to attempt to exclude patients whose usual providers of care appeared to have been working in a transient manner (e.g., locums, residents, etc.) during the study timeframe while also attempting to not exclude any patient whose usual provider of care was one of the Academic FPs (who see fewer patients in general), a limiting criterion had to be applied. Therefore, only FPs who had had a minimum of 500 patient consultations during the study timeframe (with, at least, one patient consultation in three out of the four fiscal years) were retained in the Derived Variables dataset; patients whose usual providers of care did not meet this criterion were permanently removed from said dataset. The numbers of FPs and patients who were impacted by this limiting criterion will be detailed in the following chapter.

The Derived Variables dataset was then linked back to the previously merged MCP Beneficiary Registration Files dataset, in order for each patient in the Derived Variables dataset to have their

respective age, sex, and DA of residence to be entered. Subsequent to that, the DA-level socio-economic variables from the 2016 Census and the "distance" variable (which described the distance from the centroid of a patient's DA of residence to the nearest ED in 2011) were added to the Derived Variables dataset. It may be noted that each patient was assigned the values (re: median household income, education level, unemployment level, and distance to ED) that applied to their DA of residence during the study timeframe. And, in case a patient had resided in more than one DA during the study timeframe, they were allotted to the DA in which they had resided during a majority of the four fiscal years (however, in case residence had been equally split among either four distinct DAs or two distinct DAs, they were allotted to their DA of residence during the first fiscal year of the study timeframe).

The merged data from the Emergency Department Visits/Triage Databases were then linked to the Derived Variables dataset to create the final dataset (re: the first approach towards the primary objective).

Variables In The Final Dataset – Part 1

The following patient-level variables were included in the final dataset used for analyses (re: first approach towards the primary objective, as well as the secondary objective) -

- SID (string variable) = Unique identifier number for the patient.
- AGE (continuous variable) = Age in years, as per birthday in 2011 (i.e., the first year within the study timeframe).
- SEX (binary variable) = Male (coded as "0"); Female (coded as "1").
- DA (string variable) = Dissemination Area of residence for the patient throughout (or during most of) the study timeframe.

- DA_MEDIAN_INCOME_2016 (continuous variable) = Median Household Income (C$) in the patient's DA of residence (as per 2016 Census data), with each value divided by 1000 and then rounded to three decimal places.
- DA_HIGH_SCHOOL_COMP_2016 (continuous variable) = Percentage of population in patient's DA of residence that had completed High School (as per 2016 Census data).
- DA_POST_SECONDARY_COMP_2016 (continuous variable) = Percentage of population in patient's DA of residence that had completed a post-secondary program (as per 2016 Census data).
- DA_UNEMPLOYED_PERCENTAGE_2016 (continuous variable) = Percentage of population in patient's DA of residence that were unemployed (as per 2016 Census data).
- DISTANCE_TO_ER_2011 (continuous variable) = Distance from centroid of patient's DA of residence to nearest Emergency Department, in kilometres (as per 2011 calculations), with each value corrected to two decimal places.
- CCI (continuous variable) = Charlson Comorbidity Index.
- MOST_SEEN_FP (string variable) = Provider Number of the patient's most frequently seen Family Physician.
- UPCI (continuous variable) = Usual Provider Continuity Index (with all values being between 0 and 1, and with each value corrected to two decimal places).
- COCI (continuous variable) = Bice-Boxerman Continuity Of Care Index (with all values being between 0 and 1, and with each value corrected to two decimal places).
- ACAD_PHY_MOST_SEEN (binary variable) = If an Academic Family Physician was the most frequently seen Family Physician: No (coded as "0"); Yes (coded as "1").

- AHI_SCORE (continuous variable) = Number of Total After-Hours Patient Consultations divided by Number of Total Patient Consultations (re: the patient's usual provider of primary care).
- AHI_CATEGORY (categorial variable) = Categories for the After-Hours Intensity Scores, as per the following categorization –
    - "0" (Reference category) = 0 to 4.9% of billing claims (re: unique patient consultations) from patient's usual Family Physician were billing claims for after-hours care;
    - "1" = Patient's usual Family Physician was an Academic Family Physician (note - this is a unique category);
    - "2" = 5 to 14.9% of billing claims (re: unique patient consultations) from patient's usual Family Physician were billing claims for after-hours care;
    - "3" = 15 to 24.9% of billing claims (re: unique patient consultations) from patient's usual Family Physician were billing claims for after-hours care;
    - "4" = 25% or more of billing claims (re: unique patient consultations) from patient's usual Family Physician were billing claims for after-hours care.

    This categorization was performed while attempting to have (a) the reference category only include patients of FPs who had provided no or incidental after-hours care during the study timeframe, (b) patients of the Academic FPs in one separate category due to the different model of care involving these FPs, and (c) one category (i.e., category "4") that could capture patients of FPs who had been practicing in walk-in clinics during the study timeframe.

- NON_URGENT_TRIAGE_LEVEL_COUNT (count variable) = Count of Emergency Department visits by the patient that were classified as CTAS level 4 or CTAS level 5.
- NON_WORKING_HOURS_ED_VISIT_COUNT (count variable) = Count of Emergency Department visits by the patient that were (a) classified as CTAS level 4 or CTAS level 5 and (b) made outside of usual Family Physician work hours (i.e., outside of 9 AM to 6 PM on non-holiday weekdays), as per the recorded time of registration at the ED.

Statistical Analyses – Part 1

Descriptive Statistics (overall numbers, means, medians, standard deviations, variances, as well as informative bar charts and histograms) were obtained for the predictor variable, the possible outcome variables, and the respective control variables.

AHI_CATEGORY was the predictor variable, while two respective outcome variables (i.e., main outcome variable and supplementary outcome variable) were –

- NON_URGENT_TRIAGE_LEVEL_COUNT
- NON_WORKING_HOURS_ED_VISIT_COUNT

Control variables were –

- AGE
- SEX
- DA_MEDIAN_INCOME_2016
- DA_HIGH_SCHOOL_COMP_2016
- DA_POST_SECONDARY_COMP_2016
- DA_UNEMPLOYED_PERCENTAGE_2016
- DISTANCE_TO_ER_2011
- CCI

- UPCI
- COCI

It may be noted that the respective variables that pertained to age, income, education, and unemployment could have been used in the subsequent regression analyses after being transformed into categorical variables. However, model fits were superior when the relevant variables (re: age, income, education, and unemployment) were used as continuous variables, rather than categorical variables - thus indicating respective linear relationships.

To ensure that no variables that were strongly correlated with each other were ever included together in the same regression model, correlation coefficients[112] were obtained to prevent collinearity in a model; of particular interest were these respective sets of similar variables –

- DA_HIGH_SCHOOL_COMP_2016 and DA_POST_SECONDARY_COMP_2016.
- UPCI and COCI.

The correlation tests that were performed were – Pearson Correlation Coefficient (parametric) and Spearman's Rho (non-parametric). The parametric test measures the strength of the linear relationship between two variables, while the non-parametric test explores the monotonic relationship between two variables. Explanations pertaining to the results of these two correlation tests are included in the following chapter. It may be mentioned that following the stated correlation tests (re: the two sets of variables noted above), correlations between each of the remaining socio-economic variables in the model were also tested for. And, following that, the Variance Inflation Factor (VIF)[112] was ascertained, in order to assess the multicollinearity among all independent (i.e., predictor and control) variables in the key regression models.

Following the correlation tests, the distributions of the respective outcome variables were ascertained, in order to determine which regression analyses would be the most appropriate. With

regards to the main outcome variable (i.e., NON_URGENT_TRIAGE_LEVEL_COUNT) and the supplementary outcome variable (i.e., NON_WORKING_HOURS_ED_VISIT_COUNT) – (a) the One-sample Kolmogorov-Smirnov Test was performed, (b) the means and variances of the counts were checked, and (c) the ratio of the Deviance statistic to the Degrees of Freedom was checked; these respective tests/checks were performed to look for Poisson distributions.

Using the "Generalized Linear Mixed Models" option in SPSS, Random Effects Poisson Regression and Random Effects Negative Binomial Regression models were respectively built while adjusting standard errors for clustering by respective physician (i.e., MOST_SEEN_FP was the Random Effects variable in each model).

The following points are noteworthy –

(i) The previously calculated correlation coefficients dictated that DA_POST_SECONDARY_COMP_2016 was to be used as one of the control variables, while DA_HIGH_SCHOOL_COMP_2016 was not to be used as such; the respective correlation tests indicated a strong negative linear relationship between these two variables, as will be explained further in the following chapter.

(ii) The previously calculated correlation coefficients dictated that UPCI and COCI were never to be used as control variables, together in the same model; the respective correlation tests indicated a strong positive linear relationship between these two variables, which will be explained further in the following chapter.

(iii) The main outcome variable - the "Non-urgent ED Visit Count" (NON_URGENT_TRIAGE_LEVEL_COUNT) - and the supplementary outcome variable for a sensitivity analysis - the "Non-urgent ED Visit Count outside of usual FP work hours" (NON_WORKING_HOURS_ED_VISIT_COUNT) - were each used in

separate models; this was done to ascertain if after-hours care provisions by FPs had a different relationship with non-urgent ED visits at times when most FP clinics were closed, as compared to non-urgent ED visits across the whole 24-hour period.

(iv) Since the respective outcome variables were represented by discrete counts, both Poisson and Negative Binomial models were constructed for each respective set of variables (predictor, control, and outcome) and Information Criteria – Akaike and Bayesian – were used to determine the superior model in each case (note – lower scores for each of those criteria indicate better fit of model[55]); in addition, after the Kolmogorov-Smirnov Test[113] indicated that the respective outcome variables followed either Poisson or Negative Binomial distributions, the mean and variance of each of those variables (as well as the ratio of the Deviance statistic to the Degrees of Freedom) indicated that Negative Binomial models were more appropriate. (*See Appendix VII for the Means, Variances, and Deviance/Degrees of Freedom values*).

(v) Adjusting standard errors for clustering by respective physician was mandatory because the observations in each regression model were not necessarily independent of each other (due to the fact that all patients of one particular FP may have exhibited similar behaviors, regarding non-urgent ED visits).

(vi) As required in the relevant regression models, intercepts were used with both the random effects variable that was included to help adjust standard errors for clustering (i.e., MOST_SEEN_FP) and the fixed effects variables (i.e., the respective predictor and control variables).

(vii) The Residual Method – rather than the Satterthwaite Approximation - was used with regards to the Degrees of Freedom (due to the relatively large sample size)[114].

(viii) Results of the tests of Model Effects were examined to ascertain if the predictor variable and each of the control variables had significant effects on the outcome variable (in each model).

(ix) Statistical significance was assumed if the p value was <0.05.

Creating A Final Dataset For Analysis – Part 2

The following steps (re: the second approach towards the primary objective) pertain to – exploring the relationship between billing claims for after-hours care (in total) submitted by all fee-for-service FPs in the SJMA and non-urgent visits to EDs made by adult (18+) patients residing in the SJMA, within the study timeframe and with the calendar date being the unit of analysis.

Going back to the MCP Fee-For-Service Physician Claims dataset (re: Fiscal Year 2011 – Fiscal Year 2014), the counts per each calendar date of total billing claims for after-hours care (submitted by all fee-for-service FPs) were extracted by way of the "Aggregate" function in SPSS. Since only one after-hours care billing claim by an FP for any one patient was/is permitted per day, there was no requirement to eliminate possible duplicate billing claims for after-hours care. However, such duplicate after-hours care billing claims were still manually checked for (re: the "139" fee code), in case there might have been any data-entry errors.

The variable pertaining to these date-based after-hours billing claims was subsequently categorized (into 5 categories), as is described under the following sub-heading in this chapter.

Similar to the above step, the merged Emergency Department Visits/Triage dataset was used to determine the total number of non-urgent ED visits (made by all patients) for each calendar date during the study timeframe; this was also done by using the "Aggregate" function in SPSS. It was also possible to determine two other similar variables, immediately following this step – (a) the total number of non-urgent ED visits during FP non-working hours by date, and (b) the total

number of non-urgent ED visits during FP non-working hours by date, and with public holidays considered like Saturdays/Sundays. The latter of these two variables was more relevant to the analysis since it accounted for public holidays.

For each calendar date within the study timeframe, the following were determined and appropriately coded – (a) the fiscal year, (b) the month of year, and (c) the day of week.

The final dataset for this supplementary analysis was then created with "calendar date" being the unit of analysis (i.e., *n=1,461* due to there having been 1,461 calendar days within the study timeframe). This particular analysis would help indicate whether there was a significant inverse relationship between the number of after-hours FP billing claims and the number of non-urgent ED visits (per date), as might be expected, or whether there was no such relationship. This analysis would therefore also help indicate whether the after-hours billing code was serving one of its main intended purposes. Unfortunately, it was not possible to determine the time of each after-hours FP visit or the duration of wait in an FP clinic – due to no relevant timestamps in the obtained data.

Variables In The Final Dataset – Part 2

The following variables were included in the final dataset used for the supplementary analysis –

- VISIT_DATE (date variable) = Respective calendar date, regarding the non-urgent ED visits and the after-hours FP visits.
- FISCAL_YEAR (nominal variable) = Fiscal year encompassing the respective calendar date.
- MONTH_OF_YEAR (categorical variable) = Respective calendar month (12 categories; January coded as "1" and December coded as "12" with January as the reference category).
- DAY_OF_WEEK (categorical variable) = Respective day of each week (7 categories; Sunday coded as "1" and Saturday coded as "7" with Sunday as the reference category).

- NUMBER_AFTER_HOURS_FP_VISITS (continuous variable) = Number of after-hours patient visits to FPs and/or after-hours home visits to patients by FPs (per date).
- NUMBER_AFTER_HOURS_FP_VISITS_CAT (categorical variable) = Categories for the number (per date) of after-hours patient visits to FPs and/or after-hours home visits to patients by FPs; the categorization was as follows –
    - "0" (Reference category) = 0 to 50 after-hours billing claims;
    - "1" = 51-100 after-hours billing claims;
    - "2" = 101 to 150 after-hours billing claims;
    - "3" = 151 to 200 after-hours billing claims;
    - "4" = 201 and more after-hours billing claims.

    (Goodness Of Fit parameters were examined to determine whether the model fit was improved by this variable being a categorical variable, rather than a continuous one, and that was shown to be true; this categorization was performed while (a) attempting to have a roughly equal distribution of after-hours billing claims across the respective categories, and (b) attempting to have dates when there were relatively few after-hours billing claims be part of the reference category).
- NUMBER_NON_URGENT_ED_VISITS (continuous variable) = Number of non-urgent ED patient visits, by date.
- NUMBER_NON_URGENT_ED_VISITS_AT_NON_FP_WORKING_HOURS (continuous variable) = Number of non-urgent ED patient visits during usual FP non-working hours (i.e., visits made outside of 9 AM to 6 PM on non-holiday weekdays), by date.

Statistical Analyses – Part 2

Descriptive Statistics (overall numbers, means, medians, standard deviations, variances, as well as informative bar charts and histograms) were obtained for the predictor variable, the possible outcome variables, and the respective control variables. It was also important to note any obvious variations in after-hours billing counts and non-urgent ED visit counts, based on the month of year and the day of week.

NUMBER_AFTER_HOURS_FP_VISITS and NUMBER_AFTER_HOURS_FP_VISITS_CAT were both possible predictor variables; Goodness Of Fit parameters (e.g., the Akaike Information Criterion) were used to determine which of these two variables would lead to a better fit, regarding the regression model.

Two respective outcome variables were –

- NUMBER_NON_URGENT_ED_VISITS
- NUMBER_NON_URGENT_ED_VISITS_AT_NON_FP_WORKING_HOURS

Control variables were –

- MONTH_OF_YEAR
- DAY_OF_WEEK

Using the "Generalized Linear Models" function in SPSS, Poisson Regression models were constructed with the control variables remaining the same in each model, but with the outcome variable being one of the two (as listed above) in respective models and the predictor variable being one of the two (as listed above) in respective models. Subsequently, corresponding Negative Binomial Regression models were also created with the same variables as in each of the afore-mentioned Poisson models. Using both Poisson Regression and Negative Binomial Regression

models and using two predictor variables in turn helped determine the model of best fit. And, using two outcome variables in turn provided more comprehensive results for discussion.

The following points are noteworthy –

(i) Since overdispersion (i.e., variance being much higher than the mean) was a recurring problem in the initial Poisson models and since Negative Binomial models were consistently inferior to their Poisson model counterparts (per the Akaike Information Criterion, for example), Pearson Scale Poisson models were constructed (with Pearson Chi-Square being the Scale Parameter method) to perform "overdispersed" Poisson Regression analyses[115].

(ii) Pearson Scale Poisson modeling enabled the model fit to be satisfactory while addressing the overdispersion problem; Payne et al. (when comparing various approaches to deal with overdispersion in count data) suggested that Pearson Scale-adjusted Poisson Regression in a situation like this would be superior to other possible approaches[116], and it was proven in this case – based on the Akaike and Bayesian Information Criteria – that this form of regression was superior to other approaches (i.e., Negative Binomial Regression and Deviance Scale-adjusted Poisson Regression).

(iii) As required, the intercepts were used within each respective regression model.

(iv) Goodness Of Fit parameters were obtained for each respective regression model.

(v) It was shown that using NUMBER_AFTER_HOURS_FP_VISITS_CAT as the predictor variable was superior to using NUMBER_AFTER_HOURS_FP_VISITS as such, based on Goodness Of Fit parameters; therefore, only the former variable was used in the relevant models.

(vi) The Omnibus Test[117] was performed for each model, in order to check if the respective Pearson Scale Poisson model outperformed the Null model (i.e., the null hypothesis that all of the model coefficients are equal to 0); based on the significance values, the Pearson Scale Poisson models did outperform the corresponding Null models.

(vii) Results of the tests of Model Effects were examined to ascertain if the predictor variable and each of the control variables had significant effects on the outcome variable (in each model).

(viii) Statistical significance was assumed if the p value was <0.05.

IV.4 SECONDARY OBJECTIVE

Creating A Final Dataset For Analysis

The final dataset that was created in order to complete the primary objective (part 1) of this study would suffice for this objective, as well. This analysis pertains to - the relationship between Continuity Of Care index scores of adult (18+) patients residing in the SJMA and non-urgent visits to EDs made by those patients, all within the study timeframe.

Variables In The Final Dataset

The same variables that were utilized when the primary objective (part 1) was addressed were also relevant to this secondary objective; UPCI and COCI would become predictor variables in separate models. The outcome variables remained the same, as when the primary objective (part 1) was addressed, and the control variables – with the exceptions of UPCI and COCI - also remained the same, as when the primary objective (part 1) was addressed.

Statistical Analyses

Since the variables that were used while addressing this objective were all used while the primary objective was being addressed, the respective descriptive statistics pertaining to each of those variables did not change.

Using the "Generalized Linear Mixed Models" option in SPSS, Random Effects Poisson Regression and Random Effects Negative Binomial Regression models were built while adjusting standard errors for clustering by physician (i.e., MOST_SEEN_FP was the Random Effects variable in each model). Once again, certain values (e.g., the Deviance statistic) and other criteria (e.g., the Akaike Information Criterion) indicated that Negative Binomial regression models were more appropriate, compared to corresponding Poisson regression models.

The following points are noteworthy –

(i) The previously obtained correlation coefficients dictated that DA_POST_SECONDARY_COMP_2016 was used as one of the control variables (i.e., as a fixed effects predictor), but DA_HIGH_SCHOOL_COMP_2016 was not.

(ii) UPCI and COCI were used as predictor variables in separate models (note – since these two variables were shown to be strongly correlated with each other per the tests for collinearity, they would not be used together in the same model when patient Continuity Of Care was being used to predict non-urgent ED visits by patients); while COCI is a more comprehensive measure of Continuity Of Care, a COCI value – unlike a UPCI value - could not be calculated for any patient who had only a single recorded FP consultation (so, since 2,161 patients in the final dataset each had only a single recorded FP consultation, using UPCI as a predictor remained beneficial).

(iii) The two possible outcome variables, as mentioned above (i.e., the NON_URGENT_TRIAGE_LEVEL_COUNT variable, as well as the NON_WORKING_HOURS_ED_VISIT_COUNT variable) were used in separate models to help ascertain if non-urgent ED visits at times when most FP clinics were closed had a different relationship with Continuity Of Care index scores, compared to non-urgent ED visits across the whole 24-hour period.

(iv) Adjusting standard errors for clustering by respective physician was mandatory because the observations in each regression model were not necessarily independent of each other (as previously explained).

(v) As required in the relevant regression models, intercepts were used with both the random effects variable that was included to help adjust standard errors for clustering (i.e., MOST_SEEN_FP) and the fixed effects variables (i.e., the respective predictor and control variables).

(vi) The Residual Method[114,118] – rather than the Satterthwaite Approximation - was used with regards to the Degrees of Freedom (due to the relatively large sample size).

(vii) Statistical significance was assumed if the p value was <0.05.

IV.5 SUPPLEMENTARY ANALYSES

The pre-specified analyses described above led to unexpected results (as described in the next chapter) that needed to be further clarified and contextualized. Therefore, three further analyses were performed, as follows –

(i) A regression model was used to explore the relationship between total FP consultations and non-urgent ED visits.

(ii) A regression model was used to explore the relationship between after-hours FP consultations and non-urgent ED visits.

(iii) A regression model was used to explore the relationship between total FP consultations and after-hours FP consultations.

These three patient-level analyses pertained to patients from the SJMA during the study timeframe, and non-modifiable patient characteristics were controlled for, as they were in the preceding analyses. These three analyses helped indicate whether (a) usage of primary care in general and usage of EDs for non-urgent reasons were associated, (b) usage of after-hours primary care and usage of EDs for non-urgent reasons were associated, and (c) usage of primary care in general and usage of after-hours primary care were associated. In case such associations were shown to exist, it would suggest that usage of these respective healthcare services is affected more by patient factors (e.g., comorbidity, perceived urgency, etc.), which were either not captured or incompletely captured by the covariates in the models described above. Taken together with the analyses described above, these results would indicate whether patient factors (rather than access to after-hours primary care) are the more important determinants of non-urgent ED use. Therefore, it may potentially be suggested that issues pertaining to after-hours primary care access are less important than the issue of having a relatively large proportion of high users of healthcare in the community. Following the above three supplementary analyses (as will be explained in the next chapter), a subsequent regression model was used to explore the relationship between total billing claims by FPs for patient consultations and after-hours billing claims by FPs for patient consultations. This analysis would help indicate whether FP caseloads were related to after-hours work by FPs.

V. RESULTS

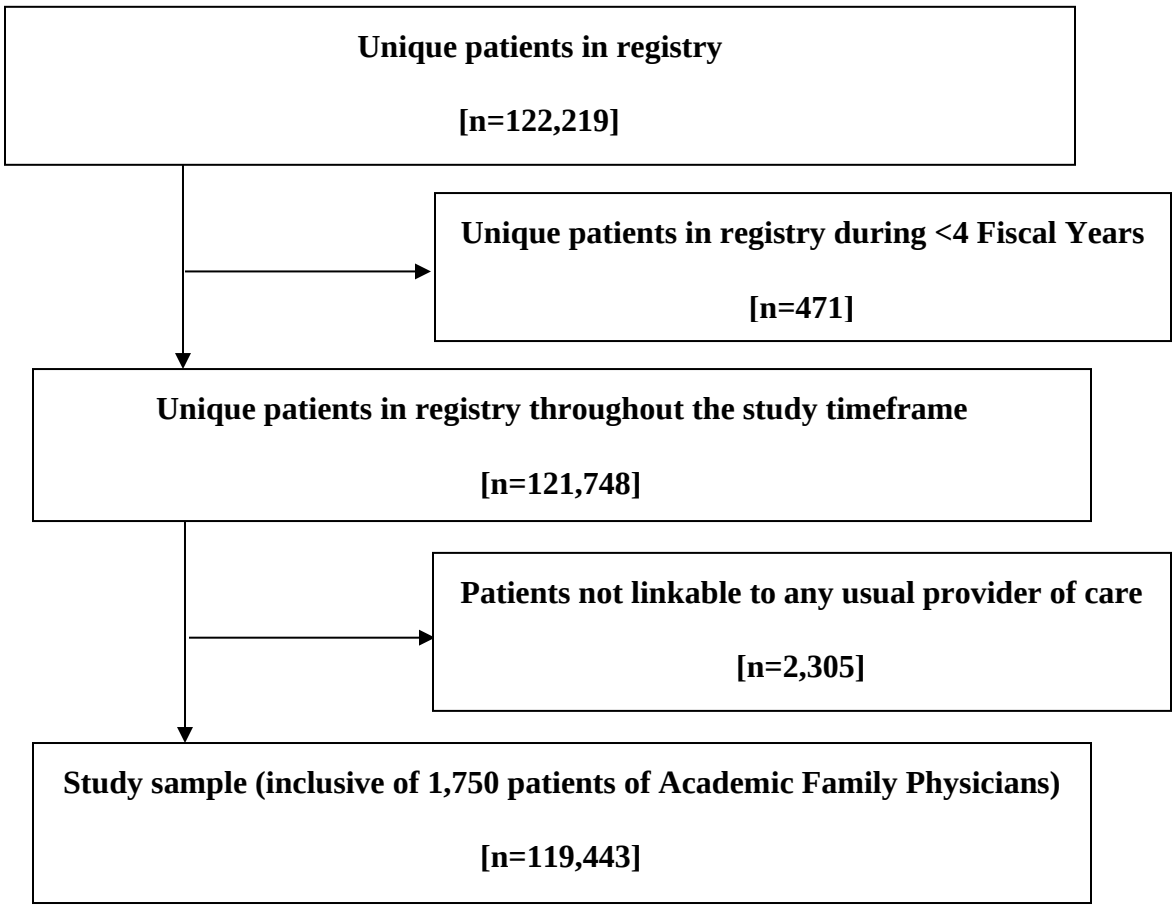
This section will be sub-divided, based on the results of the analyses that pertained to each respective objective.

V.1 PRIMARY OBJECTIVE – PART 1

Prior to the results of the various analyses being displayed, it will be necessary to explain how the study sample was arrived at with regards to the primary objective of ascertaining the relationship between the After-Hours Intensity Score (AHIS) as predictor, and the Non-urgent Emergency Department Visit Count as outcome.

Study sample

FIGURE V.1: Creation of the Study Sample (regarding Part 1 of the primary objective)



The above figure is a summary of how the final dataset for analysis was constructed. This figure can be elaborated upon, as follows –

The number of unique patients in the merged Medical Care Plan (MCP) Beneficiary Registration Files dataset – which included MCP registrations during any of the four fiscal years within the study timeframe - was 122,219.

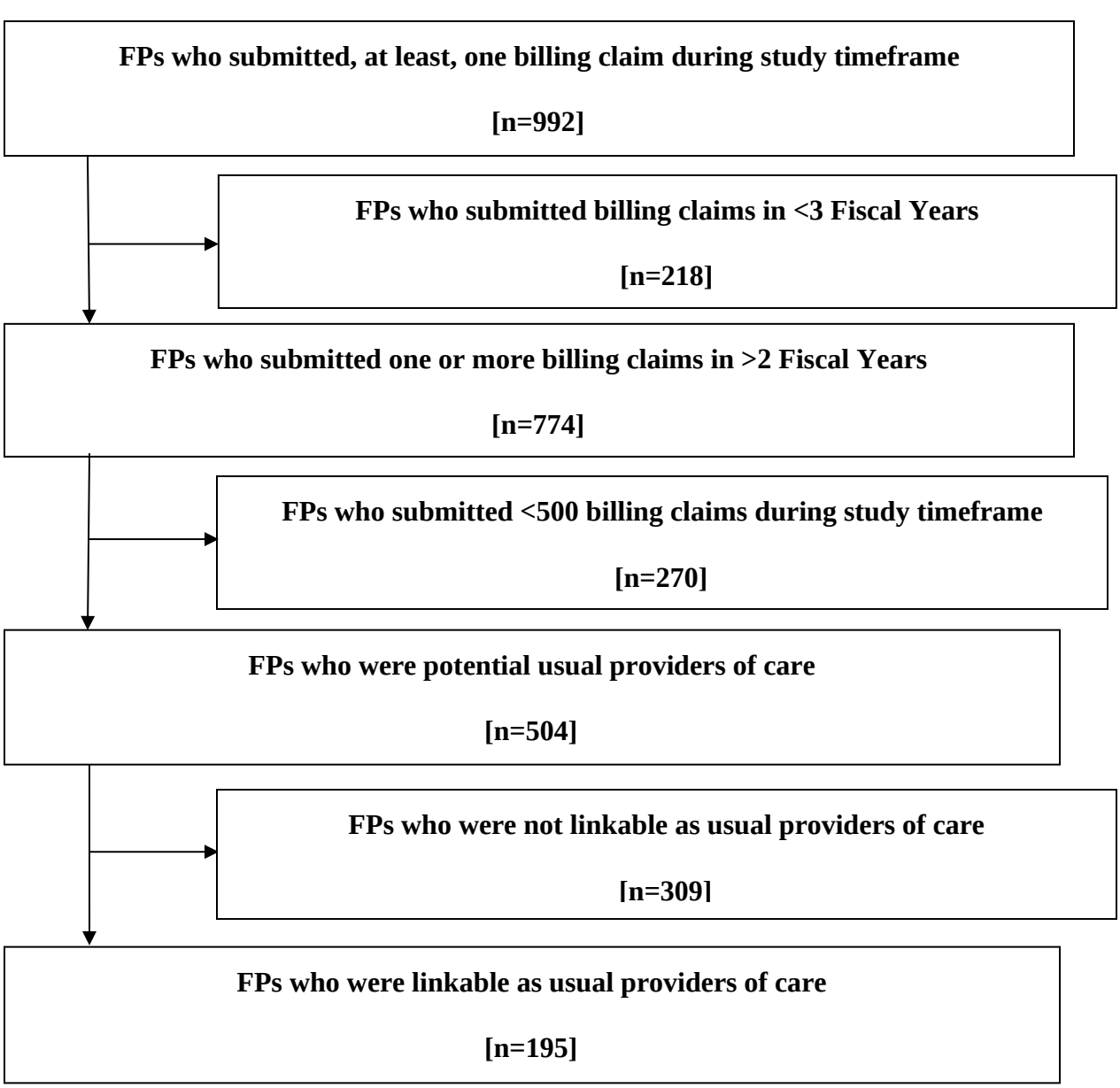
The number of unique patients in the merged MCP Beneficiary Registration Files dataset that were listed in each fiscal year within the study timeframe was 121,748. This was as a result of 471 patients being listed in said dataset during only three or fewer fiscal years.

The number of unique patients in the merged MCP Beneficiary Registration Files dataset that were listed in each fiscal year within the study timeframe and could be linked to a usual provider of primary care was 119,443. This was as a result of 2,305 patients not satisfying this criterion - due to apparently not making any clinic or home consultation with a primary care physician during the study timeframe.

1,750 of the 119,443 patients could be linked to a university-affiliated Academic Family Physician (FP) – as their regular provider of primary care – and this subset of 1,750 patients must be noted specifically, as the subsequent analyses are described.

While the study sample comprised patients exclusively, Family Physicians (FPs) were indirectly part of the relevant analyses, as well. Therefore, it is important to describe how FPs were included or excluded from the final dataset. The number of FPs (i.e., usual providers of care for patients in the final dataset that was used for primary analyses) was arrived at, as follows –

FIGURE V.2: Number of Family Physicians who were usual providers of care



Since all 17 Academic FPs were linkable as usual providers of care, the total number of FPs who were included within the study was, as follows –

195 Fee-For-Service FPs + 17 Academic FPs = 212 FPs.

The above figure is a summary of how FPs were included in the final dataset as usual providers of care for one or more patients. It should be reiterated that the aim was to only include patients of FPs who had been practicing on a full-time basis in the St. John's Metropolitan Area (SJMA) during the majority of the study timeframe. Therefore, FPs who had been practicing in other parts of Newfoundland & Labrador – but not in the SJMA – would need to be excluded. A large number of FPs who had submitted relatively few and/or infrequent and/or periodic billing claims were also excluded as usual providers of care. These FPs with few/infrequent/periodic billing claims would have comprised FPs practicing on a part-time basis, locum physicians, physicians in other parts of the province who had incidentally seen residents of the SJMA, physicians who – during the study timeframe - retired or transferred to other jurisdictions, etc. It may be noted that several of these subsequently excluded FPs had submitted single billing claims during the study timeframe; while the exact reasons for such single claims are unknown, it may be theorized that many of those were submitted by medical residents/trainees. However, it should be emphasized that the large reduction in fee-for-service FPs (i.e., from the initially retrieved 992 to the final 195) did not lead to a reduction in the number of patients who could be in the study sample. The above figure can be elaborated upon, as follows –

The total number of unique FPs in the merged MCP Fee-For-Service Physician Claims dataset was 992. This figure included every FP in Newfoundland & Labrador who had submitted, at least, one unique billing claim during the study timeframe.

The total number of unique FPs who had submitted unique billing claims (re: individual patient consultations) in at least three of the four fiscal years within the study timeframe was 774. This was as a result of 218 FPs submitting such billing claims in only one or two fiscal years within the study timeframe.

Out of the above 774, the total number of unique FPs who had submitted at least 500 unique billing claims (re: individual patient consultations) across the study timeframe was 504. This was as a result of 270 FPs – out of the 774 – not submitting enough unique billing claims across the study timeframe to indicate that they had had 500 or more individual patient consultations.

The total number of unique FPs - out of the above 504 - who could be listed as usual providers of care for one or more patients in the study sample was 195 because 309 FPs were not linkable as usual providers of care for any patient. The exclusion of 309 FPs was likely due to the fact that FPs who had been practicing in other parts of the province would be unlikely to be usual providers of care for residents of the SJMA. It may be noted that 500 unique billing claims over four years is a relatively low number for any FP practicing full-time in the SJMA under the fee-for-service model. This is supported by the fact that each FP who had practiced under the fee-for-service model and could be designated as a usual provider of care for one or more patients had submitted >5,000 billing claims during the study timeframe. However, setting the low threshold (i.e., >500 billing claims) as part of the inclusion criteria was necessary, in order to not exclude regular patients of any Academic FP. Academic FPs typically see fewer patients on a regular basis, compared to FPs practicing under the fee-for-service model; setting a higher threshold would have led to some patients - whose regular FP was an Academic FP – being unnecessarily excluded from the study sample. Ultimately, fee-for-service FPs who had submitted 500-5,000 billing claims during the study timeframe would not have been excluded until the step of linkage as a usual provider of care, further explaining the large reduction from 504 to 195 FPs at that step.

The total number of unique FPs in the Academic Family Physicians' Records dataset was 17. All of these FPs could be listed as usual providers of care for one or more patients in the final dataset. This was because - per the patient visit records - each of these FPs had had >500 patient visits

during the study timeframe, with those patient visits having occurred in, at least, three of the four stated fiscal years.

The total number of unique FPs in the final dataset (i.e., usual providers of care for patients in the final dataset) was 212. This was as a result of adding the 17 Academic FPs with the 195 fee-for-service FPs that had met the inclusion criteria.

It is also important to explain that not all of the patients who had made a non-urgent Emergency Department (ED) visit in Newfoundland & Labrador during the study timeframe could be part of the study sample. As per the merged Emergency Department Visits/Triage dataset - the number of patients who had made non-urgent (CTAS levels 4-5) ED visits within the study timeframe was 53,816. Out of those, 2,999 patients were not in the merged MCP Beneficiary Registration Files dataset and/or not linkable to a usual provider of care. The 2,999 patients would have included patients with no active provincial health cards and/or patients with health cards from other provinces/jurisdictions and/or patients who had not visited an FP during the study timeframe. Therefore, those 2,999 patients could not be included in the final dataset. The final dataset included 50,817 patients (out of the study sample of 119,443 patients) that (a) had made one or more non-urgent ED visits within the province during the study timeframe and (b) were in the merged MCP Beneficiary Registration Files dataset.

Descriptive statistics

The most important figures pertaining to the baseline characteristics of the study sample will now be presented.

TABLE V.1: Variables pertaining to the study sample at baseline (N = 119,443 unless otherwise stated)

	Missing	**Mean**	**Median**	**Range**
Age	0	46.67 years	46 years	18-103 years
Income	0	C$ 84,625.75	C$ 84,608.00	C$ 21,824-225,792
Education	0	59.78%	60.22%	22-81%
Unemployment	0	8.69%	8.10%	0-33%
Distance to ED	0	9.79 km	7.93 km	0.29-39.92 km
CCI	0	0.59	0	0-16
UPCI	0	0.80	0.85	0.13-1
COCI (*N = 117,282*)	2,161	0.67	0.71	0-1
AHIS (*N = 117,693*)	1,750	0.073	0.036	0-0.930
Non-urgent ED visits	0	0.99	0	0-217
Non-urgent ED visits outside of usual FP work hours	0	0.62	0	0-186

Notes pertaining to Table V.1:

(i) Abbreviations: (a) ED = Emergency Department, (b) CCI = Charlson Comorbidity Index, (c) UPCI = Usual Provider Continuity Index, (d) COCI = Bice-Boxerman Continuity Of Care Index, and (e) AHIS = After-Hours Intensity Score.

(ii) "Age" refers to the age in years that the patient had turned in 2011.

(iii) "Income" refers to the median household income (in Canadian Dollars per year) in the patient's Dissemination Area (DA) of residence, as per the 2016 Census.

(iv) "Education" refers to the post-secondary completion percentage in the patient's DA of residence, as per the 2016 Census.

(v) "Unemployment" refers to the unemployment percentage in the patient's DA of residence, as per the 2016 Census.

(vi) "Distance to ED" refers to the distance in kilometers to the nearest Emergency Department from the centroid of the patient's DA of residence.

(vii) The COCI cannot be calculated for any patient for whom there was only one recorded FP consultation during the study period; therefore, for all such patients, the COCI value was deemed to be "missing".

(viii) For patients for whom the usual provider of care was an Academic FP, no AHIS could be assigned because Academic FPs do not submit billing claims; however, the Academic FPs were categorized within a separate group for all of the analyses involving after-hours primary care.

The two main demographic variables (i.e., age and sex) were categorized, in order to provide greater context around the study sample and study results. These categorizations show the distributions (re: age and sex) within the study sample, in terms of both raw numbers and percentages.

TABLE V.2: Study population - sub-classifications of each demographic patient variable at baseline

Age in years during Fiscal Year 2011 – categorized (N = 119,443)	18-29	21,243 (17.8%)
	30-39	21,759 (18.2%)
	40-49	25,353 (21.2%)
	50-59	23,807 (19.9%)
	60-69	16,151 (13.5%)
	70-79	7,638 (6.4%)
	80 and over	3,492 (2.9%)
Sex – categorized (N = 119,443)	Male	54,724 (45.8%)
	Female	64,719 (54.2%)

The AHIS (i.e., predictor) was categorized because it was more appropriate – especially regarding model fit and interpretation of results - to use it as a categorical variable during the main regression analyses. Following on from that, the relationship between AHIS and the outcome variable(s) was expected to be non-linear and proven to be such. This categorization that was applied is described in the following table, which also suggests that (a) the majority of the patients (>50%) in the study sample had little or no access to after-hours care through their FPs and (b) the patients of the Academic FPs constituted a small subset (<2%) within the study sample.

TABLE V.3: Categorization of patients, based on the After-Hours Intensity Score ascertained for the patients' respective usual providers of care

After-Hours Intensity Score of the patient's usual provider of care (N = 119,443)	0-0.049	67,198 (56.3%)
	Academic FP group	1,750 (1.5%)
	0.05-0.149	38,946 (32.6%)
	0.15-0.249	6,810 (5.7%)
	0.25 and above	4,739 (4%)

Note pertaining to Table V.3:

The respective After-Hours Intensity Scores could also be expressed in the form of percentages; therefore, for example - the range of 0-0.049 means that <5% of billing claims (from the respective usual providers of care) were for after-hours care.

It was also informative to note the distribution of the FPs across the same categories that were shown in the preceding table. This categorization helps to describe the levels of after-hours care that were provided by the respective FPs. As the following table shows, the majority of FPs (>50%) who were usual providers of care provided little or no after-hours care. Regarding a majority (i.e., 79.7%) of the FPs - less than 15% of the billing claims from each of them were billing claims for after-hours care.

TABLE V.4: Categorization of Family Physicians in the final dataset, based on their respective After-Hours Intensity Scores

After-Hours Intensity Score **(N = 212)**	0-0.049	119 (56.1%)
	Academic FP group	17 (8%)
	0.05-0.149	50 (23.6%)
	0.15-0.249	14 (6.6%)
	0.25 and above	12 (5.7%)

Note pertaining to Table V.4:

The respective After-Hours Intensity Scores could also be expressed in the form of percentages; therefore, for example - the range of 0-0.049 means that <5% of billing claims (from the respective FPs) were for after-hours care.

It would be useful to know how many patients in the study sample made non-urgent ED visits during the study timeframe; this could help compare the jurisdiction of this study with other jurisdictions, in terms of inappropriate ED use. In addition, among those that did make such visits, it would be useful to know the frequency of such visits. The following table helps to provide that information. As can be seen, the majority of patients in the study sample (57.5%) did not make any non-urgent ED visit, while the majority of those who did make non-urgent ED visits made fewer than 5 such visits. In addition, an even larger proportion of patients (68%) did not make any non-urgent ED visit outside of usual FP work hours; across all other categories, fewer patients made non-urgent ED visits outside of usual FP work hours, as compared to non-urgent ED visits across all hours. This may be explained by the fact that non-urgent ED visits outside of usual FP

work hours pertained to visits during a restricted timeframe, rather than across all 24 hours of every day.

TABLE V.5: Categorization of patients by count of non-urgent Emergency Department visits during the 48-month study period

Non-urgent Emergency Department visit count (N = 119,443)	0	68,630 (57.5%)
	1-4	45,704 (38.3%)
	5-9	3,968 (3.3%)
	10-19	959 (0.8%)
	20 and above	182 (0.2%)
Non-urgent Emergency Department visit count outside of usual FP work hours (N = 119,443)	0	81,206 (68%)
	1-4	35,816 (30%)
	5-9	1,957 (1.6%)
	10-19	392 (0.3)
	20 and above	72 (0.1)

As graphical representations would help to further illustrate the values in the above table, bar charts that are based on the two sections in the above table are also provided. The first chart describes non-urgent ED visits in total, while the second chart describes non-urgent ED visits outside of usual FP work hours.

FIGURE V.3: Categorization of patients by count of non-urgent Emergency Department visits (in total) during the study period

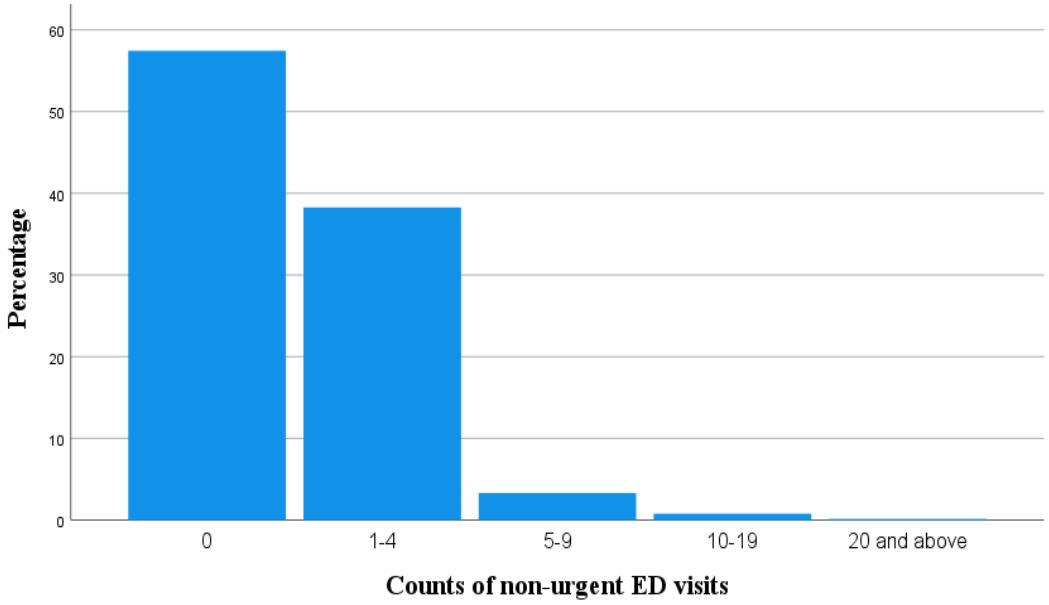
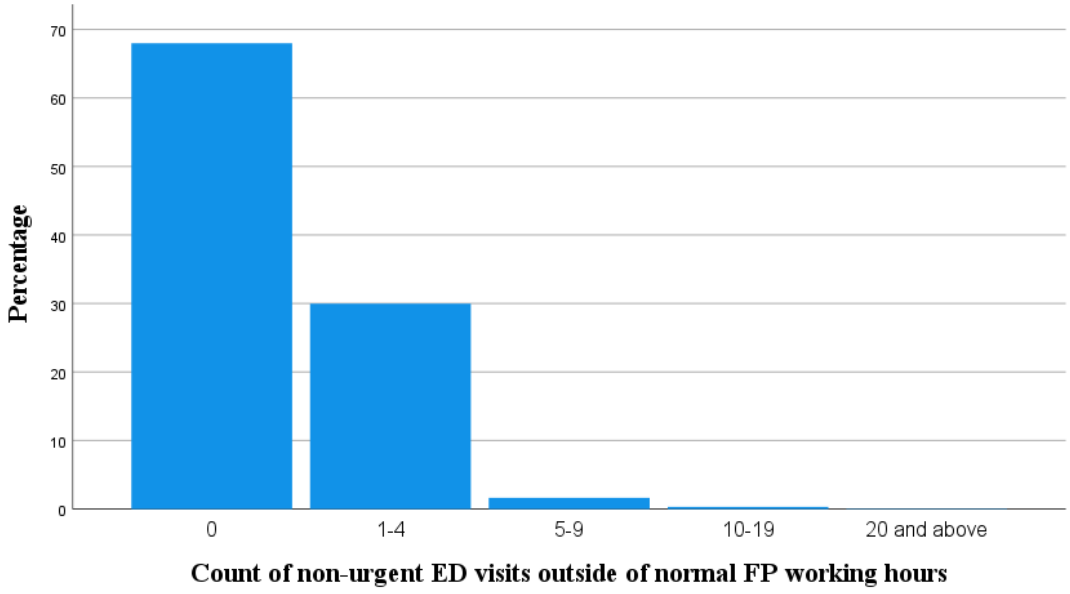


FIGURE V.4: Categorization of patients by count of non-urgent Emergency Department visits (outside of usual FP work hours) during the study period



Characteristics of the study sample are described in the following table, mainly in order to examine the representativeness of the study sample; each available patient-related variable is included.

TABLE V.6: Population (patient) characteristics, based on the categories of the After-Hours Intensity Score (AHIS) of the patients' usual providers of care

**** The data are in the form of – Mean (Range), unless otherwise specified ****

	Percentage of after-hours billing claims from FPs practicing under the Fee-For-Service model (relative to total billing claims)				**Academic FPs**
	0-4.9%	5-14.9%	15-24.9%	>25%	N/A
Age (years)	46.87 (18-103)	46.82 (18-101)	44.11 (18-100)	45.75 (18-95)	47.72 (18-92)
Sex (%)	Male: 44.78 Female: 55.22	Male: 47.75 Female: 52.25	Male: 35.39 Female: 64.61	Male: 62.4 Female: 37.6	Male = 38.4 Female: 61.6
Income (C$/year)*	83,464.98 (21,824-225,792)	86,972.41 (21,824-225,792)	85,372.42 (21,824-225,792)	82,737.01 (21,824-225,792)	79,182.87 (26,048-225,792)
Post-secondary education (%)*	59.85 (22-81)	59.99 (22-81)	58.74 (22-81)	58.34 (22-81)	60.24 (22-81)
Unemployment (%)*	8.62 (0-33)	8.76 (0-33)	8.9 (0-33)	8.62 (0-33)	8.94 (0-27)
Distance to ED (km)*	8.4 (0.29-39.92)	11.51 (0.29-34.95)	12.72 (0.29-34.95)	12.45 (0.29-34.95)	6.36 (0.29-34.95)
CCI	0.57 (0-16)	0.62 (0-11)	0.56 (0-12)	0.7 (0-11)	0.54 (0-9)
UPCI	0.81 (0.13-1)	0.79 (0.12-1)	0.72 (0.14-1)	0.74 (0.14-1)	0.67 (0.18-1)
COCI	0.69 (0-1)	0.66 (0-1)	0.57 (0-1)	0.59 (0-1)	0.47 (0-1)

Notes pertaining to Table V.6:

(i) Abbreviations: As stated after Table V.3.

(ii) For all of the listed variables, except for COCI, *n=119,443*; for COCI, *n=117,282*.

(iii) * indicates a Census-based variable measured at the level of the patient's DA of residence (therefore, the ranges listed for each of these Census-based variables indicates the range at DA level, too).

(iv) Since the Academic FPs do not submit billing claims, displaying a percentage of billing claims with respect to the Academic FPs is not applicable.

(v) The AHIS was derived from the percentage of billing claims submitted by the fee-for-service FPs for after-hours work.

The male-female ratio with regards to patients whose FPs had submitted >25% of total billing claims for after-hours care is markedly different from the male-female ratio with regards to the other patient categories. This patient group also appears to have relatively more comorbidities. These points may suggest a preponderance of male patients and relatively sicker patients making use of the jurisdiction's sole walk-in clinic.

Patients of the Academic FPs appear to (a) live in relatively closer proximity to the main general hospital, (b) have relatively better Continuity Of Care index scores (indicating stronger patient-FP relationships), and (c) have relatively lower incomes (which may be due to the Academic FPs seeing a much larger proportion of certain groups, such as government-assisted refugees).

To better understand the distributions of non-urgent ED visit counts within each of the after-hours care-related categories, the means and ranges pertaining to those respective non-urgent ED visit counts are described in the following table.

TABLE V.7: ED Visit Count by After-Hours Intensity Score of the patients' usual providers of care

**** The data are in the form of – Mean (Range) ****

	Percentage of after-hours billing claims from FPs practicing under the Fee-For-Service model (relative to total billing claims)				**Academic FPs**
	0-4.9%	**5-14.9%**	**15-24.9%**	**>25%**	**N/A**
Non-urgent ED Visit Count	1.01 (0-178)	0.94 (0-193)	1.03 (0-107)	1.12 (0-217)	1.00 (0-55)
Non-urgent ED Visit Count (outside of usual FP work hours)	0.63 (0-159)	0.60 (0-158)	0.65 (0-84)	0.72 (0-186)	0.61 (0-35)

Note pertaining to Table V.7:

Since the Academic FPs do not submit billing claims, displaying a percentage of billing claims with respect to the Academic FPs is not applicable.

The values in the above table are further illustrated by histograms, in order to provide more clarity about the respective frequency distributions before any regression analyses are performed. However, since almost all of the patients who made non-urgent ED visits during the study timeframe made <25 such visits, the histograms below depict non-urgent ED visit counts up to a

maximum of 25. The number of patients is described via the log scale to display the relevant patterns in as pictorially clear a manner as possible. The histograms below pertain to both sections of the above table – the first five histograms pertain to non-urgent ED visits in total, while the next five histograms pertain to non-urgent ED visits outside of usual FP work hours.

FIGURE V.5: Non-urgent ED visits by patients of FPs who submitted 0-4.9% of their total billings for after-hours care

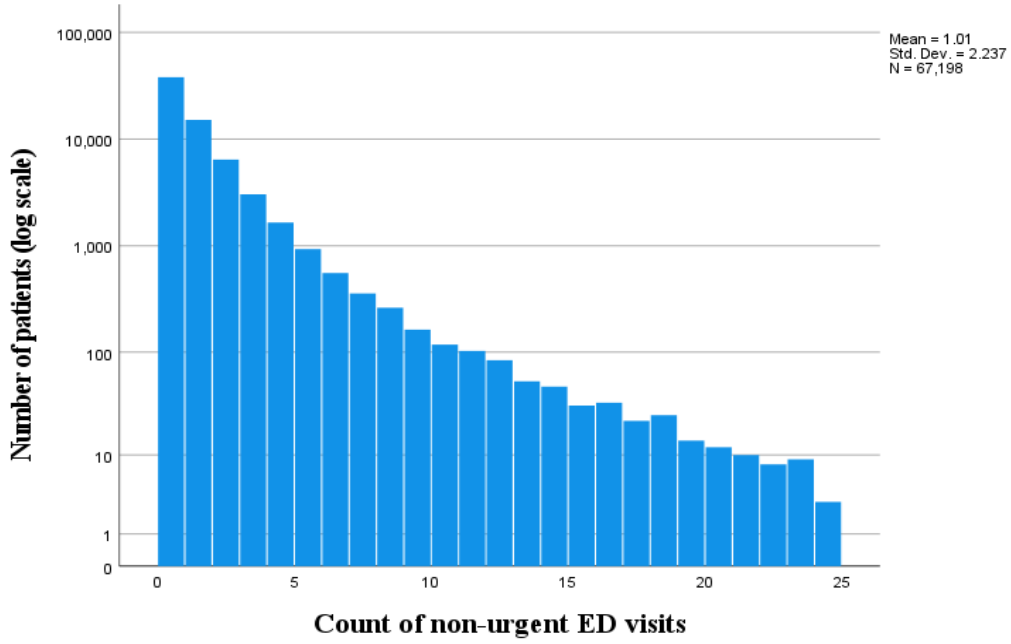


FIGURE V.6: Non-urgent ED visits by patients of FPs who submitted 5-14.9% of their total billings for after-hours care

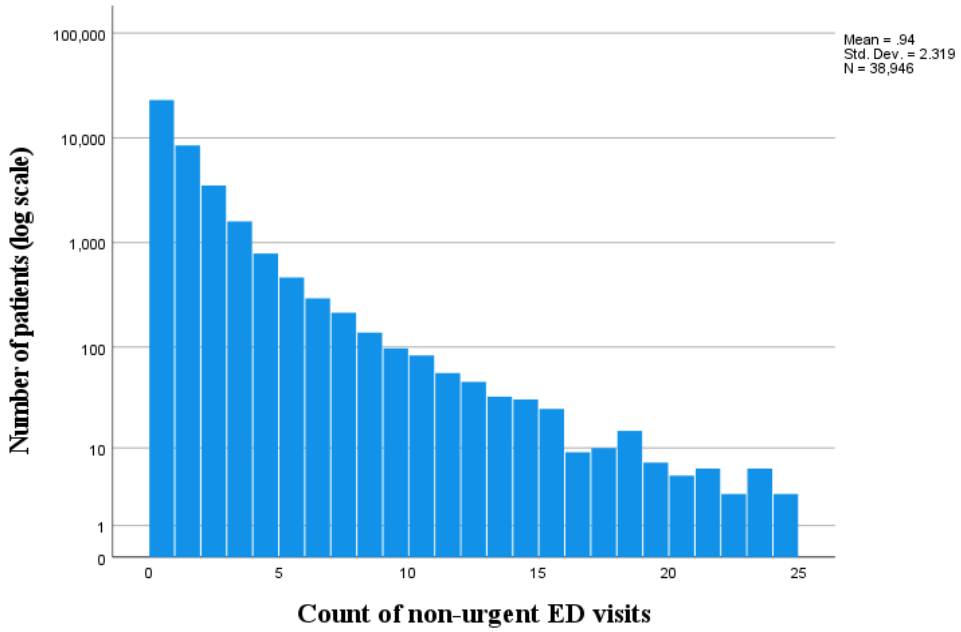


FIGURE V.7: Non-urgent ED visits by patients of FPs who submitted 15-24.9% of their total billings for after-hours care

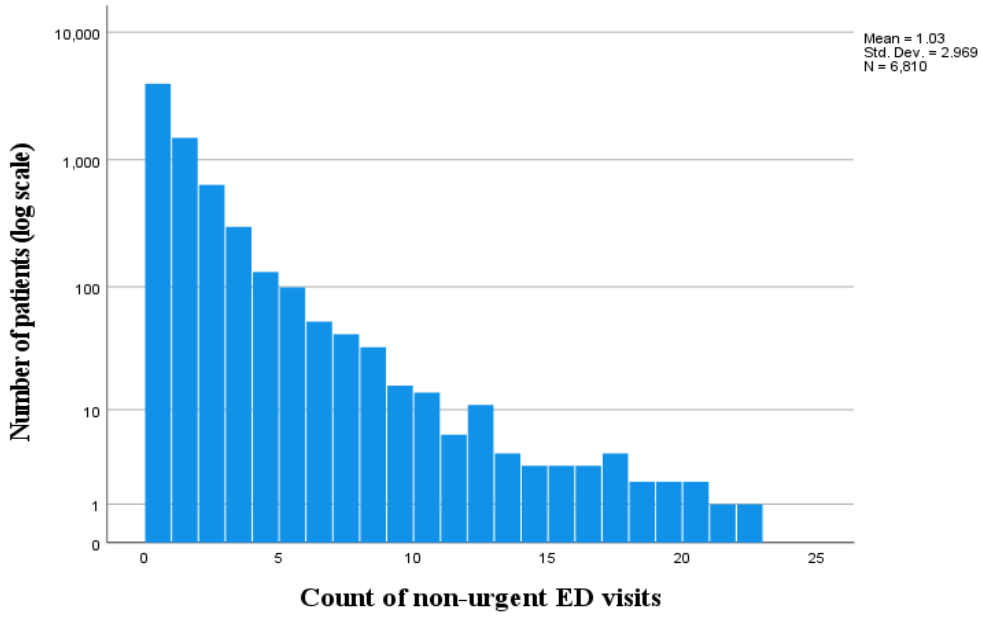


FIGURE V.8: Non-urgent ED visits by patients of FPs who submitted >25% of their total billings for after-hours care

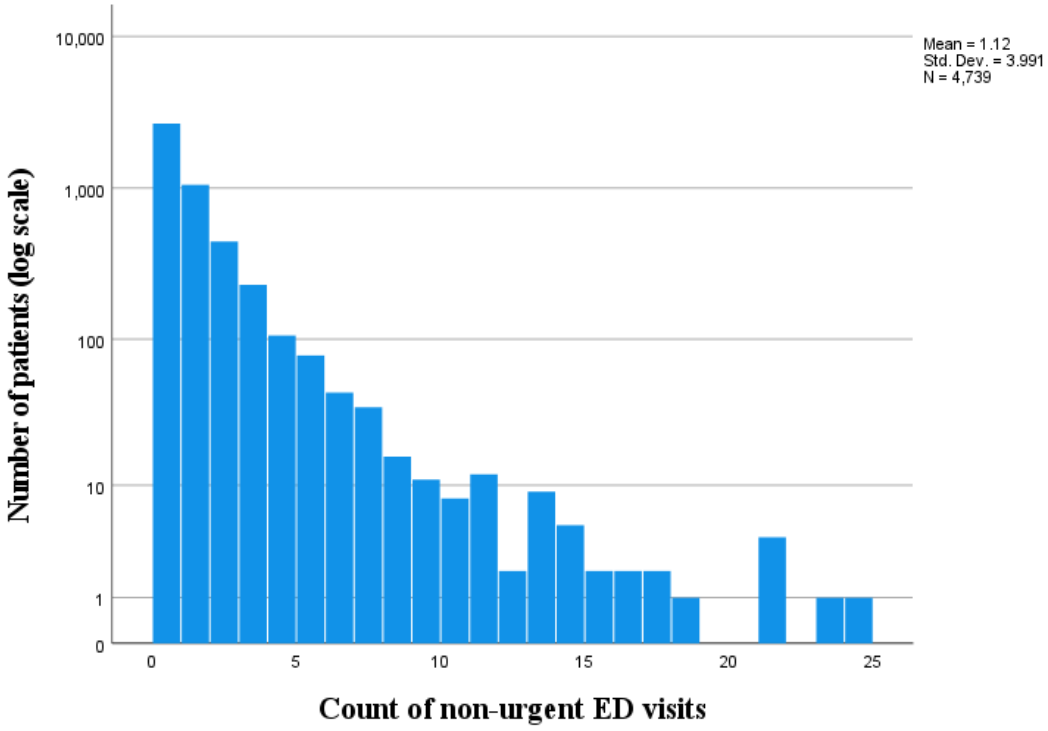


FIGURE V.9: Non-urgent ED visits by patients of Academic FPs

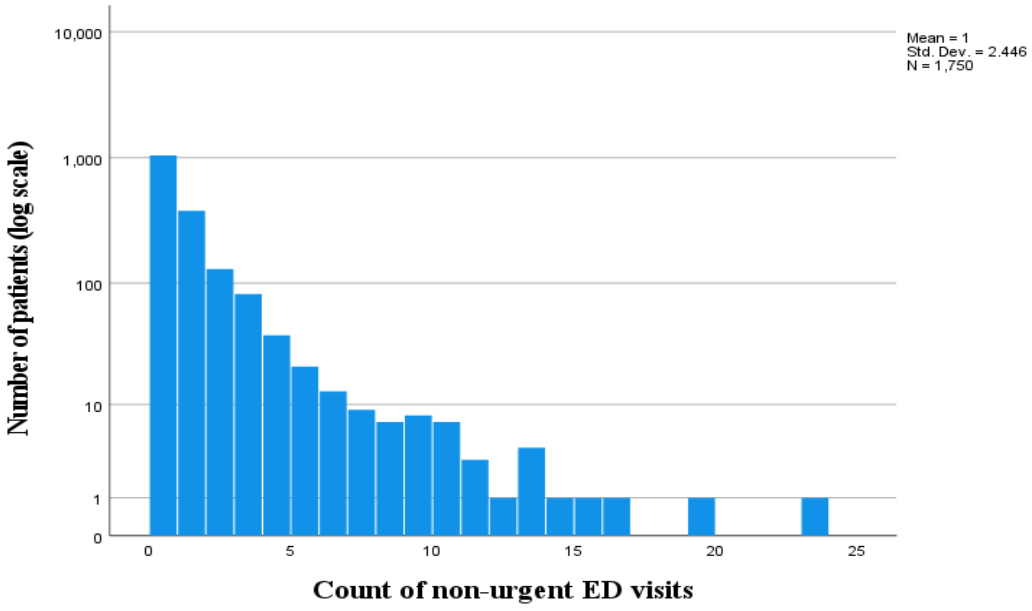


FIGURE V.10: Non-urgent ED visits outside of usual FP work hours by patients of FPs who submitted 0-4.9% of their total billings for after-hours care

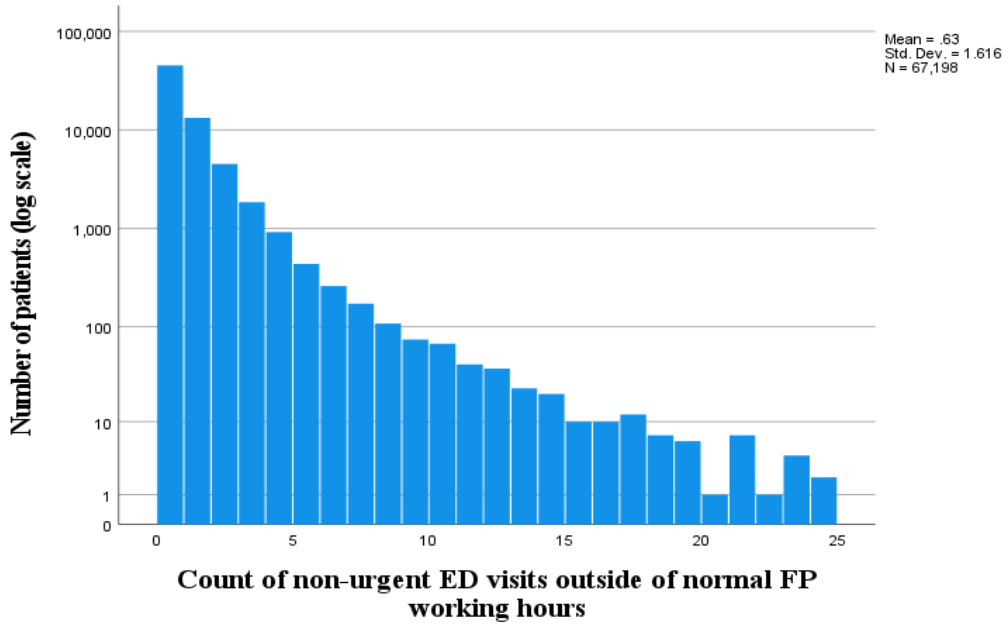


FIGURE V.11: Non-urgent ED visits outside of usual FP work hours by patients of FPs who submitted 5-14.9% of their total billings for after-hours care

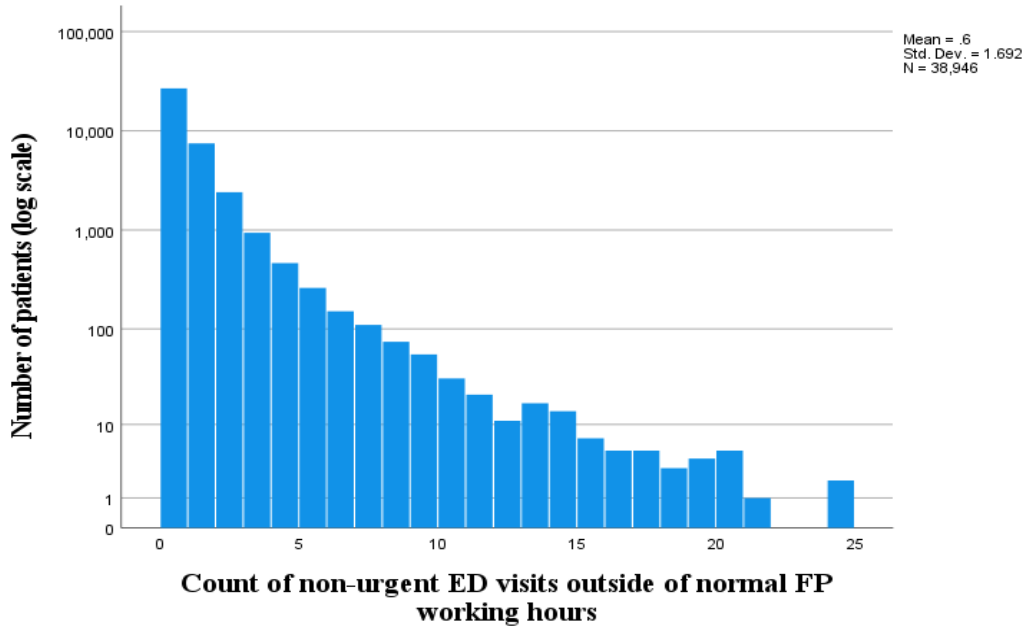


FIGURE V.12: Non-urgent ED visits outside of usual FP work hours by patients of FPs who submitted 15-24.9% of their total billings for after-hours care

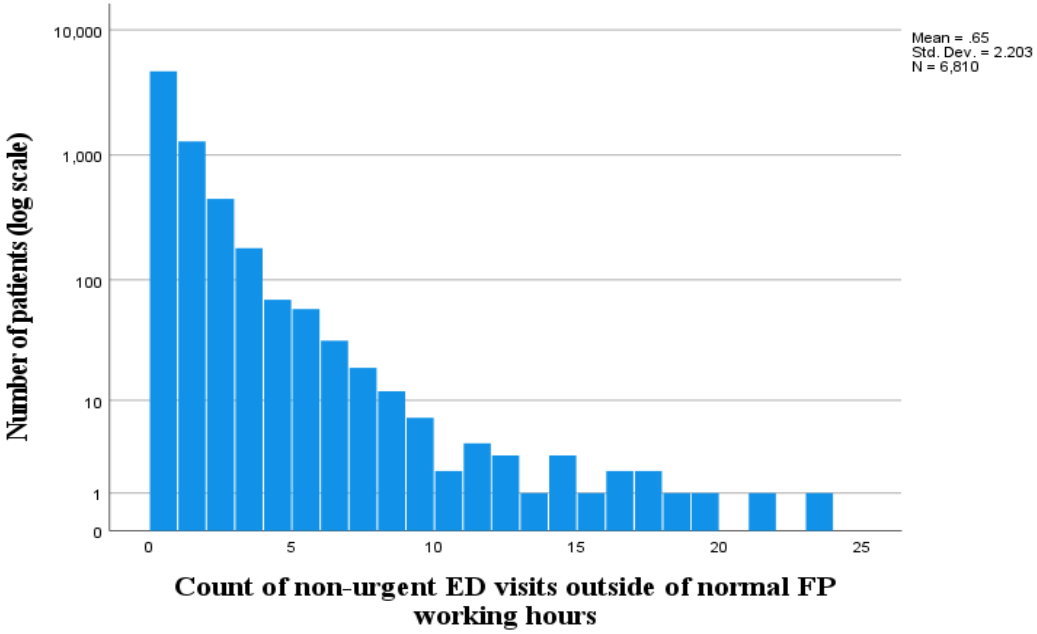


FIGURE V.13: Non-urgent ED visits outside of usual FP work hours by patients of FPs who submitted >25% of their total billings for after-hours care

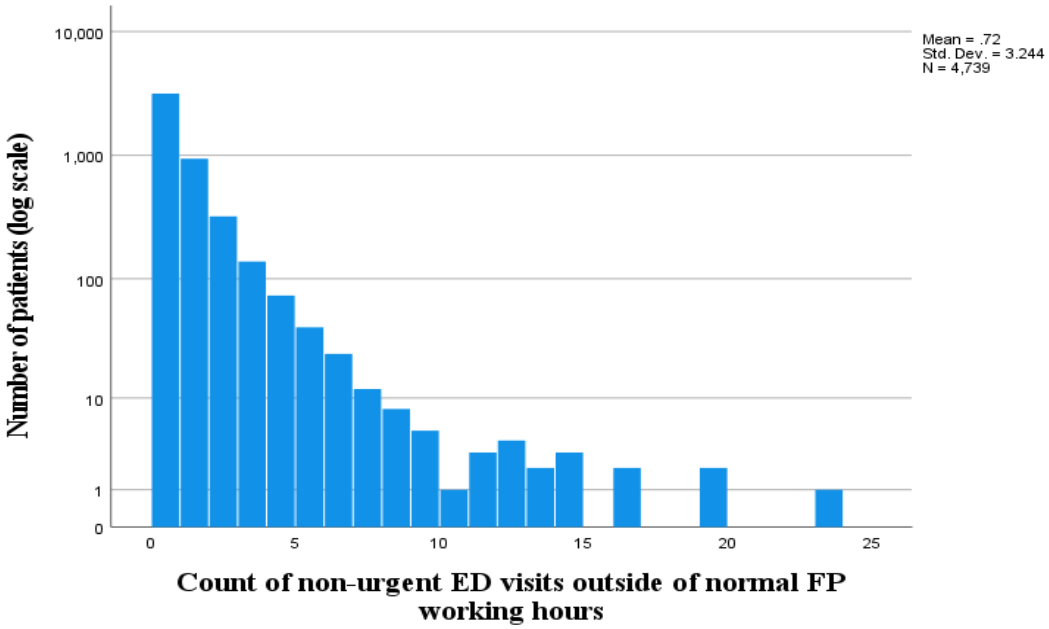
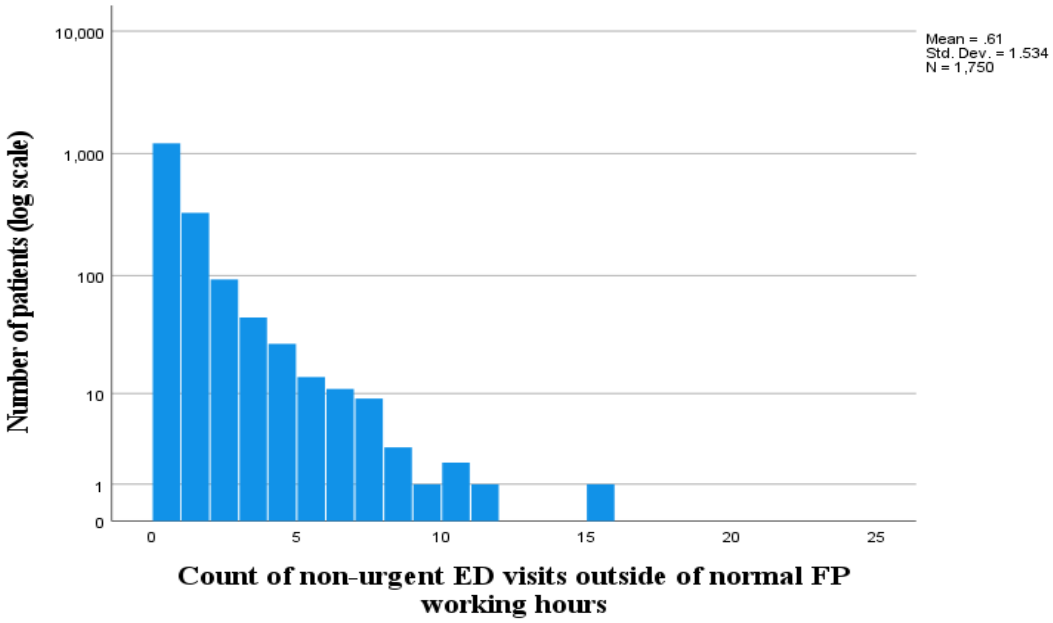


FIGURE V.14: Non-urgent ED visits outside of usual FP work hours by patients of Academic FPs



The main takeaways from the above 10 figures are – (a) the consistent positive skews, and (b) the consistent outliers (i.e., patients who had made a relatively high number of non-urgent ED visits).

Testing for Correlation Coefficients to prevent Collinearity

Regarding those independent variables in the final dataset that could be correlated with each other, it was necessary to perform certain tests to ensure that there would be no multicollinearity in the subsequently constructed regression models. If any designated independent variable was strongly correlated with another such variable in the dataset, not more than one of those correlated variables would be included in the same regression model. It may be explained that variables, which are strongly correlated with each other are not truly independent and including those variables together would be problematic (re: regression model fit); multicollinearity can undermine the significance

of an independent variable. Similarly, redundancy of any included variable in a regression model is to be prevented. With all of that in mind, of particular interest during this study were the variables that pertained to –

- DA-level education (i.e., High School Completion Percentage and Post-secondary Completion Percentage, both as per the 2016 Census);
- Patient Continuity Of Care (i.e., UPCI and COCI).

Correlations between the stated sets of variables were tested for via the described tests, and the results were obtained.

Socio-economic variables

The two socio-economic variables (i.e., High School Completion Percentage and Post-secondary Completion Percentage) were tested for correlation. The former variable comprised only those individuals who had completed high school without going on to further education, while the latter variable comprised those who had completed both high school and post-secondary education.

With regards to correlation between the variables, it was shown that (a) the Pearson Correlation Coefficient was -0.76 ($p<0.05; n=119,443$) and (b) the Spearman's Rho Correlation Coefficient was -0.77 ($p<0.05; n=119,443$). The results of these tests indicated that the two control variables in question were significantly correlated with each other to a large degree, as each Correlation Coefficient was close to -1 (i.e., there was close to being a perfect negative correlation). Therefore, even though both of these variables were available, they could both not be used in the same regression model. As per the definitions of the respective variables that were provided by the Newfoundland & Labrador Centre for Health Information (NLCHI) - the Post-secondary Completion Percentage was a more complete reflection of the education status in a given DA, as compared to the High School Completion Percentage; the latter variable did not comprise any

education after high school while the former variable comprised all education up to the post-secondary level. More importantly, estimators of model quality – such as the Akaike and Bayesian Information Criteria - indicated that the quality of models with the former variable (i.e., Post-secondary Completion Percentage) was superior to that of corresponding models with the latter variable; the two variables were not used together in any model. Therefore, out of these two variables, only the Post-secondary Completion Percentage was included during the subsequent analyses.

Continuity Of Care indices

The two available Continuity Of Care-related variables (i.e., UPCI and COCI) were tested for correlation. It may be restated that the former variable specifically addresses continuity of care in relation to the patient's usual provider of care, while the latter variable additionally accounts for the distribution of the patient's consultations across FPs.

With regards to correlation between the variables, it was shown that (a) the Pearson Correlation Coefficient was 0.97 ($p<0.05; n=119,443$) and (b) the Spearman's Rho Correlation Coefficient was 0.99 ($p<0.05; n=119,443$). The results of these tests indicated that the two control variables in question were significantly correlated with each other to a large degree, as each Correlation Coefficient was close to 1 (i.e., there was close to being a perfect positive correlation). Therefore, even though both of these variables were appropriately derived, they could both not be used in the same regression model. While the UPCI could be calculated for all patients in the study sample ($n=119,443$), the COCI could only be calculated for 117,282 of those patients; due to superior "goodness of fit" values with UPCI, this variable was preferred to COCI during the subsequent analyses. However, since the COCI possesses some unique strengths, it was used in separate regression models (without the UPCI), as part of sensitivity analyses. Using each Continuity Of

Care-related variable in separate regression models helped to cross-check and verify the results that pertained to Continuity of Care.

Notes:

(i) While the Pearson Correlation Coefficient is generally applicable to normal distributions and the Spearman's Rho Correlation Coefficient is generally applicable to non-normal distributions, both of those were obtained as described above; although no stated variable was normally distributed, the skews of each were mild, and using both correlation tests in such situations has been argued for[112].

(ii) Correlation Coefficients were subsequently obtained for each of these pairs of DA-level socio-economic variables – (a) Median Household Income and Post-secondary Completion Percentage (*Pearson Correlation Coefficient=0.59; Spearman's Rho Correlation Coefficient=0.61; $p<0.05$*), (b) Median Household Income and Unemployment Percentage (*Pearson Correlation Coefficient=-0.28; Spearman's Rho Correlation Coefficient=-0.26; $p<0.05$*), and (c) Post-secondary Completion Percentage and Unemployment Percentage (*Pearson Correlation Coefficient=-0.23; Spearman's Rho Correlation Coefficient=-0.25; $p<0.05$*); none of these variables were shown to be strongly correlated with each other, as none of the resulting coefficients were close to 1 or -1 (note – coefficient values <0.7 or >-0.7 are considered to be acceptable)[112].

(iii) Variance Inflation Factor (VIF) values were obtained for each of the relevant predictor and control variables, while each possible outcome variable was used in turn; all of the resulting values were <3, thus indicating that any existing multicollinearity within the models was acceptable[112].

The first major analysis involved constructing a Random Effects Negative Binomial Regression model wherein the non-urgent ED visit count (irrespective of time of day) was the outcome and

the number of after-hours billing claims by FPs (as a categorical variable) was the predictor. The respective control variables in the model were – (a) Age, (b) Sex, (c) DA-level median household income, (d) DA-level post-secondary completion percentage, (e) DA-level unemployment percentage, (f) distance from DA of residence to nearest ED, (g) CCI, and (h) UPCI. Standard errors (re: the model) were adjusted for clustering by respective FP. The main reason for this adjustment was – since patients of a certain FP may have exhibited similar behaviors with regards to non-urgent ED visits, it was important to try to ensure that observations remained independent from each other. It may also be noted that Sun et al. (1996)[119] argued that the use of univariate analyses to determine the predictor/control variables in subsequent multivariate analyses is inappropriate. They argued that a non-significant predictor variable in a univariate analysis could become a significant predictor variable in a subsequent multivariate analysis; omitted variable bias could occur. Therefore, a non-significant predictor variable in a univariate analysis ought to not be omitted during a subsequent multivariate analysis. With this in mind, only multivariate regression analyses were deemed to be necessary when addressing the primary objective of this study. In any case, results of univariate analyses (re: this study) did not contradict results of subsequent multivariate analyses. The following table describes the results of the first major analysis, which pertained to the primary objective.

TABLE V.8: Predictors of the Non-urgent ED Visit Count (with UPCI) – Multivariate Regression Analysis

	Sig.	Rate Ratio	95% Confidence Interval	
			Lower	Upper
Age	<0.001	0.987	0.986	0.988
Female sex (in relation to Male)	<0.001	1.057	1.025	1.089
Median Household Income (1000.00 C$)*	<0.001	0.996	0.995	0.996
Post-secondary Completion Percentage*	<0.001	0.996	0.994	0.998
Unemployment Percentage*	0.713	1.001	0.998	1.004
Distance To ED (km)*	<0.001	0.987	0.985	0.989
Charlson Comorbidity Index	<0.001	1.277	1.263	1.292
Usual Provider Continuity Index	<0.001	0.485	0.443	0.530
>25% of FP billings for after-hours care**	0.907	0.990	0.834	1.175
15-24.9% of FP billings for after-hours care**	0.572	1.054	0.878	1.267
5-14.9% of FP billings for after-hours care**	0.837	0.990	0.900	1.089
Usual provider of care was an Academic FP**	0.039	0.832	0.698	0.991

Notes pertaining to Table V.8:

(i) * Measured at the level of DA of patient's residence

(ii) ** Reference category was – "0-4.9% of FP billings for after-hours care".

(iii) Due to the strong correlation with each other, UPCI was included in the above model while COCI was not.

Interpretation of the results obtained from the above model

Age: An increase in age by one year was associated with a 1.3% decrease in the likelihood of one additional non-urgent ED visit.

Sex: Female patients were 5.7% more likely to make one additional non-urgent ED visit, compared to male patients.

Median Household Income: An increase in median household income (re: patient's DA of residence) by C$1000.00 was associated with a 0.4% decrease in the likelihood of one additional non-urgent ED visit.

Post-secondary completion: An increase in post-secondary completion percentage (re: patient's DA of residence) by 1% was associated with a 0.4% decrease in the likelihood of one additional non-urgent ED visit.

Unemployment: There was no significant relationship between the unemployment percentage (re: patient's DA of residence) and the count of non-urgent ED visits.

Distance to ED: An increase of 1 kilometre from the centroid of the patient's DA of residence to the nearest ED was associated with a 1.3% decrease in the likelihood of one additional non-urgent ED visit.

Comorbidity: An increase in the Charlson Comorbidity Index score by 1 was associated with a 27.7% increase in the likelihood of one additional non-urgent ED visit.

Continuity of Care: An increase in the Usual Provider Continuity Index (UPCI) score by 0.1 was associated with a 5.15% decrease in the likelihood of one additional non-urgent ED visit.

After-hours care: Compared to patients of the fee-for-service FPs who submitted <5% of billing claims for after-hours care, patients of the Academic FPs were 16.8% less likely to make an additional non-urgent ED visit. There was no significant relationship between the non-urgent ED

visit count and any of the categories that pertained to FPs practicing under the fee-for-service model. [The reference category: Patients of FPs who submitted <5% of billing claims - out of their total billing claims - for after-hours care].

In addition to the analysis pertaining to all non-urgent ED visits (irrespective of time of day) as presented above, an analysis pertaining to non-urgent ED visits that only took place outside of usual FP clinic work hours was also performed. This was done to help determine if FP clinics being closed to patients had a positive or negative effect on non-urgent ED visits. This additional analysis involved constructing a Random Effects Negative Binomial Regression model wherein "the non-urgent ED visit count outside of usual FP clinic work hours" was the outcome. Apart from the outcome, the other variables in this model and the characteristics of this model remained the same as those specified for the above model. The results of this additional analysis are presented in the next table. It may be noted that these results are similar to the results from the preceding analysis.

TABLE V.9: Predictors of the Non-urgent ED Visit Count outside of usual FP work hours (with UPCI) – Multivariate Regression Analysis

	Sig.	Rate Ratio	95% Confidence Interval	
			Lower	Upper
Age	<0.001	0.984	0.982	0.985
Female sex (in relation to Male)	0.017	1.042	1.007	1.079
Median Household Income (1000.00 C$)*	<0.001	0.996	0.995	0.996
Post-secondary Completion Percentage*	0.001	0.996	0.993	0.998
Unemployment Percentage*	0.654	1.001	0.997	1.004
Distance To ED (km)*	<0.001	0.985	0.983	0.988
Charlson Comorbidity Index	<0.001	1.273	1.257	1.289
Usual Provider Continuity Index	<0.001	0.478	0.432	0.529
>25% of FP billings for after-hours care**	0.970	0.997	0.838	1.186
15-24.9% of FP billings for after-hours care**	0.623	1.049	0.868	1.267
5-14.9% of FP billings for after-hours care**	0.819	1.011	0.919	1.113
Usual provider of care was an Academic FP**	0.030	0.824	0.692	0.981

Notes pertaining to Table V.9:

(i) * Measured at the level of DA of patient's residence

(ii) ** Reference category was – "0-4.9% of FP billings for after-hours care".

(iii) Due to the strong correlation with each other, UPCI was included in the above model while COCI was not.

Interpretation of the results obtained from the above model

Age: An increase in age by one year was associated with a 1.6% decrease in the likelihood of one additional non-urgent ED visit outside of usual FP work hours.

Sex: Female patients were 4.2% more likely to make one additional non-urgent ED visit outside of usual FP work hours, compared to male patients.

Median Household Income: An increase in median household income (re: patient's DA of residence) by C$1000.00 was associated with a 0.4% decrease in the likelihood of one additional non-urgent ED visit outside of usual FP work hours.

Post-secondary completion: An increase in post-secondary completion percentage (re: patient's DA of residence) by 1% was associated with a 0.4% decrease in the likelihood of one additional non-urgent ED visit outside of usual FP work hours.

Unemployment: There was no significant relationship between the unemployment percentage (re: patient's DA of residence) and the count of non-urgent ED visits outside of usual FP work hours.

Distance to ED: An increase of 1 kilometre from the centroid of the patient's DA of residence to the nearest ED was associated with a 1.5% decrease in the likelihood of one additional non-urgent ED visit outside of usual FP work hours.

Comorbidity: An increase in the Charlson Comorbidity Index score by 1 was associated with a 27.3% increase in the likelihood of one additional non-urgent ED visit outside of usual FP work hours.

Continuity of Care: An increase in the Usual Provider Continuity Index (UPCI) score by 0.1 was associated with a 5.22% decrease in the likelihood of one additional non-urgent ED visit outside of usual FP work hours.

After-hours care: Compared to patients of the fee-for-service FPs who submitted <5% of billing claims for after-hours care, patients of the Academic FPs were 17.6% less likely to make an additional non-urgent ED visit outside of usual FP work hours. There was no significant relationship between the non-urgent ED visit count outside of usual FP work hours and any of the categories that pertained to FPs practicing under the fee-for-service model. [The reference category: Patients of FPs who submitted <5% of billing claims - out of their total billing claims - for after-hours care].

Random Effects Negative Binomial Regression models wherein the COCI was a control variable instead of the UPCI were also constructed. Two such models were constructed – one in which the non-urgent ED visit count (irrespective of time of day) was the outcome, and the other in which the non-urgent ED visit count outside of usual FP work hours was the outcome. These models were constructed in the same way that the above two models were constructed. These models that included the COCI instead of the UPCI were constructed, in order to check if using a slightly different index (re: Continuity Of Care) would lead to any significant changes in the overall results. Apart from the substitution of the UPCI with the COCI, the predictor/control variables in the following two models remained the same as in the two models that have been described above (re: Tables V.8 and V.9).

The results from the Random Effects Negative Binomial Regression model wherein the COCI was a control variable and the non-urgent ED visit count (irrespective of time of day) was the outcome variable are presented in the next table.

TABLE V.10: Predictors of the Non-urgent ED Visit Count (with COCI) – Multivariate Regression Analysis

	Sig.	Rate Ratio	95% Confidence Interval	
			Lower	Upper
Age	<0.001	0.986	0.985	0.988
Female sex (in relation to Male)	0.001	1.054	1.023	1.087
Median Household Income*	<0.001	0.996	0.995	0.996
Post-secondary Completion Percentage*	<0.001	0.996	0.994	0.998
Unemployment Percentage*	0.595	1.001	0.998	1.004
Distance To ED*	<0.001	0.987	0.985	0.989
Charlson Comorbidity Index	<0.001	1.275	1.261	1.290
Bice-Boxerman Continuity of Care Index	<0.001	0.647	0.601	0.696
Usual provider of care submitted >25% of billings for after-hours care**	0.995	1.001	0.835	1.199
Usual provider of care submitted 15-24.9% of billings for after-hours care**	0.534	1.060	0.882	1.273
Usual provider of care submitted 5-14.9% of billings for after-hours care**	0.726	0.984	0.897	1.079
Usual provider of care was an Academic FP**	0.038	0.834	0.702	0.990

Notes pertaining to Table V.10:

(i) * Measured at the level of DA of patient's residence

(ii) ** Reference category was – "0-4.9% of FP billings for after-hours care".

(iii) Due to the strong correlation with each other, COCI was included in the above model while UPCI was not.

(iv) COCI values were only available for 117,282 patients, out of the total sample of 119,443 patients.

Interpretation of the results obtained from the above model

As the above table shows, an increase in the Bice-Boxerman Continuity of Care Index (COCI) score by 0.1 was associated with a 3.53% decrease in the likelihood of one additional non-urgent ED visit. Apart from this particular result, the results pertaining to the other control/predictor variables were nearly identical to the results from the previously described model (re: Table V.8) wherein all of the variables were the same, except for the COCI. Table V.10 confirms this fact; therefore, it would not be necessary to repeat the interpretations of those results in this section.

The results from the Random Effects Negative Binomial Regression model wherein the COCI was a control variable and the non-urgent ED visit count outside of usual FP work hours was the outcome variable are presented in the next table.

TABLE V.11: Predictors of the Non-urgent ED Visit Count outside of usual FP work hours (with COCI) – Multivariate Regression Analysis

	Sig.	Rate Ratio	95% Confidence Interval	
			Lower	Upper
Age	<0.001	0.983	0.982	0.985
Female sex (in relation to Male)	0.024	1.040	1.005	1.076
Median Household Income*	<0.001	0.996	0.995	0.996
Post-secondary Completion Percentage*	0.001	0.996	0.993	0.998
Unemployment Percentage*	0.537	1.001	0.998	1.004
Distance To ED*	<0.001	0.985	0.983	0.988
Charlson Comorbidity Index	<0.001	1.271	1.255	1.288
Bice-Boxerman Continuity of Care Index	<0.001	0.637	0.586	0.693
Usual provider of care submitted >25% of billings for after-hours care**	0.902	1.012	0.843	1.214
Usual provider of care submitted 15-24.9% of billings for after-hours care**	0.561	1.057	0.876	1.277
Usual provider of care submitted 5-14.9% of billings for after-hours care**	0.904	1.006	0.916	1.105
Usual provider of care was an Academic FP**	0.027	0.828	0.701	0.979

Notes pertaining to Table V.11:

(i) * Measured at the level of DA of patient's residence

(ii) ** Reference category was – "0-4.9% of FP billings for after-hours care".

(iii) Due to the strong correlation with each other, COCI was included in the above model while UPCI was not.

(iv) COCI values were only available for 117,282 patients, out of the total sample of 119,443 patients.

Interpretation of the results obtained from the above model

As the above table shows, an increase in the Bice-Boxerman Continuity of Care Index (COCI) score by 0.1 was associated with a 3.63% decrease in the likelihood of one additional non-urgent ED visit outside of usual FP work hours. Apart from this particular result, the results pertaining to the other control/predictor variables were nearly identical to the results from the previously described model (re: Table V.9) wherein all of the variables were the same, except for the COCI. Table V.11 confirms this fact; therefore, it would not be necessary to repeat the interpretations of those results in this section.

It may be emphasized that using each Continuity Of Care index in turn did not change the overall results (re: the relationship between Continuity Of Care and non-urgent ED visit counts). Irrespective of index used, the regression models showed that better Continuity Of Care was significantly associated with a lower non-urgent ED visit count.

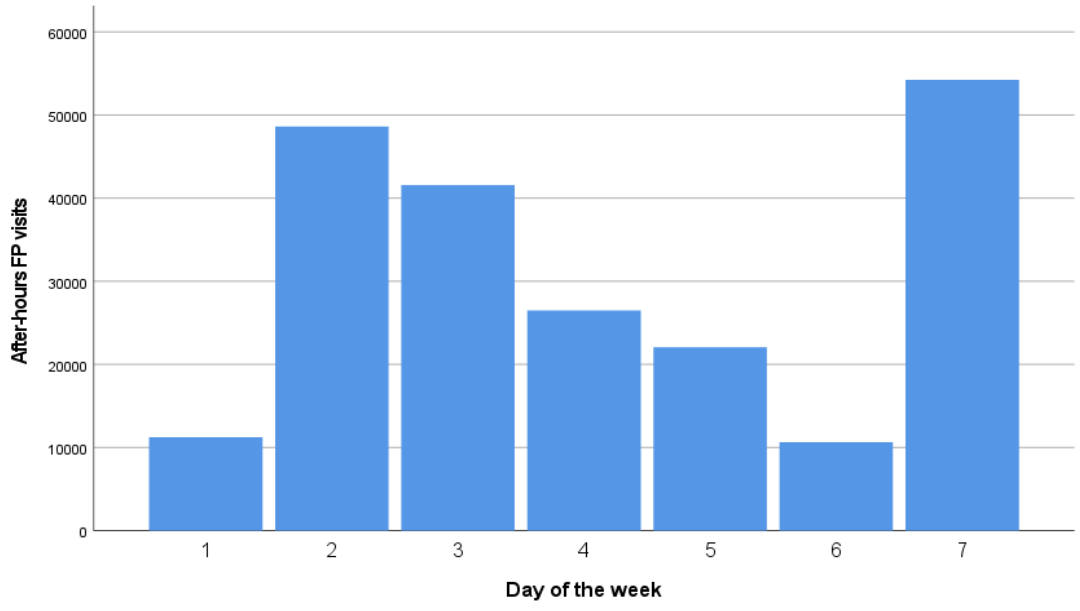
V.2 PRIMARY OBJECTIVE – PART 2

The primary objective was also approached in a different manner, as described in the preceding chapter. The relationship between the number of billing claims for after-hours care by fee-for-service FPs in the SJMA and non-urgent ED visits by patients from the SJMA was explored. For

this analysis, calendar date was the unit of analysis, while “Day Of Week” and “Month Of Year” were controlled for. It may be restated that “after-hours care” pertained to care that was provided on Saturdays, Sundays, and public holidays, as well as to care that was provided outside of 9 AM – 6 PM on non-holiday weekdays.

Prior to detailed analyses, it was important to describe any variability in the numbers of after-hours billing claim submissions, based on the day of the week and the month of the year. Therefore, those pieces of information will be described in graphical form before any further analytical results are described. There was variability in the numbers of after-hours billing claim submissions across the respective days of the week and months of the year. And, that variability (re: the following Figures V.3 and V.4) provided a rationale for this approach wherein the calendar date was the unit of analysis. The possible reasons for the relatively high after-hours billing claim submissions on Monday, Saturday, March, and April will be stated in a following chapter.

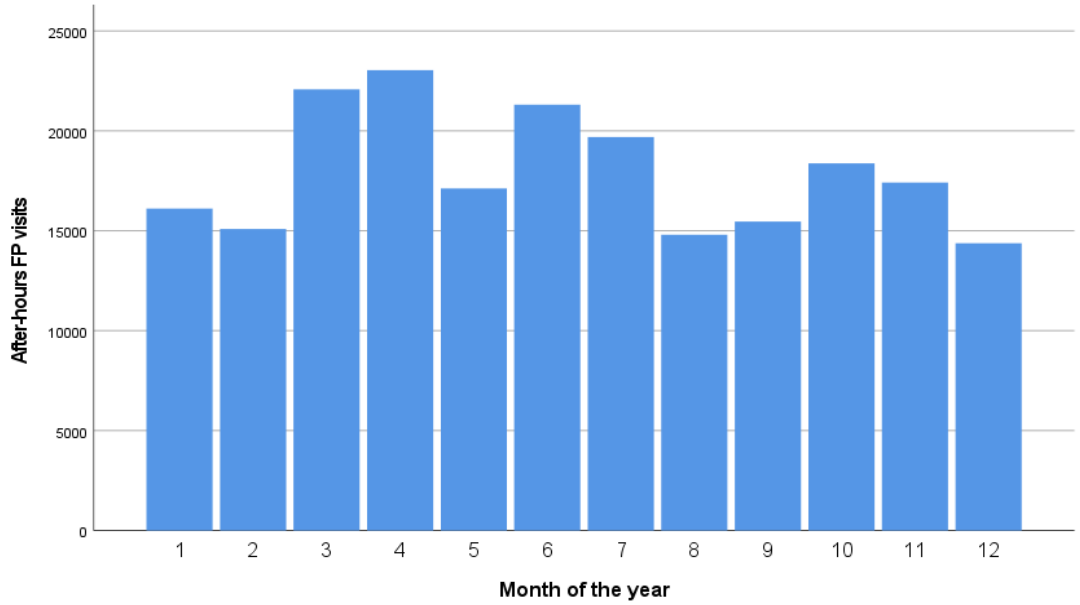
FIGURE V.15: Total unique after-hours patient consultations with fee-for-service FPs (based on billing claims for same) per day of the week



Note pertaining to Figure V.15:

In the above chart – "1" is Sunday and "7" is Saturday.

FIGURE V.16: Total unique after-hours patient consultations with fee-for-service FPs (based on billing claims for same) per month of the year



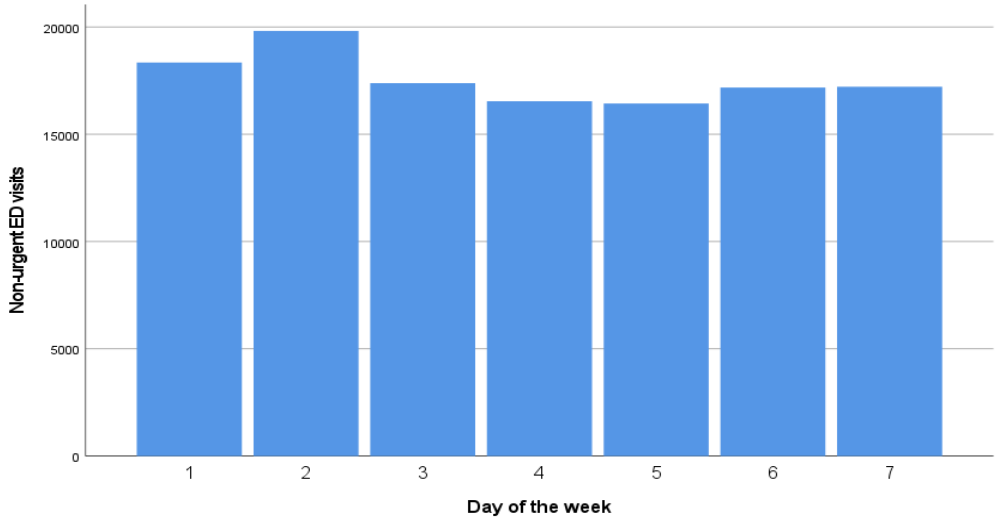
Note pertaining to Figure V.16:

In the above chart – "1" is January and "12" is December.

It was also important to describe any variability in the numbers of non-urgent ED visits, based on the day of the week and the month of the year. Such variability in the numbers of non-urgent ED visits was not as pronounced as the corresponding variability in the numbers of after-hours billing claims (as described above). However, there were relatively more non-urgent ED visits on Monday, July, and August. And, that variability (re: the following Figures V.5 and V.6) also provided a rationale for this approach wherein the calendar date was the unit of analysis. The

possible reasons for higher numbers of non-urgent ED visits on Monday, July, and August will be stated in a following chapter.

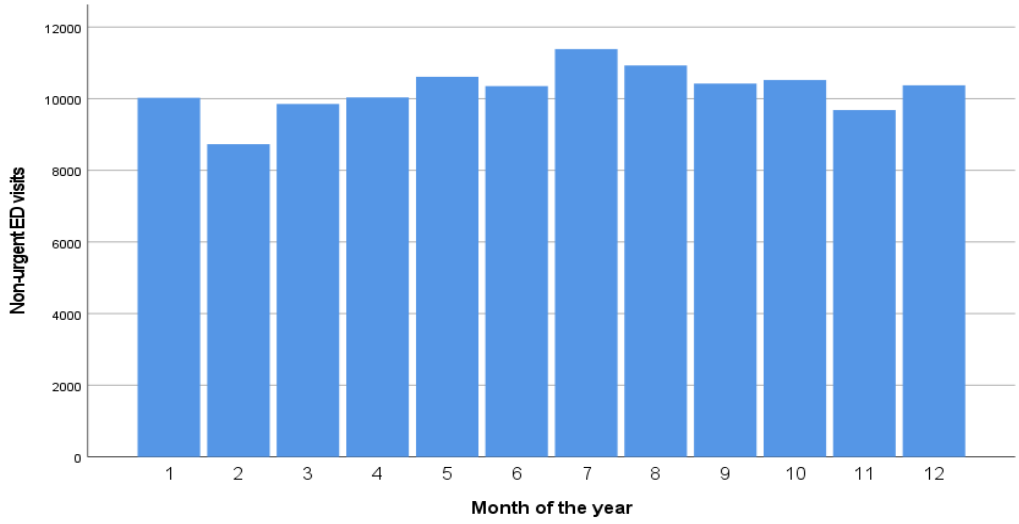
FIGURE V.17: Total non-urgent ED visits by patients per day of the week



Note pertaining to Figure V.17:

In the above chart – "1" is Sunday and "7" is Saturday.

FIGURE V.18: Total non-urgent ED visits by patients per month of the year



Note pertaining to Figure V.18:

In the above chart – "1" is January and "12" is December.

After the above descriptive graphs/figures were obtained, regression analyses were performed. Poisson Regression was used with a Pearson Scale Poisson model being constructed for each of two respective analyses. In the first Pearson Scale Poisson model, the number of non-urgent ED visits was the outcome variable and the number of after-hours billing claim submissions by fee-for-service FPs was the predictor variable; calendar date was the unit of analysis, while day-of-the-week and month-of-the-year were control variables. The results from this first model are in the following table.

TABLE V.12: Predictors of the Non-Urgent ED Visit Count (per calendar date)

	Sig.	**Rate Ratio**	**95% Confidence Interval**	
			Lower	**Upper**
>200 total after-hours FP consultations*	0.033	1.062	1.005	1.122
151-200 total after-hours FP consultations*	0.131	1.041	0.988	1.097
101-150 total after-hours FP consultations*	0.579	1.013	0.969	1.059
51-100 total after-hours FP consultations*	0.598	0.992	0.964	1.021

Notes pertaining to Table V.12:

(i) After-hours billing claim submissions by fee-for-service FPs have been converted into after-hours consultations (re: fee-for-service FPs) since they are assumed to be identical.

(ii) * indicates that the reference category against which this particular category was compared was – "0-50 total after-hours FP consultations".

Interpretation of the results obtained from the above model

(1) On days when there were more than 200 after-hours patient consultations with the fee-for-service FPs (re: the SJMA), an additional non-urgent ED visit was 6.2% more likely; while this result may be counterintuitive, the possible reasons for this result (e.g., seasonal illnesses, a Saturday-specific effect, etc.) will be explored in a following chapter. [Note: It was not possible to know - based on the available data - whether any of the non-urgent ED visits occurred due to referrals by FPs].

(2) There was no significant relationship between the other three categories (re: after-hours FP consultations per date) and non-urgent ED visits per date.

In the second Pearson Scale Poisson model, the number of non-urgent ED visits outside of usual FP work hours was the outcome variable and the number of after-hours billing claim submissions by fee-for-service FPs was the predictor variable; calendar date was the unit of analysis, while day-of-the-week and month-of-the-year were control variables. The results from this second model are in the following table.

TABLE V.13: Predictors of the Non-Urgent ED Visit Count outside of usual FP work hours (per calendar date)

	Sig.	Rate Ratio	95% Confidence Interval	
			Lower	Upper
>200 total after-hours FP consultations*	0.010	1.083	1.019	1.150
151-200 total after-hours FP consultations*	0.031	1.064	1.006	1.126
101-150 total after-hours FP consultations*	0.101	1.040	0.992	1.090
51-100 total after-hours FP consultations*	0.495	1.010	0.981	1.039

Notes pertaining to Table V.13:

(i) After-hours billing claim submissions by fee-for-service FPs have been converted into after-hours consultations (re: fee-for-service FPs) since they are assumed to be identical.

(ii) * indicates that the reference category against which this particular category was compared was – "0-50 total after-hours FP consultations".

Interpretation of the results obtained from the above model

1) On days when there were more than 200 after-hours patient consultations with the fee-for-service FPs (re: the SJMA), an additional non-urgent ED visit outside of usual FP work hours was 8.3% more likely; while this result may be counterintuitive, the possible reasons for this result (e.g., seasonal illnesses, a Saturday-specific effect, etc.) will be explored in a following chapter. [Note: It was not possible to know - based on the available data - whether any of the ED visits occurred due to referrals by FPs].

2) On days when there were 151-200 after-hours patient consultations with the fee-for-service FPs (re: the SJMA), an additional non-urgent ED visit outside of usual FP work hours was 6.4% more likely; while this result may be somewhat counterintuitive, the possible reasons for this result (e.g., seasonal illnesses, a Saturday-specific effect, etc.) will be explored in a following chapter. [Note: It was not possible to know - based on the available data - whether any of the ED visits occurred due to referrals by FPs].
3) There was no significant relationship between the other two categories (re: after-hours FP consultations per date) and non-urgent ED visits outside of usual FP work hours, per date.

V.3 SECONDARY OBJECTIVE

As described above (in the section on the Primary Objective – Part 1), both of the respective Continuity of Care indices were significantly related to the respective outcome variables, as follows –

- An increase in the Usual Provider Continuity Index (UPCI) score by 0.1 was associated with a 5.15% decrease in the likelihood of one additional non-urgent ED visit.
- An increase in the Bice-Boxerman Continuity of Care Index (COCI) score by 0.1 was associated with a 3.53% decrease in the likelihood of one additional non-urgent ED visit.
- An increase in the Usual Provider Continuity Index (UPCI) score by 0.1 was associated with a 5.22% decrease in the likelihood of one additional non-urgent ED visit outside of usual FP work hours.
- An increase in the Bice-Boxerman Continuity of Care Index (COCI) score by 0.1 was associated with a 3.63% decrease in the likelihood of one additional non-urgent ED visit outside of usual FP work hours.

[Notes: (i) The above statements are based on Tables V.8, V.9, V.10, and V.11;

(ii) Regression model fits were superior when AHIS was included as a control variable, compared to when AHIS was excluded; in addition, it could be logically assumed that patients whose usual FPs provided more after-hours services would have stronger relationships with said FPs].

V.4 SUPPLEMENTARY ANALYSES

As a result of the analyses described above, further analyses were necessary for the purpose of clarifying and/or verifying the previously obtained results. These supplementary analyses will now be described.

Three supplementary regression analyses were performed, in order to explore whether the results of the primary analyses – as detailed above – may be explained by the study sample having comprised a relatively large proportion of high users of healthcare services. The results of these three supplementary analyses were, as follows -

(i) As per a Negative Binomial Regression model, a patient who had made an FP consultation was 2.5% more likely to have made a non-urgent ED visit (*Rate Ratio = 1.025; 95% Confidence Interval = 1.024-1.026; $p<0.05$*); the demographic, socio-economic, and geographic variables were controlled for, along with CCI and UPCI.

(ii) As per a Negative Binomial Regression model, a patient who had made an after-hours FP consultation was 4.8% more likely to have made a non-urgent ED visit (*Rate Ratio = 1.048; 95% Confidence Interval = 1.046-1.051; $p<0.05$*); the demographic, socio-economic, and geographic variables were controlled for, along with CCI and UPCI.

(iii) As per a Negative Binomial Regression model, a patient who had made an FP consultation was 4.1% more likely to have made an after-hours FP consultation (*Rate*

Ratio = 1.041; 95% Confidence Interval = 1.040-1.042; p<0.05); the demographic, socio-economic, and geographic variables were controlled for, along with CCI and UPCI.

A further supplementary analysis explored whether the results of the primary analyses – as detailed above – may be explained in part by a direct relationship between total billing claims for all (clinic or home) patient consultations and billing claims for just after-hours patient care. The result of this analysis was, as follows –

As per an FP-level Linear Regression model, an FP who had submitted a billing claim for a patient consultation (at the FP clinic or patient's home) was 9.5% more likely to have submitted a billing claim for after-hours patient care (*Rate Ratio = 1.095; 95% Confidence Interval = 1.081-1.110; p<0.05*); however, it was not possible to control for any FP-related characteristics because the required ministerial approval for access to relevant FP-related data was not forthcoming.

Apart from the supplementary analyses described in this section, two other noteworthy findings concerning the study sample were, as follows –

(i) The mean CCI for the patients of the fee-for-service FPs (*n=117,693*) was 0.59, while the mean CCI for the patients of the Academic FPs (*n=1,750*) was 0.54.

(ii) Despite only 9.7% of patients in the study sample having been patients of fee-for-service FPs who had submitted 15% or more billing claims for after-hours care, 52.6% of patients in the sample had had, at least, one after-hours FP consultation during the study timeframe.

VI. PUBLIC (PATIENT AND PHYSICIAN) ENGAGEMENT

In this chapter, an overview regarding the concept of Public Engagement within healthcare-related research will be provided, along with the specific aspects of Public Engagement that this study encompassed.

VI.1 PATIENT-ORIENTED RESEARCH

Active engagement with patients and other relevant members of the community has now become a vital aspect for researchers to consider during health-related research.

The Canadian Institutes of Health Research (CIHR) provides this statement concerning Patient-Oriented Research[120] - "Patient-oriented research is not only about improving the way research is done, but is fundamentally about improving health care policies and practices across the system, and ultimately, health outcomes; as a result, patient-oriented research requires the engagement of a wide range of stakeholders."

The impetus for the Strategy for Patient-Oriented Research (SPOR) in Canada was the desire by the CIHR to[120] - "transform the role of the patient from a passive receptor of services to a proactive partner who helps shape health research"[120]. The CIHR webpages about SPOR explain that funding partnerships (involving Canadian provinces, territories, academic institutions, etc.) were subsequently created to enable patient-oriented research to become a practical reality within health-related research across Canada[120].

While it is beyond the scope of this project to go into in-depth descriptions of each aspect of SPOR[120], a key tenet of SPOR is that "patients must be put first", which basically means that patients must be collaborative partners – along with researchers, healthcare providers, and

decision-makers – as we work towards the goal of bringing about positive changes to the health of Canadians and to healthcare systems in Canada. Locally, a key partner within SPOR has been the Newfoundland & Labrador Support for People and Patient-Oriented Research and Trials (or NL SUPPORT) unit, which is responsible for supporting and advancing patient-oriented research in Newfoundland & Labrador and which provided fellowship support during this study.

NL SUPPORT has created a checklist-based document called the *Patient And Public Engagement Planning Template*[121], which requires researchers to answer the following questions, prior to attempting to engage with patients or other specific members of the public during their research. This checklist was utilized, prior to seeking any public engagement within this study. The checklist is as follows –

1) Why do you want to involve patients (or other specified members of the community)?
2) Who do you want to involve (i.e., which specified groups in the community)?
3) When and how can patients (or other specified members of the community) be involved?
4) What degree of engagement are you looking for?
5) How do you plan to make your selected degree of engagement a practical reality?
6) Where do you plan to identify potential partners (re: patients and/or other specified members in the community)?
7) What resources would you need to make the patient/public engagement work successfully?
8) What is your budget with regards to the patient/public engagement?
9) How will you implement your patient/public engagement strategy?
10) How will you evaluate the level of success with regards to your patient/public engagement, both from the point of view of the researchers and from the point of view of the patients (and/or other specified members of the community)?

Regarding the degrees of engagement, experts commonly describe five possible levels[122], ranging from lower to higher levels of engagement. These levels are - (a) informing the patient/public partners about the actual study and about the information accrued via the study, (b) consulting the patient/public partners periodically to get feedback on analyses, decisions, results, etc., (c) involving the patient/public partners, such that patient/public concerns and aspirations are consistently considered during each decision-making stage in the research process, (d) actively collaborating with the patient/public partners, such that those partners contribute to each decision-making stage of the research, and (e) empowering the patient/public partners, such that all final decisions (re: the research process) are placed in the hands of those partners. The level of engagement pertaining to this study was a hybrid between the first and second levels (i.e., levels (a) and (b)).

Gaining insights from stakeholders in the community, regarding the necessity of our study and the subsequent results from the study, was going to be beneficial. A clear rationale for the study and a more thorough interpretation of the results could then be disseminated with the help of those insights. We wanted to mainly involve patients and Family Physicians (FPs) from the St. John's Metropolitan Area (SJMA) in our study because the study focuses on primary care provisions by FPs in said area and on how those provisions may impact patient behaviors with regards to Emergency Department (ED) use. NL SUPPORT comprises a Patient Advisory Council (PAC), which includes patients who volunteer their time to be involved in relevant research projects across Newfoundland & Labrador. All interested patient representatives - who were part of the NL SUPPORT PAC and were 12 in number - were given periodic updates, regarding the available data and the progress of this study. Those representatives (as well as other interested stakeholders, such as FPs) were informed of the study results and conclusions, after the study was completed.

Members of the groups that we invited feedback from could provide their feedback in several ways – at in-person presentations/meetings (which mostly applied to the patient representatives), by responding to brief online publications (which mostly applied to FPs), and via emails at any time (which applied to any interested stakeholder).

An extremely important step during the patient/public engagement process was – determining the most appropriate degree of patient engagement. With that in mind, we consulted with NL SUPPORT to determine which approach or approaches would be advisable. Due to this study being based solely on available historical data, there were obvious constraints, in terms of involving patient/public partners in decision-making within the project; the possible research questions to ask and the analyses to perform were basically dictated by the available data. It was subsequently decided that the level of patient/public engagement that would be most appropriate for this particular study would be a hybrid between the "informing" and "consulting" levels (i.e., the lower two levels, as per the above description).

Once the degree of engagement was decided upon, NL SUPPORT helped to take care of points (5) through (10), as per the template that is described above. A department within NL SUPPORT took care of (a) setting up presentations for (and gathering feedback from) members of the afore-mentioned PAC, (b) inviting and gathering feedback from FPs in the community via online newsletters and online summaries of the study, and (c) disseminating the study results and conclusions to a broad array of stakeholders (including policymakers in the region) via physical publications. Since this study was funded by NL SUPPORT, the required resources and the budget for these activities were provided by NL SUPPORT. The evaluation of the patient/public engagement (re: this study) is ongoing and will be completed at a later date.

VI.2 STEPS FOLLOWED

Following the finalization of the study outline, the following specific steps (re: patient/public engagement) were undertaken –

- An overview of the available data for the study, the study outline, the study sample, the study objectives, and the progress estimates plus expectations (re: this study) were shared with members of the NL SUPPORT PAC in April 2017 (prior to any data being received); a request for suggestions on how to enhance the study was put to this council at the time, and suggestions were subsequently received from certain members of the council.
- Brief updates on the progress of the research were shared via email with members of the NL SUPPORT PAC between 2018 and 2019.
- The results, conclusions and inferences were shared with members of the NL SUPPORT PAC in September 2019; a request for feedback on all aspects of the study was put to this council at the time, and feedback was subsequently received from several members of the council (especially pertaining to the interpretations of key study findings).
- A plain-language poster displaying the outline of the study and the key study findings was shared with the public - with a focus towards the patient body in general - at the Science, Health And Research Education (SHARE) Summit, held during November 2019 in St. John's (*see Appendix VIII*).
- A one-page summary with an emphasis on the results of the study was published online via Quality Of Care NL, and the link to this summary was included in Family Physician (FP)-targeted newsletters and bulletins within Newfoundland & Labrador; along with this summary, feedback (via three specific questions) was invited from all FPs practicing under the fee-for-service model of care in the SJMA[123].

- Key points (re: this study) were published in the July, 2020 edition of the Quality Of Care NL Practice Points magazine[124]; feedback was invited via this publication, too.

VI.3 FEEDBACK OBTAINED

With regards to the opinions expressed by twelve members of the NL SUPPORT PAC (which were obtained at in-person presentations and via email) on the findings of this study, the main feedback points obtained were summarized. Several of these points were each made by more than one individual, though not always with the same words; therefore, presenting the points in paragraph form, rather than as direct quotes, was deemed to be preferable. The main feedback points obtained were, as follows –

Stronger long-term relationships between a patient and their FP should be encouraged, in order to lessen the amount of ED use. Ways to encourage stronger long-term FP-patient relationships are – (a) *more virtual FP consultations, along with a lesser necessity for in-person FP consultations*, and (b) *FP clinic appointments that are automatically set up at fixed durations for the purpose of patient check-ups (and these appointments could occur, either every 6 months or annually)*. It may be emphasized that these opinions on virtual FP consultations were all obtained, prior to the start of the COVID-19 pandemic during which virtual primary care has become more prevalent.

More analyses on after-hours care in this province and more reviews of studies on this topic (in other jurisdictions) are needed, especially because it was possible that this study had captured overtime work by FPs as part of after-hours care, instead of only capturing true after-hours care.

Patients with chronic conditions are expected to make a large proportion of ED visits. Attempts to optimize management in the community to help such patients avoid ED use ought to be considered. For this group of patients in particular, greater access to primary care and better patient education would therefore be helpful.

FPs would likely be resistant to regularly providing true after-hours care in the current environment, especially if no substantial extra compensation will be provided to them for such care.

A panel of relevant stakeholders (administrators, physicians, patient representatives, etc.) ought to be set up to study this issue (i.e., after-hours care by FPs in this province) in greater detail; the panel ought to particularly focus on the available resources, the required infrastructure, the long-term feasibility, the potential cost benefits, and the community buy-in.

The lack of resources and medical personnel (especially in many rural parts of Newfoundland & Labrador) ought to be addressed before after-hours care by FPs can be seriously considered.

The results of this study ought to be disseminated more widely.

The Academic FP model of care ought to be expanded in the SJMA, if possible; other models of primary care can also be tried out on an experimental basis, if possible because the current general model of primary care in Newfoundland & Labrador does not appear to be optimal.

Walk-in clinics are not totally satisfactory because of the following reasons (among others) - the lack of a triage system, the difficulty in forming a stable long-term FP-patient relationship, the wait times (which are often long in these clinics, too), and the difficulty that FPs face in ascertaining the detailed medical history of a presenting patient. [Note: One additional comment

was that, at least in the short-term, 24/7 walk-in clinics for non-life-threatening (but still serious) conditions could be beneficial].

With regards to the opinions – obtained via a physician-directed Newsletter and via a Facebook group of practicing physicians in the province – that were expressed on the findings of this study by four practicing FPs in Newfoundland & Labrador, the main feedback points were, as follows –

Providing after-hours care also requires setting up appointments for such, which can dissuade many patients from going to an FP clinic; similarly – after-hours appointments, even when they are possible, cannot be provided to patients on a 24/7 basis.

Patients often decide to visit an ED, based on the thinking that they have an acute condition, which would be best taken care of in an ED.

The Academic FP model probably has a positive effect on non-urgent ED use by patients due to the following – (a) 24/7 phone access (including phone triage when necessary), (b) the pay structure for Academic FPs (which allows them to spend more time with any presenting patient), and (c) a more team-based approach by the Academic FP group, compared to the FPs who practice under the fee-for-service model.

The possibility of a financial penalty could be considered for FPs whose patients present at Emergency Departments (EDs) for non-urgent reasons.

Conducting a more extensive and better-powered study would be advisable, especially in terms of including ED Physicians and more FP practices within the study while also including more information about each study subject (e.g., more demographic-related information about the patients, more information about the comorbidities among the patients, etc.).

With regards to this study, it was ultimately deemed beneficial to have engaged with patient representatives and FPs. While some of the obtained feedback pertained to points that were outside the scope of this study, there appeared to be a consensus of opinion that (in the SJMA) - (a) the numbers of ED visits by patients needed to be reduced and (b) access to after-hours primary care needed to be enhanced and/or explored further with the aim of enhancing it. However, it was also generally agreed that several challenges to improving primary care access exist and that more research may be necessary. Importantly, the obtained feedback helped with the interpretation of some of the study results, as will be described in the following chapter.

VII. DISCUSSION

As stated in preceding sections of this thesis, the main objective of this study was to explore whether there was a significant relationship between the after-hours care provided by Family Physicians (FPs) in the St. John's Metropolitan Area (SJMA) and non-urgent Emergency Department (ED) visits by patients from the SJMA – from April 1, 2011 to March 31, 2015.

The main finding to come out of this study was - there was no significant relationship between non-urgent ED visits and after-hours Family Physician (FP) visits when FPs practicing under the fee-for-service model of care were considered. However, patients of the university-affiliated Academic FPs made significantly fewer non-urgent ED visits, compared to patients of FPs who had provided minimal or no after-hours care. The results also indicated significant associations between a reduced number of non-urgent ED visits and the following - (a) patients having better continuity of care (COC) with their usual providers of care, (b) older patients, (c) male patients, (d) patients living in areas with higher median household incomes, (e) patients living in areas with higher post-secondary completion rates, (f) patients living further away from an ED, and (g) patients with lower Charlson Comorbidity Index (CCI) scores. In addition, an alternative approach towards this study's main objective indicated that, on days when a relatively high number of after-hours billing claims were submitted by FPs, a significantly higher number of non-urgent ED visits were made by patients, as well.

In this chapter, the study sample will be discussed in brief, followed by a more detailed discussion of the key results. The limitations and strengths of this study will also be enumerated in this chapter.

VII.1 THE FINAL DATASET AND STUDY SAMPLE

This section will be used to describe the representativeness and generalizability of the patient sample that was used for this study. Certain salient features of the sample will also be stated.

The final study sample included 119,443 patients. However, 122,219 unique patients were listed in the Medical Care Plan (MCP) Beneficiary Registration Files database that was provided by Newfoundland & Labrador Centre for Health Information (NLCHI), with 2,776 of those not meeting this study's inclusion criteria. As per publicly available information from Statistics Canada, the 2016 Census indicated that there were 166,922 individuals who were 18 years of age or older and living in the St. John's Census Metropolitan Area (SJCMA)[104]. The disparity in the numbers (i.e., 122,219 versus 166,922) may be explained by the fact that the 2016 Census data were collected after the study timeframe (i.e., after Fiscal Year 2014); it may also be due to the known fact that not every adult resident in the region – either because of non-application or non-renewal - has a valid provincial health card (i.e., MCP card) at a given time. In addition, a patient had to have made, at least, one visit to an FP during the study timeframe to be included in the study sample. Therefore, only an adult resident of the SJMA who had a valid MCP card throughout the study timeframe and had made, at least, one FP consultation during the study timeframe could be a study subject.

The number of FPs who were part of the study (i.e., full-time practicing FPs who could be listed as usual providers of care for one or more patients within the study sample) was 212. This figure was closely comparable to figures from the Newfoundland and Labrador Medical Association (NLMA), regarding full-time practicing FPs in the SJMA during the study timeframe (*see Chapter I*). And, anecdotal estimates of FP numbers during the relevant timeframe were similar to that figure of 212, as well. As described in a preceding chapter, a large number of FPs (i.e., 797 FPs)

who had submitted relatively few and/or sporadic billing claims during the study timeframe could not be included in this study. No one out of those 797 FPs had apparently been practicing regularly in the SJMA during the study timeframe and/or was a usual provider of care for a patient in the study sample.

The average age of the study sample was 46.67 years (median = 46 years), while the 2016 Census data indicated that the average age of residents of the SJCMA was 40.3 (median age = 40)[97]; however, these differences are explained by the fact that the study sample was restricted to the adult population in the region. The 2016 Census data also indicated that 52.2% of the adult population in the SJCMA was female while 47.8% was male, but in the study sample, 54.2% was female while 45.8% was male. The slight difference (re: sex breakdown in the study sample versus that in the census data) may be due to female individuals being higher users of healthcare in general, compared to male individuals[125]. As a result, comparatively more female residents of the SJMA may (a) have had valid MCP cards during the study timeframe and (b) have made, at least, one FP consultation during the study timeframe, thereby enabling them to be linked to respective FPs.

The socio-economic data derived from the Statistics Canada 2016 Census pertained to the 2015 calendar year[104]. Per that census-based data, the median household income of those in the SJMA was $79,750.00[104], which was comparable with the median household income, regarding the study sample ($84,608.00). The number of individuals who had completed a form of post-secondary education made up 60.22% of the census-recorded population[104], which was almost identical with the 59.78% of individuals in the study sample who had completed a form of post-secondary education. In addition, the unemployment percentage in the census-recorded population was 10.83%[104] while the unemployment percentage in the study sample was 8.69%. The differences in

values (especially regarding income and unemployment) may be explained by miscellaneous factors (e.g., recall bias, entry errors, etc.), regarding the representativeness. However, it could also be suggested that the employed – who would likely have higher median household incomes than the unemployed – would be more likely to keep their health cards (i.e., MCP cards) up to date, compared to the unemployed. Therefore, a slightly higher median household income and slightly lower unemployment percentage (re: the study sample when compared to the census-recorded population) may be explained. The difference between the number of individuals in the study sample and the number of individuals included in the census data should also be reiterated when discussing those socio-economic variables. Also worth restating is the fact that - regarding income, education, and unemployment - this study had to use Dissemination Area (DA)-level data, rather than individual-level data. And, education and income levels in the census data were calculated, based on individuals who were 15 years and older, whereas the study sample did not include anyone who was below 18 years of age.

The average distance from an individual's home to the nearest ED was 9.79 kilometres (median = 7.93 kilometres) with regards to the study sample. This compares to an average distance of 19.2 kilometres (median = 9 kilometres) from home to nearest ED when the whole province was considered. This fact is worth highlighting, should generalizability of this study's results to the rest of the province be explored. It may be noted that the relevant province-wide distances were ascertained and then recorded in a report titled "Patterns Of High Cost Acute-Care Hospitalization And Emergency Department Utilization In Newfoundland And Labrador – Final Report" (Aubrey-Bassler et al.; April, 2019) in which *n=531,187*. Regarding this variable, the recorded median distance (re: the whole province) is very similar to the recorded average distance (re: the SJMA), as stated. Therefore, this suggests that the findings from this study (re: the relationship between

distance from home to nearest ED and non-urgent ED use) could be generalized to several other parts of the province.

The study sample values with regards to certain derived variables – the COC index scores and the CCI score – were closely comparable with corresponding values from similar studies wherein COC and comorbidity were measured[25,126]. As an example, Dreiher et al. recorded several such scores from a patient sample during a similar study[126]; for that sample, the mean Usual Provider Continuity Index (UPCI) score was 0.76 (median = 0.81), while the mean Bice-Boxerman Continuity Of Care Index (COCI) score was 0.67 (median = 0.68) and the median CCI score was 0. It would be expected that a majority of individuals in such a study sample (i.e., a large sample of adult patients) would have no measurable comorbidities and therefore have CCI scores of 0; this is as opposed to a sample with, say, only geriatric patients. The median CCI score for this current study's sample was also 0, which was expected since the sample was a large sample of adult patients. The median UPCI score for this study's sample (0.85) was higher than the median COCI score for the same sample (0.71) due in main part to the former score comprising even those patients who had had only one FP consultation during the study timeframe; the latter score could only be calculated for individuals who had had multiple such consultations. The median UPCI and COCI scores (re: this study) were almost identical with the corresponding scores in the study by Dreiher at al.[126]; in each of these studies, the main reason for the difference between the median UPCI score and the median COCI score was the reason stated in the prior sentence. Regarding both COC indices, the mean and median scores for this study's sample – being relatively high - suggested that a majority of individuals in said sample were regular patients of one respective FP during the study timeframe, rather than patients who consulted multiple FPs.

The After-Hours Intensity Score (AHIS) was another derived variable, and it pertained to those FPs who had practiced under the fee-for-service model during the study timeframe. The AHIS was created after being deemed to be the most practical way of capturing the level of after-hours care that was provided by each of those relevant FPs. This variable was created with FP billing claims in mind since those claims were the only avenue through which after-hours care could be measured, based on the available databases. Comparing the AHIS to similar variables in other studies in the literature was not deemed to be appropriate; no variable in the reviewed literature shared the exact same characteristics as the AHIS. Among regular patients of FPs practicing under the fee-for-service model, only 9.7% were patients of FPs who had submitted 15% or more of their billing claims for after-hours care; however, based on submitted FP billing claims, 52.6% of patients in the study sample had made, at least, one after-hours FP consultation during the study timeframe. This suggested that use of after-hours primary care might have been more dependent on patient factors, rather than on physician factors. Additionally, FPs practicing under the fee-for-service model who had submitted 15% or more of their billing claims for after-hours care made up only 13.3% of the total number of such FPs, suggesting that routine after-hours care provisions by fee-for-service FPs was at a low level. Following on from that, a small proportion of FPs had regularly submitted billing claims for after-hours care, but a majority of patients in the study sample had utilized after-hours primary care, at least once. Therefore, it may be suggested that the after-hours billing code was often used for regular/routine FP appointments that were just delayed for various reasons beyond regular work hours. That prior statement is supported by the FP-level analysis wherein the relationship between total billing claims by FPs (re: clinic/home patient consultations) and after-hours care billing claims by FPs was explored; FPs who had submitted more total billing claims had also submitted significantly more after-hours care billing claims. It

may then be inferred that FPs who saw comparatively more patients in general also saw comparatively more patients outside of regular work hours. With that in mind, the after-hours billing code may not have been used in large measure for true after-hours care that could potentially prevent ED use. Rather, said code may have been frequently used when FPs extended regular work hours to manage high patient volumes.

The count of non-urgent ED visits (re: the study sample during the study timeframe) was difficult to compare against such counts from prior studies in other jurisdictions due to different population characteristics, models of care, ED distributions, etc. in those other jurisdictions. However, the previously referenced report (by Aubrey-Bassler et al.) suggested that the average number of ED visits per person across Newfoundland & Labrador over a 2-year period was 1.7 (median = 0), with 52% of the population making at least one ED visit. This was irrespective of the assigned Canadian Triage and Acuity Scale (CTAS) level. In a similar vein, 42.5% of the patients in this study – which was restricted to just the SJMA - had made at least one non-urgent ED visit during the 4-year timeframe, with the majority of those who did make such visits making 1-4 visits. With regards to patients in this study, the median non-urgent ED visit count was 0, as would be expected; it would be anticipated that a majority of the individuals in any jurisdiction would make no non-urgent ED visits.

VII.2 THE FINDINGS

The relevant findings that came out of this study will be discussed in detail within this section. The results pertaining to the primary objective will be discussed first, followed by the results pertaining to the variables that were controlled for (inclusive of results pertaining to the secondary objective).

After-hours care and model of care

The primary objective of this study addressed the relationship between after-hours primary care in the SJMA (as provided under two separate models of care) and non-urgent ED visits; the results pertaining to this objective will now be discussed.

The after-hours care provided by FPs practicing under the fee-for-service model of care was not significantly associated with non-urgent ED visits. This finding was dissimilar to the findings that came out of a majority of studies that were reviewed in a preceding chapter. In each of the Ontario-based studies that explored how incentivizing FPs to provide after-hours care might affect ED visits[88,90,91], the introduction of the incentives was associated with a reduction in ED visits. The patient characteristics in those studies were notably similar to those in this study. However, the after-hours primary care incentives in Ontario were associated with certain factors that were (and are) not associated with the after-hours billing code in Newfoundland & Labrador; those factors included – (a) the enrollment/rostering of patients within each FP clinic, (b) the periodic increase in the amount of the after-hours incentive for FPs, (c) the base salary that FPs received, in addition to the compensation received via fee-for-service billings, and (d) care between 5 PM and clinic opening time (on weekdays) being designated as after-hours care. In Newfoundland & Labrador, the after-hours billing code is simplistic in comparison, as it is only an add-on to the other fee-for-service billings and does not involve any prerequisites with regards to the FPs who submit it. For example, in Newfoundland & Labrador, any fee-for-service FP can bill for after-hours care; there is also no requirement for the FP to enrol/roster patients, work in a group practice, or receive a financial penalty if an enrolled patient consults another FP, after-hours. In addition, regarding weekdays, the after-hours billing code in this province can only be used for FP consultations between 6 PM and 12 AM, which means that it does not incentivize after-hours care during the

majority of the after-hours periods on weekdays. It may be suggested that the after-hours billing code in this province is not serving one of its main intended purposes (i.e., helping to reduce non-urgent ED visits) because the code is time-restricted and is not being associated with certain prerequisites, as similar incentives are in Ontario.

Several studies that were reviewed in a preceding chapter indicated that the introduction or enhancement of access to after-hours primary care was associated with a reduction in ED usage[82,84,85,86,87]. And, none of those were studies that focused on the incentivization of primary care physicians, regarding after-hours care. However, it may also be noted that one Ontario-based study suggested that the enhancement of after-hours primary care access was associated with greater ED use, despite an improvement in COC[83]. Some of the limitations of that study – including the observational study design, the reliance on administrative data, and the inability to determine the nature of each after-hours FP consultation – were common to this study, as well. In any case, with this being a cross-sectional study and not a longitudinal one, it was not possible to explore whether any periodic changes (re: after-hours primary care access within the SJMA) had any effect on ED visits.

Other studies that were reviewed in a preceding chapter indicated that the introduction of an after-hours primary care clinic or cooperative was associated with a reduction in ED usage[12,82]. However, there was no introduction of a new after-hours primary care clinic or cooperative within the SJMA during the study timeframe; therefore, the main findings from those afore-mentioned studies could only be indirectly related to the results of this study.

This finding of a lack of association between the after-hours care provided by fee-for-service FPs and non-urgent ED visits by patients from the SJMA may be explained by certain factors. Those factors will now be presented.

Firstly, patient-related factors may have contributed towards that stated lack of association. The results of patient-level analyses showed that there was a significant association between (a) FP consultations and non-urgent ED visits, (b) after-hours FP consultations and non-urgent ED visits, and (c) FP consultations and after-hours FP consultations. Notably, these relationships were analysed while controlling for patient characteristics, and the strongest relationship of the three was (b). Therefore, the study sample could have comprised a relatively large proportion of high users of all healthcare services. And, as one of the studies from Ontario suggested[83], the introduction of more healthcare services in a community could fuel more use of healthcare services in general in said community. Therefore, in this case, greater access to - and use of - after-hours FP services could have led to greater use of EDs, as well.

Secondly, the after-hours billing code may have been used more for FP overtime work (i.e., regular patient appointments that could not fit within regular work hours due to high patient volumes), rather than for urgent after-hours care. When "calendar date" was used as the unit of analysis, it was shown that on days when there were more after-hours FP visits, there was a greater likelihood of more non-urgent ED visits, too. A possible explanation for this is – seasonal factors (e.g., flu outbreaks) may have led to increases in visits to both FP clinics and EDs at certain times; and, at the EDs, presentations of patients with only flu symptoms would have typically been deemed to be non-urgent. The analysis that showed that FPs who submitted more total billing claims also submitted more after-hours billing claims supports the idea that high patient volumes at certain FP clinics may have led to increased after-hours billing claims; a coexisting need for urgent care may have been largely absent.

Thirdly, a "Saturday effect" may have contributed to the lack of a significant relationship between FP after-hours consultations and non-urgent ED visits. An increased need for care on a Saturday

would have led to more ED visits, as well as to more FP consultations on the day; crucially, as per the rules, every single FP consultation on a Saturday could be billed as an after-hours consultation. Figure V.15 shows that Saturday was the day of the week in which the highest number of after-hours billing claims were submitted by fee-for-service FPs; this supports the possibility of an oversized effect being exerted by Saturday FP consultations on the main relationship being studied. It may be added that Mondays are traditionally the busiest days of the week at both FP clinics and EDs, per anecdotal evidence; this may explain the relatively higher numbers of both after-hours FP consultations and non-urgent ED visits on Mondays. Anecdotal evidence also suggests that (a) March and April are months during which flu cases rise in Newfoundland, and (b) July and August are months during which many FPs in the SJMA take their annual vacations. Therefore, the relatively higher numbers of after-hours FP consultations in March and April plus the relatively higher numbers of non-urgent ED visits in July and August may be partially explained.

Fourthly, FPs providing after-hours care may have been subsequently referring many of the patients who were seen after normal work hours to an ED. This thought is also supported by the finding that additional non-urgent ED visits were more likely on days when there was a relatively high number (>150) of after-hours billing claim submissions by FPs (*see Tables V.12 and V.13*). However, such referrals could have been related to seasonal factors (e.g., flu outbreaks), as well. Unfortunately, there was no way of ascertaining the diagnoses/conditions that led to any of the after-hours billing submissions by FPs. This prevents us from further delving into the above four possible explanations.

The next noteworthy result pertained to the model of care that was (and is) followed by the university-affiliated Academic FPs. The Academic FP model was associated with a significant difference, in terms of non-urgent ED visits. Patients of the Academic FPs were 17% less likely

to make non-urgent ED visits, compared to patients of FPs practicing under the fee-for-service model who had submitted <5% of billing claims for after-hours care (note – the latter group of patients made up 56% of the study sample and formed the reference category). The relevant literature did not describe a replica of the Academic FP model in another jurisdiction. However, multiple studies[127,128,129] described an Ontario-based model of primary care wherein FPs - who were paid via capitation and had rostered patients - were able to (when necessary) direct their patients to telephonic triage via the Telephone Health Advisory Service (THAS)[130]. It may be mentioned that THAS is staffed by nurses, but it includes on-call physician back-up when needed[130]. That Ontario-based model was associated with fewer non-urgent ED visits – in a majority of the jurisdictions where it was introduced - when it was compared against traditional fee-for-service FP models[128,129]. The postulated reasons for that model helping to apparently reduce non-urgent ED use were – (a) the rostering, (b) the requirement to provide after-hours or on-call coverage, (c) the better COC that the model encouraged, and (d) the high level of patient education that was associated with the model. Since there are several similarities between the Academic FP model in the SJMA and the Ontario-based model (involving rostered patients and non-fee-for-service FPs), both of these models could be expected to have similar effects on ED use, and that was apparently the case. It may be noted that the Ontario-based model included a requirement to provide after-hours care, and three of the publications mentioned in this paragraph did examine the relationship between the introduction of the model and non-urgent ED visits. However, none of these publications were reviewed in great detail because (a) the report by Glazier et al.[127] provided postulates and suggestions, but no data on the relationship between after-hour primary care and non-urgent ED use, (b) the study by Singh et al.[128] explored the effect of the described model on non-urgent ED use, but it did not specifically relate after-hours primary care

to any form of ED use, (c) the publication by Singh et al.[128] included a mention that, though mandated within the described model, only 74% of FP practices that had introduced this new model were providing the requisite after-hours/on-call coverage, and (d) the study by Ly et al.[129] explored the effect of the described model on low-acuity (i.e., non-urgent) ED use, but it did not specifically relate after-hours primary care to any form of ED use.

The finding of the association of the Academic FP model in the SJMA with fewer non-urgent ED visits may be explained by certain factors that pertain only to the Academic FPs, and not to the FPs practicing under the fee-for-service model. Those factors will now be presented.

The factors include - (a) the Academic FP group has a resident on call at all hours to answer patient calls and to provide telephonic triage, (b) the Academic FPs have relatively smaller practice sizes, and this allows them to spend more time with each patient, thereby encouraging stronger patient-FP relationships and potentially improving COC, (c) one Academic FP is always available to see a patient of any Academic FP, should that be necessary after a telephonic consultation, and (d) the Academic FP model involves learners, which could alleviate physician workloads and improve care.

Following on from the above points, and as concluded via prior studies in other jurisdictions[22,24] - the stronger that the patient-FP relationship is, the less likely the patient is to seek non-FP forms of care at short notice. After the dissemination of the main results from this study, feedback from members of the previously mentioned Patient Advisory Council (PAC) supported this inference on the benefits of better COC. Therefore, the association of the Academic FP model with lower numbers of non-urgent ED visits may be due in large measure to the model encouraging a high level of COC. Similarly, the literature suggests that patients who are well aware of the after-hours care provisions of their regular FPs are more likely to utilize said care[82,84]; feedback from PAC

members indicated that regular patients of the Academic FPs were fully aware of (and generally happy with) the after-hours care provisions of their FPs.

Since the Academic FP model was associated with lower numbers of non-urgent ED visits while the fee-for-service FP model was not, it was advisable to compare the health of the two patient groups. Therefore, the health of the patient group that had Academic FPs as usual providers of care ideally needed to be compared with the health of the patient group that had fee-for service FPs as usual providers of care. However, the only available measure to make this comparison was the CCI score, and the mean CCI score regarding patients of the Academic FPs (i.e., 0.54) was similar to the mean CCI score regarding patients of the fee-for-service FPs (i.e., 0.59). In any case, using the CCI score alone to make inferences about a population's health is problematic due to these limitations – (a) the CCI relies on diagnoses recorded in administrative data, (b) FPs typically record only a single diagnosis per patient in billing/visit records, which may not capture multiple diagnoses that a patient may have, (c) while hospitalization data are usually more comprehensive than outpatient billing records, there may be omissions in the former data, too, (d) FPs who spend relatively more time with each of their patients – as Academic FPs are suggested to do – are likely to record more accurate/complete diagnoses, as compared to FPs who spend less time with their patients due to heavier workloads, (e) incomplete patient histories can lead to incorrect diagnoses being entered during certain hospitalizations, and (f) hospitalization data may not distinguish between a complication that arose during a patient's hospital stay and a pre-existing condition of the patient.

Variables that were controlled for

A discussion of the results pertaining to the respective variables, which were controlled for during the main analyses and/or were part of the secondary analysis now follows.

Age

An increase in age was associated with a lesser likelihood of making non-urgent ED visits. Therefore, younger individuals appeared to be more likely to make non-urgent ED visits, compared to older individuals. This same finding was noted in prior studies that focused on age-related ED usage[131,132]; younger patients were also less likely to be admitted following their ED visits, compared to older patients[132]. This finding may be explained by older patients – who are generally sicker in any population – (a) having a better understanding of healthcare provisions in the region, (b) having stronger relationships with their usual providers of care, and (c) being more likely to be assigned a lower (i.e., more urgent) CTAS level at ED triage.

Sex

Female patients were more likely to make non-urgent ED visits, compared to male patients. Although this finding is not universal among the existing literature, relatively greater use of EDs by female patients was noted in certain studies that explored ED usage trends over two years or more[133,134]. The fact that obstetric and/or gynecological conditions often lead to ED visits may help to explain this finding; regarding this study specifically, the stated explanation is supported by feedback from patients. In addition, the literature suggests that female individuals are relatively higher users of healthcare services in general, as well[125].

Socio-economic status

Individuals from DAs comprising households with higher median incomes were slightly less likely to make non-urgent ED visits. Similarly, individuals from DAs with higher post-secondary

education completion rates were slightly less likely to make non-urgent ED visits. However, DA-level unemployment rates were not significantly associated with non-urgent ED visits. The existing literature suggests that better access to FPs - and to primary care in general - among the more educated and more affluent individuals in a community may be an explanation for this finding[135]. The literature similarly shows that relatively underserved communities - which face educational and economic challenges - also face more barriers to primary care (including to after-hours primary care)[135].

Distance to ED

Individuals who lived closer to an ED were more likely to make non-urgent ED visits. A study that specifically explored how geography impacts ED usage indicated that ED visit rates decreased, as the distance between the home and the nearest ED increased[136]. Logic would also dictate that the closer to an ED that one's home is, the more likely one would be to make use of said ED for any condition that appears to require prompt care.

Comorbidity

Patients with more comorbidities were more likely to make non-urgent ED visits. This finding is also widely described in the existing literature on the topic[137,138]. Patients with comorbidities are likely to be sicker and more symptomatic, compared to individuals without comorbidities. Therefore, patients with comorbid conditions are more likely to present at EDs - especially when they cannot access primary care - even though they may not actually require urgent care at the time of each ED presentation (per their respective CTAS levels).

Continuity Of Care (COC)

Patients with higher COC scores were less likely to make non-urgent ED visits. This finding was determined via the secondary objective of this study; this finding has also been noted in several

other studies within the literature[24,139]. A strong relationship between a patient and his/her usual provider of care often diminishes the need for the patient to seek primary care from anyone but his/her usual provider of care. Patient confidence in the expertise of a usual provider of care (i.e., FP), greater physician knowledge of the patient's history, more time spent during patient-physician consultations, and a close patient-FP relationship have all been shown to enhance the level of COC[24]. The strength of the association (per this study) between higher COC scores and fewer non-urgent ED visits may have been stronger, if "usual clinic of care" was examined, rather than "usual provider of care". This is because a regular patient of a multi-practitioner clinic could have been seen by different FPs at that clinic at different times; however, it was not possible to account for clinics where multiple fee-for-service FPs practiced together.

VII.3 LIMITATIONS

While interpreting the results of the various analyses performed during this study, it is also important to consider the limitations of the study. Specifically, having to exclusively use the available historical data meant that the study was constrained by the available variables. And, major limitations included the following –

Having to indirectly determine patient visits – regarding the fee-for-service FPs - via the billing claims from those FPs was a limitation because it meant that each of these variables could only be ascertained via those claims - (a) the usual provider of care for each patient, (b) the numbers of FP after-hours visits, and (c) the COC indices. As such, it cannot be definitively stated that each after-hours billing code submission by an FP practicing under the fee-for-service model was for an after-hours appointment. While billing records are generally accurate since they are a true reflection of how fee-for-service FPs are paid, we do not conclusively know how many after-hours billing code

submissions were for actual appointments after normal work hours. It may be reiterated that, as far as the respective Academic FPs were concerned, actual patient visit information (with respective time stamps, patient diagnoses, etc.) was available.

Determining whether an ED visit was urgent or non-urgent had to be based on the particular CTAS level that was assigned to the patient by the ED triage nurse, rather than on the complete diagnosis pertaining to each patient presentation. Since some amount of subjectivity on the part of the nurse would have been associated with the CTAS level that was allotted at the initial triage, there was the potential for inaccuracies when the final dataset – which had to include only non-urgent ED visits - was constructed.

Another limitation that relates to the CTAS level is the fact that not all patients who are triaged and assigned a CTAS level of 4 or 5 can be appropriately managed in a primary care setting. Patients who require suturing and/or care for simple fractures are examples of this since most primary care physicians do not do suturings and no primary care physician can offer adequate fracture care. Therefore, despite the aim of this study to only include ED visits that a visit to an FP could potentially have prevented, it must be recognized that a small proportion of the ED visits included in the final dataset were not preventable, despite seemingly being non-urgent.

The need to allot DA-level values (re: income, education, and unemployment) to each study subject - rather than including person-specific values for those variables - was not ideal because such aggregated data bring in the possibility of an ecological inference fallacy; values assigned to a group may not pertain to each individual within said group. Since census-related data is self-reported, there could have been some accuracy-related issues with regards to the DA-level data (re: income, education, and unemployment), as well. Additionally, a subject who had resided in more than one DA during the study timeframe had to still be allotted to one particular DA of

residence, based on the criterion that was explained in Chapter IV. That criterion – though the most appropriate under the circumstances – could have certainly led to some inaccurate allocations (re: patients to DAs); the stated criterion was applied to 12,064 subjects in the study sample (i.e., 10.1% of the study population).

An ecological inference fallacy could also have occurred because not all of the patients who were assigned to one particular FP (i.e., usual provider of care) would have utilized any available FP after-hours care in the same manner. An attribute of a group may not apply to each member of said group.

It would have been preferable to know more about each FP (e.g., age, gender, years of experience, educational background, etc.) during the analyses and the subsequent interpretation of the results. FP characteristics within the final dataset could potentially have helped indicate whether any FP-related factor (e.g., years of work experience) had a significant relationship with non-urgent ED visits by patients. Unfortunately, despite being requested, data with FP characteristics were not obtainable in a timely fashion due to the lack of ministerial approval to access FP-related data that were not already deidentified.

Not having information about fee-for-service FP practice characteristics was a limitation. This was because explanations of the results could have been more comprehensive if we had known whether, for example, a certain FP practiced in a walk-in clinic, or in a clinic that routinely provided after-hours care, or in a clinic where after-hours care was never provided. As it was, there could only be an assumption that an FP with a relatively high proportion of after-hours billing claims was practicing in a walk-in clinic. Information on group FP practices versus individual FP practices would have been useful, too. We also had no way of knowing if a billing claim for after-hours care pertained to urgent care, or was just for a patient appointment during regular work hours

that had been delayed beyond regular work hours. Knowing whether an FP after-hours billing claim was for care pertaining to an urgent versus a chronic issue would have been beneficial, as well.

It would also have been beneficial if "Distance from home to clinic of usual provider of care" could have been controlled for, but this variable was not obtainable. However, being able to control for "Distance from home to nearest ED" was fortunately possible.

The fact that the study timeframe was 2011-2015 was a limitation. A more recent timeframe could have potentially been more relevant to the current care provisions in the SJMA. However, only relevant data up until Fiscal Year 2014 were available at the time.

Having to exclusively focus on the SJMA due to the non-availability of relevant data from non-urban parts of this province meant that only an urban patient population (and FPs practicing in the same urban area) could be part of this study. A province-wide study would have been more representative - and potentially more informative - due to the wider variety of patient characteristics and FP care provisions that would likely be within such a province-wide study. However, it should be noted that ED operations and staffing processes in rural areas are different from those in urban areas while FP compensation typically differs, too; a province-wide study would cause difficulties during the analyses.

Not being able to use the same dataset(s) when calculating the CCI for each patient in the study sample was a limitation that has been previously stated and elaborated upon.

A minor limitation pertained to the fact that all of the available databases that contributed towards the study's final dataset used biological sex - rather than gender – to classify patients; therefore, every patient within the study was classified as either male or female, only.

VII.4 STRENGTHS

There were several strengths of this study, and those will be enumerated, too. Noteworthy strengths included the following –

This is the first study of its kind, regarding the jurisdiction of the SJMA. Examining the relationship between after-hours FP care and non-urgent ED patient visits is a potentially valuable first step before more in-depth research and/or policy-based ideas on the topic could be considered within the jurisdiction.

The large sample size (*n=119,443*) was a noteworthy strength. The number of subjects in the study sample was comparable with the rough estimate of residents in the SJMA (who were 18 years of age or older) during the study timeframe, which suggested that the study sample was representative of the community under study. It may be noted that the 2016 Census indicated that there were 165,640 individuals who were 19 years or older and residing in the SJMA. However, not all of those individuals would have had valid MCP cards during each of the four years within the study timeframe; individuals also needed to have made, at least, one FP consultation during the study timeframe to be in the study sample and be linked to a usual provider of care.

The number of FPs (*n=212*) who were included within this study as usual providers of care for one or more study subjects was similar to the estimate of FPs who were practicing in the SJMA on a full-time basis during the study timeframe. This statement is based on province-wide records at the NLMA[50].

Even though this was a cross-sectional study, the fact that the study timeframe spanned four years was beneficial because it could capture the relevant information over a wider span of time, as compared with many other cross-sectional studies. A wider timeframe was especially helpful in terms of allotting a usual provider of care to each patient with a greater degree of certainty.

It was possible to control for eight different variables. The fact that seven out of those eight variables significantly predicted the main outcome of interest was noteworthy, as well because that fact helped to add more context and nuance to the overall findings. Being able to control for those eight variables improved the quality of the relevant regression models, as well; Akaike and Bayesian Information Criteria indicated that regression models with all eight control variables were superior to corresponding models in which not all of those eight control variables were included.

Being able to use "Distance to ED" as one of the control variables was beneficial. This point is noteworthy because most studies on this topic do not include "Distance to ED" as a covariate, despite close proximity of one's home to an ED being a potential driver of non-urgent ED visits (as suggested by the results of this study, too).

Using two different approaches (re: the primary analyses) to help answer the same question helped to strengthen/validate the results from each of those two approaches. Those respective approaches were – (a) using patient-level analyses to explore the relationship between FP after-hours consultations and non-urgent ED visits, and (b) using the calendar date as the unit of analysis to explore the relationship between FP after-hours consultations and non-urgent ED visits.

Adjusting standard errors for clustering by FP during the patient-level primary analyses ensured that potentially similar behaviors (re: non-urgent ED visits) by individuals in a patient cluster – as influenced by care from the cluster's usual provider of care - were accounted for.

The ability to perform analyses pertaining to the secondary study objective (i.e., the relationship between COC and non-urgent ED patient visits) while using two separate COC indices was an added strength/benefit. These analyses helped to answer the question of whether COC – regarding

patients in the SJMA – was associated with non-urgent ED use by patients, and they also helped to verify that answer.

The lack of any missing data (re: the primary analyses) was also noteworthy since that fact led to the statistical analyses being more robust. The data custodian - NLCHI - confirmed this lack of missing data when the necessary data was provided for this study.

VII.5 FEEDBACK OBTAINED

As stated in the previous chapter, feedback was obtained from some PAC members, as well as from some physicians at large. Points from the obtained feedback that helped to further illustrate the study results were particularly sought.

The feedback obtained from the patients helped to reinforce several findings from this study. Also of note were - (a) the patients' preferences to see the Academic FP model of care be enhanced/expanded, if possible, and (b) the patients' opinions that stronger relationships between patients and their respective primary care physicians – which ought to be encouraged more - would substantially reduce the need to visit an ED for care.

The feedback from the physicians was more related to the study design and the models of care. Therefore, direct explanations from the physicians with regards to this study's results were not obvious. However, the feedback from the physicians provided valuable suggestions for future research, regarding the topic of this study.

VIII. CONCLUSIONS

The results of this study led to several conclusions, as described in the following statements.

The after-hours care provided by the Family Physicians (FPs) who practiced under the fee-for-service model in the St. John's Metropolitan Area (SJMA) did not appear to be significantly related to the numbers of non-urgent Emergency Department (ED) visits by adult patients from the SJMA.

The model of care followed by the university-affiliated Academic FPs was significantly associated with a reduction in the numbers of non-urgent ED visits by adult patients from the SJMA; however, this was an observational study that could not determine causality.

Better Continuity Of Care (COC) was significantly associated with a reduction in the numbers of non-urgent ED visits by adult patients from the SJMA.

A reduction in the numbers of non-urgent ED patient visits (i.e., a desirable outcome) was also significantly associated with each of the following - (a) older age, (b) the male sex, (c) a higher median household income in area of residence, (d) a higher education level in area of residence, (e) a greater distance from home to nearest ED, and (f) fewer comorbidities.

IX. RECOMMENDATIONS

With the conclusions of this study in mind, several recommendations may be put forward.

From the perspective of clinicians: Those Family Physicians (FPs) practicing under the fee-for-service model could assess whether the after-hours care being provided by them is aimed at preventing non-urgent Emergency Department (ED) patient visits, or is being provided primarily for other reasons (e.g., to clear patient appointments that cannot be cleared during regular working hours). On the other hand, the university-affiliated Academic FPs could attempt to further examine the specific features that have made their model of care be apparently more successful (re: the prevention of non-urgent ED patient visits); that endeavor might help to enhance their model of care in the future, too. In any case, it would be imperative for knowledge dissemination (re: this study) to reach as many practicing FPs as possible in the St. John's Metropolitan Area (SJMA) before any further examinations into the study results can be performed. Knowledge dissemination has already included – poster presentations, oral presentations to select audiences, and publications of the study summary in forums and pamphlets; future dissemination plans include – seminar presentations and publications in peer-reviewed journals.

From the perspective of patients: Greater knowledge dissemination from this study - as well as greater education - would be advisable, especially in order for patients to understand more about (a) the most appropriate reasons for vising an ED, (b) how best to make use of primary care services, and (c) the advantages of having a strong relationship with one's primary care provider.

From the perspective of policymakers: It may be beneficial to explore possible ways of expanding the model of care being followed by the university-affiliated Academic FPs. And, during deliberations, it would be advisable to consider certain aspects of that model of care, such as – smaller physician practice sizes, involvement of learners in the model, etc. Therefore, specific

aspects of the model of care followed by the Academic FPs could be examined separately, and one or more of those aspects could then be expanded/improved if appropriate. The specific factors that led to the stated relationship (i.e., reduced non-urgent ED usage by patients of the Academic FPs) cannot be definitively stated via this study. However, there can be further exploration of the possible contributing factors, such as – the 24-hour access to telephonic consultations and the telephonic triage option. Considerations about refining the fee-for-service Family Physician (FP) model of care in the region might also be appropriate, especially if the original goals that led to the creation of the after-hours billing code ("139") are not being met (note – one of the stated primary reasons why a distinct billing code for FP after-hours work was created was to help reduce unnecessary ED use; however, this billing code could also have been created to encourage FPs to see more patients on a daily basis and/or to register more patients with their respective practices). In any case, when upcoming evaluations of the fee-for-service FP model in the SJMA are undertaken, it would be beneficial to include "ED Usage" as an outcome measure during such evaluations.

From the perspective of researchers: A more robust study – especially a study utilizing experimental data - would be advisable; in the order of preference, the options for a superior study would be –

(a) A Randomized Control Study in which each full-time practicing FP in the region would be allotted to one of two groups with the FPs in one group mandated to provide a stipulated form of after-hours care while the FPs in the other group would be required to not provide any after-hours care. The two groups would then be followed forward for a predetermined period of time and the behaviors of patients (re: non-urgent ED visits) of the FPs in the respective groups would be compared and contrasted. However, it may be noted that

recruitment of FPs into such studies has traditionally been challenging; this is a caveat to be borne in mind.

(b) An Interrupted Time-Series Observational (Longitudinal) Study in which all adult patients in the region would be followed forward and their behaviors (re: non-urgent ED visits) would be measured before and after an intervention (i.e., the initiation of unrestricted and region-wide access to after-hours FP care). This kind of study could also help, among other things, to shed light on whether the after-hours billing code – which would be an intrinsic part of the intervention – is serving its intended purpose(s).

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APPENDICES

I: Ethics Approval Letters (from the Health Research Ethics Board)

I.1 Initial Approval Letter

Ethics Office,

Suite 200, Eastern Trust Building,

95 Bonaventure Avenue,

St. John's, NL A1B 2X5

February 22, 2017

Dear Mr. Siromani:

Researcher Portal File # 20171551

Reference # 2017.021

RE: "Determinants Of Potentially Preventable Emergency Department Utilization – With An Emphasis On Family Physician Work Hours - By Adult Patients In The St. John's Metro Area."

Your application received a delegated review by a sub-committee of the Health Research Ethics Board (HREB). Full approval of this research study is granted for one year effective February 21, 2017.

This is your ethics approval only. Organizational approval may also be required.

It is your responsibility to seek the necessary organizational approval from the Regional Health Authority (RHA) or other organization as appropriate. You can refer to the HREA website for further guidance on organizational approvals.

This is to confirm that the HREB reviewed and approved or acknowledged the following documents (as indicated):

- Application, approved
- Letter of request, approved
- List of Variables, approved

MARK THE DATE

This approval will lapse on February 21, 2018. It is your responsibility to ensure that the Ethics Renewal form is submitted prior to the renewal date; you may not receive a reminder. The Ethics Renewal form can be found on the Researcher Portal as an Event form.

If you do not return the completed Ethics Renewal form prior to date of renewal:

- ***You will no longer have ethics approval***
- *You will be required to stop research activity immediately*
- *You may not be permitted to restart the study until you reapply for and receive approval to undertake the study again*
- *Lapse in ethics approval* ***may result in interruption or termination of funding***

You are solely responsible for providing a copy of this letter, along with your approved HREB application form; **to Research Grant and Contract Services** should your research depend on funding administered through that office.

Modifications of the protocol/consent are not permitted without prior approval from the HREB. **Implementing changes without HREB approval may result in your ethics approval being revoked, meaning your research must stop.** Request for modification to the protocol/consent must be outlined on an amendment form (available on the Researcher Portal website as an Event form) and submitted to the HREB for review.

The HREB operates according to the Tri-Council Policy Statement: Ethical Conduct for Research Involving Humans (TCPS2), the Health Research Ethics Authority Act (HREA Act) and applicable laws and regulations.

You are responsible for the ethical conduct of this research, notwithstanding the approval of the HREB.

We wish you every success with your study.

Sincerely,

Ms. Patricia Grainger (Chair, Non-Clinical Trials Health Research Ethics Board)

Dr. Joy Maddigan (Vice-Chair, Non-Clinical Trials Health Research Ethics Board)

CC: Dr. Kris Aubrey-Bassler

I.2 Final Renewal Letter

Researcher Portal File #: 20171551

Dear Mr. Jerome Siromani

This e-mail is notification that your ethics renewal for study **HREB# 2017.021 –** ***Determinants Of Potentially Preventable Emergency Department Utilization – With An Emphasis On Family Physician Work Hours - By Adult Patients In The St. John's Metro Area*** **- has been approved**.

Please log in to the Researcher Portal to view the approved event.

Ethics approval for this project has been granted for a period of twelve months effective from February 21, 2019 to February 21, 2020.

The ethics renewal will be reported to the Health Research Ethics Board (HREB) at their meeting dated January 17, 2019.

Joan Dalton
Secretary
Health Research Ethics Board, Non-Clinical Trials
95 Bonaventure Avenue, Suite 200
St. John's, NL
A1B 2X5
Telephone: 709-777-8942/6974
Email: hreb.nct@hrea.ca
Website: www.hrea.ca
Office Hours: 8:30 a.m. – 4:30 p.m. (NL TIME) Monday-Friday

II. Data Request Approval Letter

(from the Newfoundland & Labrador Centre for Health Information)

Newfoundland & Labrador Centre for Health Information

August 20, 2018

Jerome Siromani

Faculty of Medicine

Memorial University

Dear Mr. Siromani:

RE: Determinants of Potentially Preventable Emergency Department Utilization — With a Focus on St. John's and Family Physicians.

Our Reference 1M111691.

This is to advise you that the Centre's Secondary Uses Committee (SUC) has reviewed your application to request de-identified Record-Level Information for Secondary Use. Having consulted with the SUC chair, I authorize the release of the requested data.

The approval of your application and use of the requested data is conditional upon the following:

- The data received must be used only for the purposes of this request. Any future uses and/or disclosures of the data provided must have HREB approval as well as approval from the Centre;
- Members of the research team accessing the released data must not attempt to re-identify the subjects of the released data;
- Cell counts or statistics based on cell counts less than 5 are not published;
- The data must be stored on a Memorial University asset and must not be placed on a personal device;
- All members of the research team must comply with Memorial University's policies and procedures for privacy, security and data storage, and have signed an Oath of Confidentiality;
- At the end of the data retention period data must be disposed of by ensuring the drives on the device are appropriately sanitized (securely deleted or destroyed) prior to the disposal or repurposing of the system or any storage components;
- If there are changes with the research study and/or research team then the Centre must be notified. Any amendments or updated ethics approval(s) will be supplied to the Centre accordingly;
- Transfer of all record-level data to and from the Centre will be completed using the Centre's Managed File Transfer System (MFT);

- The Centre reserves the right to conduct an audit review of requestors who have been disclosed record-level data.

Please sign below and return to acknowledge you accept the above conditions of approval.

On behalf of the Centre, I wish you every success with this research study.

Sincerely,

Gillian Sweeney

Vice President, Clinical Information Programs and Quality, NL Centre for Health Information

CC: Donna Roche, Chair, Secondary Uses Committee

CC: Dr. Kris Aubrey-Bassler, Supervisor

III. The Charlson Comorbidity Index Score

The Charlson Comorbidity Index score was created, based on research by M. E. Charlson, P. Pompei, K. L. Ales, and C. R. MacKenzie; the description of this measure was published by these researchers in "A new method of classifying prognostic comorbidity in longitudinal studies: development and validation" (Journal of Chronic Diseases (1987); 40(5): 373-83).

This score is calculated by scoring and weighting 17 items (i.e., 16 disease conditions that the patient may or may not have, plus the age of the patient).

A patient receives points (as stated within the parentheses below), based on the presence of the following conditions (with 0 points being given, if the stated condition is absent) –

- Myocardial Infarction (+1)
- Congestive Heart Failure (+1)
- Peripheral Vascular Disease (+1)
- Cerebrovascular Disease (+1)
- Dementia (+1)
- Chronic Pulmonary Disease (+1)
- Rheumatological Disease (+1)
- Peptic Ulcer Disease (+1)
- Liver Disease (+1 if mild; +3 if moderate/severe)
- Diabetes (+1 if controlled; +2 if uncontrolled)
- Hemiplegia/Paraplegia (+2)
- Renal Disease (+2)
- Malignancy (+2 if localized; +6 if metastatic)
- Leukemia (+2)
- Lymphoma (+2)
- AIDS (+6).

In addition, a patient who is 50 years of age or older receives additional point(s) –

- 50-59 years of age (+1)
- 60-69 years of age (+2)
- 70-79 years of age (+3)
- 80 years of age or older (+4)

The maximum possible Charlson Comorbidity Index score is 37, and the minimum possible is 0.

For this study, the Charlson Comorbidity Index score was calculated for each patient, based on recorded diagnoses in hospitalization data and Family Physician visit data (note - the latter data were in one database for patients of fee-for-service Family Physicians and in another database for patients of Academic Family Physicians).

As an example - a 63-year-old patient with (a) a history of Myocardial Infarction, (b) a Peptic Ulcer, and (c) moderate Liver Disease would receive a Charlson Comorbidity Index score of 7 (i.e., 2 + 1 + 1 + 3).

IV. The Usual Provider Continuity Index Score

As stated by N. S. Hanafi, A. Abdullah, P.Y. Lee, S. M. Liew, Y. C. Chia, and E. M. Khoo in "Personal Continuity of Care in a University-Based Primary Care Practice: Impact on Blood Pressure Control" (PLoS One (2015); 10(7): e0134030), the Usual Provider Continuity Index score is – "the ratio of patient visits to the usual provider TO the total number of visits to all providers" in a given time period.

All Usual Provider Continuity Index scores are >0 and ≤1.

For this study, the relevant time period was – Fiscal Year 2011 to Fiscal Year 2014; the providers in question were Family Physicians.

Therefore, as an example – a patient who had a total of 18 clinic/home consultations with various Family Physicians during the study timeframe and had 11 of those consultations with his/her usual provider of care would receive a Usual Provider Continuity Index score of 0.61 (i.e., 11 ÷ 18).

V. The Bice-Boxerman Continuity Of Care Index Score

As stated by T. W. Bice and S. B. Boxerman in "A quantitative measure of continuity of care" (Medical Care (1977); 15(4): 347-9), the Bice-Boxerman Continuity Of Care Index score is derived by the following formula –

$((\text{SUM}(n_j^2))-n)/(n(n-1)))$ from $j = 1$ to $j = s$)

where n is the total number of FP-related visits, n_j is the number of visits to the FP j, and s is the total number of FPs seen.

The Bice-Boxerman Continuity Of Care Index score is based on the number of visits made to each physician by a certain patient in a given time period; this score reflects the relative share of all of the patient's physician visits.

All Bice-Boxerman Continuity Of Care Index scores range from 0 to 1.

For this study, the relevant time period was – Fiscal Year 2011 to Fiscal Year 2014; the physicians in question were Family Physicians.

Therefore, as an example – let us focus on a patient who had a total of 8 clinic/home consultations with various Family Physicians during the study timeframe, and had 3 of those consultations with his/her usual provider of care, 2 of those consultations with another Family Physician, and each of the remaining 3 consultations with 3 other Family Physicians. This patient would receive a Bice-Boxerman Continuity Of Care Index score of 0.14, as a result of $((3^2 + 2^2 + 1^2 + 1^2 + 1^2) – 8) ÷ (8 (8 – 1))$.

VI. The After-Hours Intensity Score

The After-Hours Intensity score was specifically created to capture the relative amount of after-hours care provided by each fee-for-service Family Physician in this study. It was a physician-level measure that was defined as – the proportion of after-hours billing claims TO total billing claims, all within the study timeframe (i.e., Fiscal Year 2011 to Fiscal Year 2014).

After-Hours Intensity scores may range from 0 to 1.

As an example – a Family Physician who had submitted 5,591 billing claims for clinic/home consultations during the study timeframe out of which 523 claims were for after-hours care would receive an After-Hours Intensity score of 0.09 (i.e., 523 ÷ 5,591). This effectively means that 9% of the billing claims by this Family Physician were billing claims for after-hours care.

VII. Poisson Versus Negative Binomial Regression

Since the first approach towards the study's primary objective involved two possible outcome variables that each involved count data, the required regression analyses needed to be either Poisson or Negative Binomial.

The mean and the variance of the main outcome variable (i.e., NON_URGENT_TRIAGE_LEVEL_COUNT) were – 0.99 and 5.79, respectively.

The mean and the variance of the supplementary outcome variable (i.e., NON_WORKING_HOURS_ED_VISIT_COUNT) were – 0.62 and 3.13, respectively.

Since the mean was not equal to the variance for either of the above variables, it was concluded that the relevant data did not strictly follow Poisson distributions. Therefore, Negative Binomial regression models were deemed to be more appropriate than Poisson models. The quality of the subsequently constructed Negative Binomial models was shown to be superior to the quality of the corresponding Poisson models.

In addition, the ratio of the Deviance statistic TO the Degrees of Freedom was obtained for each of the outcome variables, as follows –

For the NON_URGENT_TRIAGE_LEVEL_COUNT variable – the ratio was 2.31 for Poisson and 1.13 for Negative Binomial; as the latter value was closer to 1, Negative Binomial regression was indicated here, too.

For the NON_WORKING_HOURS_ED_VISIT_COUNT variable – the ratio was 1.73 for Poisson and 0.99 for Negative Binomial; as the latter value was closer to 1, Negative Binomial regression was indicated here, too.

VIII. A Presented Poster – Summary Of The Study

The following (enlargeable) poster was presented at the Science, Health And Research Education (SHARE) Summit, which was held during November 2019 in St. John's, Newfoundland & Labrador.

NEWFOUNDLAND AND LABRADOR SUPPORT
Support for People and Patient Oriented Research and Trials

Determinants Of Potentially Preventable Emergency Department Utilization – With A Focus On Family Physician Work Hours - By Adult Patients In St. John's, Newfoundland & Labrador

- Jerome Siromani PhD (C) [Co-supervisors – Kris Aubrey-Bassler MD, Brendan Barrett MD] -

[Department of Clinical Epidemiology, Faculty of Medicine, Memorial University – St. John's Campus]

MEMORIAL UNIVERSITY

Introduction

- Wait-times for patients in (hospital) Emergency Departments across Canada are very high and need to come down to improve patient care.
- Studies suggest that about half of the patients who go to Emergency Departments in Canada do not need urgent care (note - "urgent care" means that a patient must be seen within 30 minutes).
- Other studies have suggested – (a) most patients prefer to visit their Family Physician instead of an Emergency Department, if their Family Physician is accessible when needed and (b) non-urgent Emergency Department visits increase wait-times for all patients in those Emergency Departments.
- Numbers of patient visits to Emergency Departments (and associated wait-times) have been steadily increasing in St. John's.
- A study to see if more after-hours care (between 5 PM and 9 AM on weekdays, and on weekends) by Family Physicians in St. John's could help prevent non-urgent Emergency Department visits by patients from the city is worthwhile.

Patient Engagement

With respect to the Newfoundland & Labrador SUPPORT Patient Advisory Council (PAC):

February, 2018

- Presented the outline of the study.
- Requested and received feedback (plus suggestions that could be blended into the study).

July, 2019

- Presented the key takeaways from the study.
- Requested and received feedback (including - questions for practicing Family Physicians in St. John's, and possible policy initiatives).

Methods and Results

METHODS

- Merge six sets of data that covered the study period (April 1, 2011 to March 31, 2015).
- Determine for each patient (within study period) –
  - i) Age and gender;
  - ii) The average income level, education level and unemployment level in the area of residence;
  - iii) Previously-diagnosed medical conditions;
  - iv) Approximate distance from home address to the nearest Emergency Department;
  - v) If seen by one Family Physician, or by multiple;
  - vi) Level of after-hours care provided by the Family Physician who was visited, most often.
- Find out the significant relationships within the data.

KEY RESULTS

- Patients of the Academic Family Physicians (who all work within Memorial University in St. John's) made significantly fewer visits to Emergency Departments for non-urgent reasons, compared to patients who did not have regular access to after-hours care from their usual Family Physicians... the difference between the two groups was about 17%.
- No significant relationship was found between the after-hours care provided by the Fee-For-Service Family Physicians (in St. John's) and the numbers of non-urgent Emergency Department visits made by patients of these Family Physicians.

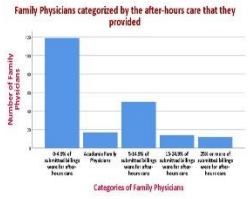
KEY NUMBERS

- Family Physicians who had been practicing, regularly during the study period = 212.
- Patients who had one of the above Family Physicians as their "usual provider of care" = 119,443.

ANOTHER NOTEWORTHY RESULT

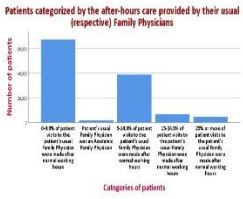
- Patients who saw only one Family Physician made significantly (and much) fewer non-urgent Emergency Department visits, compared to patients who saw multiple Family Physicians.

SOME KEY FIGURES / TABLES



Non-urgent Emergency Department visits made by patients from St. John's

	Number of patients	Percent
0 visits	68630	57.5
1-4 visits	45704	38.3
5-9 visits	3968	3.3
10-19 visits	959	.8
20 or more visits	182	.2
Total	119443	100.0



Potential Impacts

- The model of patient care being used by the Memorial University-affiliated Academic Family Physicians in St. John's may be expanded; this could reduce the traffic to (and the wait-times in) Emergency Departments.
- All patients may be encouraged to consistently see (and be satisfied with) just one Family Physician; this could reduce the traffic to (and the wait-times in) Emergency Departments.
- Once traffic to Emergency Departments decreases, associated wait-times would decrease, and other problems for patients (improper care, stress of waiting, etc.) in Emergency Departments would decrease, too.

Key Messages

- **The model of care that the Memorial University-affiliated Academic Family Physicians in St. John's use (including 24-hour patient access via telephone) appears to help reduce the numbers of non-urgent Emergency Department visits by patients, thereby reducing wait-times within Emergency Departments.**
- **After-hours care by the Fee-For-Service Family Physicians in St. John's does not appear to have an effect on the numbers of non-urgent Emergency Department visits by patients.**
- **Patients who stick with one Family Physician (that is – have just one "usual provider of care") are likely to make fewer visits to Emergency Departments for non-urgent reasons, compared to patients who visit multiple Family Physicians.**
- **Using billing information to determine the patient visits to the Fee-For-Service Family Physicians and not being able to know which Family Physicians worked in Walk-In Clinics were two limitations of interest to researchers.**

Acknowledgements

- **Translational & Personalized Medicine Initiative (TPMI) / Newfoundland & Labrador SUPPORT, which has provided the funding for this study.**
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Science, Health and Research Education (SHARE) Summit, October 10, 2019

SHARE
Science, Health and Research Education Summit