Sharing the Health

Canada's market for prescription drug services and its impact on self-perceived health

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Abstract

Canada is one of the only nations in the world that offers universal health coverage that excludes outpatient prescription drug services. This means that citizens may find out their diagnosis free of charge, but must incur out-of-pocket expenses for prescription drugs dispensed outside of hospitals. This paper examines the prevalence of prescription drug coverage in Canada across various socioeconomic groups, and identifies which specific factors have the strongest bearing on perceived health. The results show that age, education, location and income all play a significant role in determining whether or not individuals are able to obtain coverage, amongst other factors, and that these are proportionally related to how individuals assess their own well-being. This suggests that Canada's current healthcare system is not as comprehensive as it is made to seem, and that a redesign may be warranted moving forward.

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1. Introduction

The past several decades have seen vast improvements in medical research, disease treatment and overall quality of life. Whether it be the successful draft sequencing of the human genome, development in stem cell research, or the enactment of laws eliminating smoking in public places and worksites, many countries have taken significant strides towards a healthier, happier, future. Perhaps nowhere are these advancements more apparent than in the field of medicine. Due to increased availability and the use of medicines to treat an extensive array of ailments, prescription drugs have become one of the fastest growing elements of healthcare spending in recent decades, with annual growth rates averaging 9.9% and 10.1% for the United States and Canada from 1997-2005, respectively (Aitken et al., 2009; Morgan, 2005).

As a nation that prides itself on equality and social cohesion, Canada is paradoxically the only country in the world that offers a universal health insurance system that excludes outpatient prescription drug services (Daw et al., 2014). This means that unlike physician and hospital services, which are fully covered under the Canada Health Act, individuals must pay out-of-pocket for prescription drugs dispensed outside of hospitals (Wang et al., 2015). The current system in place consists of a patchwork of public and private plans that offer partial insurance to the majority of Canadians, although the extent of coverage is subject to significant debate. While the Canadian Life and Health Insurance Association (CLHIA) estimate that 97% of the population receive some form of drug expense insurance, examinations by Millar (1999) of prescription drug coverage across Canada found that amongst people aged fifteen or older, just 61% had sufficient coverage to pay for their medical expenses (Kapur & Basu, 2005). Those unable to qualify are often comprised of self-employed, out of work, or low income individuals, with just 52% and 38% of Canadians in the latter two categories reporting some form of coverage, respectively (Millar, 1999). Thus, there are large question marks regarding the efficacy of the current system and the coverage it provides.

To compound this issue further, the market for prescription drugs in Canada has been the fastest growing component of healthcare expenditure in recent decades by a significant margin, growing from 6% of spending in 1977 to 14% in 2007, during which time the costs of medication rose by more than 10% per year (Morgan et al., 2013). While rising drug costs are an inevitable and important facet of any burgeoning healthcare system, there are growing concerns that recent trends towards newer, costly forms of treatment are creating a divergence between what people need and what they can afford. As pointed out by the Health Council of Canada (2014), over 14% of Canadians spent more than $1000 CAD out-of-pocket for health care in 2014, with between 10-15% reporting that they did not fill a prescription or skipped a daily dosage owing to cost.

The motivation behind this paper lies in the fact that Canada appears to be falling behind other high-income nations in terms of patient integration and health outcomes. Canada has among the highest detail prices for prescription drugs of all the OECD countries, second only to Switzerland, but offers inequitable coverage to a significant portion of Canadians that depend on medication to minimize the effects of chronic pain or illness (CIHI, 2009). The aim of this study is thus to evaluate how prescription drug services in Canada, or the lack thereof, affect the self-perceived health of Canadian citizens. While the pressures of high medication costs and inequitable health coverage present a confounding dilemma for many, social determinants of health such as education, personal income, and availability of care ultimately decide how individuals respond to the challenges they present. There is a risk that Canada's contradictory stance with regards to prescription drugs place certain groups at a distinct disadvantage, unable to afford the medication they require due to circumstances outside of their control. Utilizing microeconomic data from the most recent Canadian Community Health Survey (CCHS), a sample of nearly 130,000 respondents, this paper will identify what socioeconomic and demographic factors correlate with perceived health, and what this means for Canada's wayward healthcare system. As a country that frequently receives praise for the provision of equal access to treatment for all walks of life,

statistically significant results will indicate that the current patchwork of private and public medical insurance is not sufficient when it comes to protecting the health of Canadian citizens, and that a redesign may be required. Conversely, insignificant results may indicate that Canada's exclusion of prescription drug services does not produce dire results, and that talks of Medicare expansion – commonly referred to as "pharmacare" – may be premature.

The paper will proceed as follows. Section two provides an overview of some prominent literature published on the subject of affordable healthcare, and analyzes key findings that may be pertinent to Canadian policymakers moving forward. Section three focuses on the inspiration and background behind this paper's methodology – how disjointed insurance options and provincial disparities manifest in poor health – as well as the institutional setting that makes Canada's healthcare system unique. Section four is comprised of statistical methods and analysis. Included in this section is a prevalence-based model to assess which socioeconomic factors play a role in determining prescription drug coverage, as well as a multivariate logistic regression model to determine how these variables affect health outcomes in Canada. This is followed by sensitivity analysis, potential limitations, and an interpretation of what the results mean for Canada moving forward.

2. Literature Review

2.1 Canadian Studies

Despite the wealth of research conducted on Canada's healthcare system in recent years, no study to date has examined the relationship between the nation's pharmaceutical system and the self-assessed health of its citizens using microeconomic data. That said, there have been a multitude of studies with an emphasis on inequity in coverage. One paper that has received considerable attention is a 2012 study by Law et al., which analyzed the 2007 responses of 5732 Canadians to questions pertaining to cost-related non-adherence to treatment,

defined as halving or skipping a prescribed dosage of medicine due to financial concerns. The authors found that 9.6% of respondents reported some form of sub-optimal adherence in the past year, and that individuals living with poor health, lower income, or without medical insurance were far more likely to report difficulties owing to cost, with variability in insurance coverage appearing to be the most decisive factor (Law et al., 2012). In contrast, Germany (6%), the Netherlands (3%) and the United Kingdom (2%) all had significant lower rates of difficulty pertaining to cost, while maintaining universal drug coverage for their respective populations (Morgan et al., 2013; Gagnon, 2014). In their analysis of self-reported financial barriers to treatment amongst Canadian patients with chronic cardiovascular conditions, Campbell et al. (2014) found that 12% of 1,849 respondents reported some form of financial barriers to care, 14% lacked any form of drug insurance, and 4% reported an inability to pay for their medications. Further, those unfortunate enough to fall under these classifications were 70% more likely to visit the emergency room or be hospitalized over the course of a year. To further illustrate the precarious circumstances many Canadians find themselves in with regards to health coverage, Hennessy et al. (2015) examined the relationship between out-of-pocket spending and cost-related non-adherence in 2,400 Canadian citizens living with chronic disease, and found that a significant portion was spending 5% or more of household income on prescription drugs, with considerable financial difficulty. "Out-of-pocket" in this context includes deductibles, co-payments and coinsurance, as well as all of the costs incurred by those without any form of public or private insurance (Morgan et al., 2013; Blomqvist & Busby, 2015).

Periodic recommendations by advisory groups and committees to expand Medicare in Canada to cover prescription drugs have been ongoing since the mid-1970s, but as Wang et al. (2015) note, discussions starting becoming much more active in the late 1990s. One report in particular that has sparked considerable controversy and discussion is the Royal Commission on the Future of Health Care, or 'The Romanow Report', which outlined a series of ways in which the Canadian health care system can be improved, chief among them the gradual integration of

prescription drugs into the Canada Health Act (Romanow, 2002). The author identifies two critical issues that must be addressed. First, improving access and easing financial barriers to ensure that Canadians are able to access the prescription drugs they require, and second, continuing to focus on safety and improving cost-effectiveness. Wang et al. strengthen these arguments in their 2015 assessment of a mandatory universal drug plan in Canada, using Canadian National Population Health Survey (NPHS) longitudinal data to examine the impact of a mandatory provincial drug program recently introduced in Quebec. Following implementation, drug coverage substantially increased, along with medication use, health outcomes, and general practitioner (GP) visits, allowing the authors to conclude that the positive effects of a comprehensive national insurance plan would be worth the accompanying costs. In his 2015 'Universal Pharmacare Report', Gagnon analyzes the market for pharmaceutical drugs in Canada against an international backdrop, with an emphasis on prices, disparities in coverage and considerations for the future. Gagnon argues that the current system in place is unsustainable owing to unhindered growth in drug costs, and like Romanow, advocates for the rational implementation of a more comprehensive universal drug plan, with social programs designed to provide a certain threshold of care for all citizens.

    While the idea of a publicly funded universal drug plan is brought up regularly, especially in academia, the idea has yet to gain any sort of significant traction with the nations' policymakers. One notable attempt was made in 2004, when federal, provincial and territorial governments jointly developed the National Pharmaceuticals Strategy (NPS) in an attempt to confront issues pertaining to access and affordability of medications, but as noted by MacKinnon (2009), progress has been limited at best. Total expenditures on prescription drugs increased by 37% in the four years following the accord, worsening the strain felt by the public, and MacKinnnon makes the argument can be made that the system is even worse off than before the accord was signed. Thus, more research is needed before expansion can be considered a viable alternative.

2.2 International Studies

Insight into inequity in coverage and how patients respond can also be derived from abroad. A considerable amount of research has been conducted in the United States, which only recently reformatted their healthcare system to better accommodate low-income individuals and households. In their 2002 study, Rector and Venus surveyed a random sample of 1,500 elderly citizens covering five states and enrolled in eight different types of public insurance plans and found that 32% did not fill a prescription, or described some form of non-adherence due to out-of-pocket costs. The authors conclude that lower drug benefits, income, poor health and high costs all contribute to the likelihood of an individual underusing their medication and experiencing poor health outcomes. Another notable study by Schoen et al. (2013) examined the health care experiences and outcomes of US citizens compared to individuals living in eleven other high-income nations, all of which offered different forms of universal health coverage with the exception of Canada. The authors found that access and affordability issues were far higher amongst the uninsured, regardless of country, but also found that even insured Americans were far more likely to go without care due to high out-of-pocket spending concerns. This latter finding is particularly interesting, as it shows the oft-overlooked issues that high deductibles and cost sharing can present. In contrast, fewer than 10% of adults reported high costs in Sweden, the United Kingdom, France, the Netherlands and New Zealand, while those in Australia, Canada and Switzerland all reported cost as as being a significant stressor when it comes to medication and treatment (Schoen et al., 2013).

Sarnak & Ryan (2016) also found that amongst high-need patients – classified as those with terminal or complex conditions, cognitive/physical limitations or poor behavioural health issues – approximately 20% of respondents in the U.S. and Canada reported an emergency room visit that could have been avoided had they had better access to prescription medication and coordination with their respective health systems. Canada was also found to have the second highest number of older

adults (65+) living with multiple chronic conditions, who account for a disproportionately large percentage of overall health care costs.

3. Background

Despite spending more on medication than other comparator countries, there are legitimate concerns that the growth of Canada's pharmaceutical sector is coming at the expense of its citizens. While medical attention should be a product of need, rather than ability to pay, an increasing number of studies are showing that citizens are unable to afford the medications prescribed by their physicians, or are being forced to pay disproportionately high costs out-of-pocket. These are products of a larger issue, that being a startling lack of parity with regards to outpatient prescription drug services. Variations in coverage across regions, territories and provinces mean that there is little consensus when it comes to pricing or eligibility, and thus no benchmarks against which all services are measured. This calls into question one of the founding principles of the Canada Health Act, that being fair and equal access for all citizens (Pomey et al., 2010). More importantly, it forces many individuals to choose between financial stability and the treatment they require, an unacceptable trade-off given Canada's socioeconomic position amongst industrialized countries. The following subsections illustrate several glaring inefficiencies unique to Canada that have contributed to this quandary. First is a brief analysis of the country's institutional setting, which explains how the current system came to be, and how the pricing of brand name prescription drugs is negotiated. This is followed by an examination of Canada's blend of private and public insurance plans, and disparities in coverage from province to province.

3.1 Institutional Setting

When Canada's Medical Care Act was formalized in 1972, the role of prescription drugs was limited for the large majority of Canadians. Medical technology, though on the rise, was nowhere near the level it is at today, and so

emphasis was instead placed on physician visits and hospitals, which laid the foundation for the current system in place. Nevertheless, the policymakers behind Medicare left the door open to expansion for other health services, believing that the nation's thirteen provinces and territories would band together at the appropriate time to take the next step with regards to prescription drug coverage. Examining national health expenditure trends from 1975-2015, it appears that time has come. Adjusting for inflation, private sector per capita spending on medication has increased from just $39.70 in 1975 to $611.91 in 2011, an increase of 8.4% per annum (CIHI, 2009; see Figure 4 in appendix). As noted by Pomey et al. (2010), this growth was largely the result of new drug therapies and technology, which vastly improved diagnostic capabilities, making it simpler to treat patients at home. The result was a tremendous surge in prescription drug consumption outside of hospitals. In 1996, Canadians were averaging eight prescriptions per year; by 2006, the average had reached fourteen (Pomey et al., 2010; IMS Health, 2007).

Unsurprisingly, the price of drugs has increased in unison with consumption over this period, and patented medication prices in Canada are now amongst the highest in the world (Pomey et al., 2010). This growth is a product of Canada's unique institutional setting and technological innovation, but also of perplexing pricing schemes. Control of patented prescription drugs takes place at the federal level, and is handled by the Patented Medicine Prices Review Board of Canada (PMPRB), an independent body established in 1987 (Tang, Ghali & Manns, 2014). The PMPRB has historically used the average price of seven comparator countries when capping the prices of new, prescription brand-name drugs, but as pointed out by Gagnon (2015), four of these seven countries (United States, Switzerland, Sweden, and Germany) have the most expensive brand-name prices in the world. This system automatically makes Canada the third or fourth most expensive country on an annual basis, even though they are receiving the same drugs as countries further down the list.

Even with the PMPRB, there has been a sizeable increase in Product Listing Agreements (PLAs) over the last decade, which allow drug manufacturers to

negotiate confidential prices with pharmacies that are achieved through rebates, and often depend on drug expenditures and utilization trends (Morgan et al., 2013; Gagnon, 2014). While the design of these agreements is altruistic in theory – they allow pharmacies to attain significant price discounts, which are then passed along to the customer – there are concerns that the reduced transparency and variations across pharmacies may ultimately harm consumers. As pointed out by Morgan et al. (2013), the outcome of price negotiations is often a product of the size of the population the drug plan covers, which automatically places smaller provinces at a disadvantage. Further, there are no guarantees that the rebates will trickle down to the consumer on account of the confidentiality agreement between manufacturer and insurer, so uninsured Canadians or those with inadequate coverage are still likely to be left with inflated list prices.

3.2 Public vs. Private Insurance

A significant hindrance to more comprehensive prescription drug coverage – and thus better health outcomes – is Canada's disjointed insurance system. While a considerable amount of research has shown that insurance availability and type is highly correlated with greater utilization of medication and treatment, the interweaving of Canada's public and private insurance systems has produced sizeable coverage gaps and disparities across provinces and demographics (Kratzer et al., 2015; Soumerai, 2004). With provincial governments paying for all services delivered by physicians and hospitals, increasingly limited budgets and the burden of an aging population mean there is even less money for other areas of healthcare, aggravating prescription drug concerns. This leaves provinces and territories with significant challenges in terms of trying to rein in costs without sacrificing access and quality to healthcare. They can either restrict provincial formularies to cover a smaller range of drugs, reduce spending in other areas, or seek alternative methods of raising revenues to pay for increasing costs (Romanow, 2002). Unable to accrue support for any of these options, provinces have instead responded by restricting coverage almost exclusively to three key subgroups: the elderly, those requiring

social assistance and citizens with specific diseases obliging catastrophic drug coverage, and even then there are sustainability concerns (Wang et al., 2015; Daw and Morgan, 2012). Seniors consistently receive some level of financial support above the general population, and are exempt from paying premiums in all but two provinces (Nova Scotia and New Brunswick). While the elderly do account for a disproportionate percentage of prescription volume and spending, there are concerns that the country's rapidly aging baby-boomer population will cause an aggregate reduction in the country's tax base in the next 10-15 years, and accelerated age-related spending on healthcare (Ragan, 2012). The combination of these two factors stands to place a tremendous strain on both the federal and the provincial governments, and could feasibly crowd out more citizens in need of medical aid if managed ineffectively.

The inability of provincial governments to provide adequate coverage for citizens outside of these defined groups has given way to another concern, which is an overreliance on private drug plans. Those that do not qualify for public insurance must seek their own private forms of coverage, often through employment benefit plans, which are associated with higher expenses and administrative fees. One glaring disadvantage of this option is that private insurance plans pay more for drugs – up to 7% more for generic drugs and 10% for brand name varieties – on account of the fact that they have reduced bargaining power relative to public plans (Gagnon, 2015; Competition Bureau, 2008). This of course results in higher prices for consumers. Another downside is that coverage is inherently linked to individual job security. Thousands of individuals change jobs each year, and once an employment contract is terminated, coverage is eliminated as well. Approximately 70% of new hires are required to wait a period of at least three months following employment in what is often referred to as a "trial period", which poses a sizeable risk to individuals requiring consistent treatment, such as those suffering from hypertension or diabetes (Fraser Group, 2000).

As a testament to the growth of private spending on healthcare, prescription drug spending in the private sector increased from $3.6 billion in 1993 to $15.9

billion in 2013, a fivefold increase over the course of 20 years (O'Brady et al., 2015). These dramatic increases can be attributed to the fact that private drug plans have different objectives than those provided by government sponsors. For starters, there are few incentives for firms to implement cost-control measures, as insurance companies are typically compensated as a percentage of overall expenditures (Kratzer et al., 2015). As reductions in expenditures imply a proportionate decrease in administrative income, emphasis is placed on expansive, unrestricted drug formularies consisting of the most recent medicines, even if they do not confer benefits beyond cheaper, generic alternatives (Canadian Health Coalition, 2007; Gagnon, 2015). Drug plans also function as part of a firm's Human Resources (HR) strategy in the sense that they are an element of employee compensation packages (Fraser Group, 2000). This can be used as a bargaining tool when attempting to attract or retain employees, and also allows firms to benefit from Canadian tax laws, which provide more financial incentives for health benefits than monetary compensation (Fraser Group, 2000). Private plans also differ from public plans with regards to limits on out-of-pocket spending, opting out of annual expense ceilings, and are less likely to limit the size of deductibles and co-payments, which means less financial protection for individuals with considerable drug expenses (Gagnon, 2015). These ulterior motives do not negate the benefits of the provided plans, but they do help explain the tremendous growth compared to public plans, which exists solely to provide reprieve from exorbitant drug costs.

According to estimates from the Canadian Institute of Health Information (2009), 37% of the Canadian populace depends on private insurance to afford their medication, while 45% are covered by public plans and 18% are forced to pay out-of-pocket for all prescription drug expenses. This latter percentage is the highest of all OECD countries save for the United States, and individuals that fall under this umbrella are often the ones that require financial assistance the most: the self-employed, or those working in low-income positions far removed from benefit plans. These individuals face a confounding predicament in the sense that they earn enough income to exceed the requirements for social assistance, but do not make

enough to supplement high medication cost pressures. In a study by Kapur and Basu (2005), self-employed individuals were 22% less likely to have coverage than the general population, while households with incomes in the range of $10,000-29,999 were 14-31% less likely to have prescription drug coverage than individuals with incomes up to $9,999, implying a small holiday bonus could conceivably push an individual out of coverage.

Another undesirable outcome of these insurance gaps are that physicians often incorrectly assume that their patients have full coverage when writing up their prescriptions. Despite a responsibility to be acutely aware of the various facets of the medications they prescribe, a 2000 survey of 134 Canadian physicians revealed that 80% were unaware of the actual costs, and only 13% had been formally educated about the prices of brand name medications (Tang et al., 2014; Reichert et al., 2000). This results in more brand name prescriptions and a greater financial burden for patients requiring medication.

The consequence of this disjointed system is that many Canadians do not feel comfortable with their current level of health care, and face significant cost-related barriers to acquiring their prescribed medication. Examining the 2010 International Health Policy Survey, just 68% of Canadians reported feeling confident that they would be able to afford treatment if they were become seriously ill, above only the United States (58%) and below Sweden (70%), New Zealand (75%), the Netherlands (81%) and the United Kingdom (90%), all of which provide universal drug coverage (Schoen et al., 2013).

3.3 Provincial Disparities

As a nation consisting of ten provinces and three territories, healthcare in Canada has always been regulated under the auspices of provincial, rather than federal, governments (for a provincial breakdown of Canada, see Figure 3 in appendix). In accordance, the country can be said to have thirteen distinct health care systems, rather than one one unified scheme (Pomey et al., 2010). Each provincial or territorial government has a direct influence on the provision, price

and range of prescription drugs offered through the organization of drug formularies. Beyond the primary focus of ensuring all available drugs meet safety and efficacy criteria, these enterprises are responsible for negotiating drug prices with pharmaceutical companies, legislating the price ceilings for generic alternatives, and determining the extent of cost-sharing for consumers (Tang et al., 2014).[*]

As previously mentioned, provincial governments provide insurance to defined, disadvantaged subgroups, with coverage varying by province (Wang et al., 2015; Daw and Morgan, 2012). This fragmented system has significant ramifications, as it essentially means that an individual's income, occupation, and address all determine which kind of access they have to prescription drugs (Romanow, 2002; Grégoire at al., 2001). Demers et al. (2008) present several examples to illustrate these disparities in coverage. A 73-year old male with congestive heart issues earning a low-to-average income will spend over $1,300 per year if he lives in Manitoba, Saskatchewan or Newfoundland, but less than $100 in Prince Edward Island or New Brunswick. Further, a 65-year-old woman who counts diabetes, hypertension and insomnia amongst her ailments could expect to spend between $300-$500 per year in Quebec, Manitoba and Saskatchewan, or less than $30 in Ontario, New Brunswick, or Labrador. These inconsistencies across provinces are significant and can result in portability issues, as provincial relocation often results in loss of coverage for up to three months until individuals are eligible in their new province (Fraser Group, 2000). This lag can result in dire consequences for those in precarious health situations.

There are a multitude of factors that influence the distribution of spending, chief among them the demographics of the population and average age of the populace. The maritime provinces (Prince Edward Island, Nova Scotia and New Brunswick) currently have the largest percentage of elderly citizens, and are thus

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[*] Cost-sharing can either take the form of deductibles, in which a beneficiary pays the full price of a prescription up to some pre-specified amount, or co-payments, in which an individual pays either a flat indemnity or a predetermined percentage of the overall cost.

amongst the nation's leaders in terms of ratio of private-to-public spending on prescription drugs (New Brunswick spends the least, at just 32%, compared to 72% in Nunavut) (CIHI, 2009; Gagnon, 2014). Due to the fact that an aging population spends a disproportionately large amount of health care – spending in New Brunswick comprises 40% of the provincial budget, the highest in Canada – public plans are only able to accommodate those requiring social assistance and the elderly (Morgan et al., 2013). Prince Edward Island is the only maritime province to provide coverage to seniors regardless of income or financial standing, while New Brunswick and Nova Scotia maintain premiums, although these are typically waived if the individual is eligible for Guaranteed Income Supplement (GIS) support, or in one of the lowest income brackets (Willison et al., 1998). For seniors that do not qualify, co-payment rates average 30%, with a maximum of $382 per prescription (Gagnon, 2015). Even when age is controlled for, spending per capita in the Atlantic provinces far exceeds that of the rest of the country, with New Brunswick, Nova Scotia and Newfoundland paying 14%, 8% and 15% more than the national average, respectively (Morgan et al., 2013). This is likely related to the fact that these provinces are given a relatively small percentage of federal transfers on account of their size, obliging different forms of revenue seeking. There has been a marked reduction in average prescription size (in terms of physical units) since 2010, producing a 'push effect' in the sense that individuals need to return to the pharmacy more often to refill their medication, resulting in increased dispensing fee expenditures (Morgan et al., 2013). The Maritime provinces also have the unfortunate distinction of having the highest average prescription costs for high-need citizens, on account of the fact that their catastrophic drug coverage is limited to a select few high cost diseases. A beneficiary without coverage can be expected to pay up to $24,019 in New Brunswick and Nova Scotia, the highest in Canada (Morgan et al., 2013).

Quebec has the distinction of being the only province that offers universal public coverage to all citizens not covered privately, through its Régie de l'assurance-maladie du Québec (RAMQ) program. Premiums are dependent on age

and income and approximately 44% of the population takes advantage of this service, with the remaining 56% being covered by private plans, making Quebec the only province in Canada in which 100% of the population has some form of coverage (Kapur and Basu, 2005). As a result of this leverage, Quebec is better able to negotiate with pharmaceutical firms, and requires that generic manufacturers provide drugs at the lowest price available in the other provinces. This obviously reduces the burden of drug expenses for much of the populace, although brand name prices remain an issue. Even with low generic prices, Quebec residents face the third highest per capita costs, 13.4% more than the national average at $769 CAD, and the per capita volume of prescriptions is nearly 45% higher than the average (Gagnon, 2015). This implies that residents of Quebec receive twice as many prescriptions as citizens of British Columbia, even after controlling for population size. As was the case with the maritime provinces, prescription size is partially to blame – the average prescription size in Quebec is 38% smaller than the Canadian average, which means more refills and dispensing fees (Gagnon, 2015). Further, the fact that all citizens have coverage does not imply they are protected from high deductibles and co-payments. Over the course of thirteen years, from 1996-2009, senior citizens in Quebec went from having to pay $2 per prescription, for a max of $100 per year, to having to pay a monthly deductible of $14.95 in addition to 32% co-payment rates, for a max of just under a thousand dollars per year (Gagnon, 2015; Tamblyn et al., 2001; CIHI, 2009). Despite these concerns however, Quebec represents a bright spot in the Canadian healthcare sphere. The fact that the province has successfully negotiated a price ceiling showcases the obvious benefits of purchasing power, and presents a glance at what a national drug formulary might be able to achieve if the provinces were to band together.

As the largest province in Canada, Ontario has also done an exemplary job of using its size to negotiate competitive prices and comprehensive coverage for certain groups, such as seniors. The province's Ontario Trillium Plan provides coverage to all elderly citizens and those in need of social assistance, and also provides catastrophic drug coverage for those plagued by rare, high-cost conditions like

Amyotrophic Lateral Sclerosis (ALS). Qualifying citizens must pay up to 4% of their gross income in medication costs, after which the average price per prescription is reduced to just $2 per prescription (Gagnon, 2015). Approximately 22% of citizens are covered by public plans, while 60% have private coverage and 17% pay out-of-pocket, the second lowest rate in Canada after Quebec (Kapur & Basu, 2005). The province has also implemented aggressive generic price reforms in the last three years, so that prices are now at most 25% of brand name drug prices. As a result of these decisions at the provincial level, citizens of Ontario have the lowest absolute and relative burden of prescription drug costs, as measured by Kapur and Basu (2005).

Moving westward, Saskatchewan and Manitoba both offer opt-in coverage with income-dependent deductibles, while Alberta is the only province that offers coverage independent of income, and covers 70% of drug costs at the expense of high quarterly premiums (Gagnon, 2015). With that said, public plans in these three provinces also cover the lowest percentage of people, at just 8.8% (Manitoba), 15.3% (Saskatchewan) and 16.5% (Alberta) (Morgan et al., 2013). In terms of plans/eligibility, Manitoba offers a 'Special Support Program', which provides assistance to those whose forced to spend a disproportionate percentage of their income on necessary medications. Individuals receiving Guaranteed Income Supplement (GIS) support can be expected to pay an annual deductible of $200, while co-payments are typically in the range of 30-35% (PMPRB, 2014). Per the Patented Medicine Prices Review Board (2014), Alberta set co-payments at 30% of the prescription to a maximum of $25 for seniors, widows, palliative care and non-group beneficiaries. Premiums for non-group beneficiaries were $118.00/month for families and $63.50/ month for singles.

In terms of average per capita spending, British Columbia is by far the most cost-efficient, with median prices nearly 28% cheaper than the Canadian average according to Morgan et al. (2008). Similar to Ontario, the province has managed to negotiate a generic price ceiling of 35% of brand name cost, and offers coverage for a variety of beneficiaries, including all residents born prior to 1940, recipients of

income assistance, children and youth needing care, and individuals with certain conditions such as cystic fibrosis (PMPRB, 2013). In terms of cost-sharing, individuals whose net income is less than $15,000 do not have to pay any deductibles, while those making more than $30,000 pay approximately 3% of net income (PMPRB, 2013).

One major consequence of this disjointed system is that it undermines provincial abilities to negotiate prices with multinational pharmaceutical firms. Comparatively smaller provinces like Prince Edward Island simply do not have the same leverage when it comes to bulk purchase arrangements, and are thus forced to accept inferior terms. If Canadian provinces and territories were to band together to form a united national drug agency, it would result in greater purchasing power, more thorough assessments of drug costs and benefits, and better prices for Canadian citizens. This would require consensus on the drugs to be added to the national formulary – a potential obstacle considering provinces vary in terms of demographics and thus drug requirements – but the potential benefits in terms of cost reductions are certainly worth the discussion.

Finally, the intent of these comparisons is not to show that Canada's provinces do not look out for their citizens – each has designed programs to provide assistance to those who need it most – but rather, to highlight the discrepancies in coverage from province to province. With each province receiving federal funding based on population and size, provinces like Quebec and Ontario are able to negotiate more competitive prices with pharmaceutical firms, while a disproportionate burden is placed on smaller provinces like New Brunswick and Nova Scotia. This lack of parity places a considerable burden on residents of the smaller provinces, both in terms of prescription drug costs and health outcomes. As a high-income country, Canada needs to find a way to bridge this gap so that citizens from coast to coast are able to receive the medical care that they require.

5. Methods

Theoretical Model

The analysis used in this paper is based on a two-factor health care utilization model. The likelihood of an individual reporting poor self-perceived health was theorized to be a product of invariant (i.e. age, gender, country of birth) and demographic/socioeconomic (i.e. education, province, income, employment status, medical insurance) factors. Variables directly related to self-perceived health, such as chronic pain, or high blood pressure, were omitted.

Data and Variables

Data for analysis was obtained from the 2013-2014 Canadian Community Health Survey (CCHS), a cross-sectional survey of nearly 130,000 citizens designed to collect information pertinent to health status, determinants and utilization within the Canadian population. A joint mandate created by the Canadian Institute for Health Information (CIHI), Statistics Canada, and Health Canada, the objectives of the CCHS are to provide health data at the national, provincial and regional levels for purposes of health surveillance, and to provide a unified data source representative of Canada's many small populations and unique subgroups. Data is collected from individuals aged twelve and over residing in Canada's ten provinces and three territories, with the only omissions from the sampling frame being those living on Indian reserves/Crown lands, full-time members of the Canadian Armed Forces, and residents of extremely remote regions that cannot be reached by email or telephone. The survey represents approximately 98% of the Canadian population over the age of twelve, 92% of whom must be over the age of 18. Data collection takes place on an ongoing basis and covers common content (questions asked of respondents in all provinces and territories), optional content (designed to give health regions the opportunity to select content that addresses specific health priorities) and rapid response content on emerging, pertinent topics in Canadian health care which varies by year. The survey utilizes a multistage, stratified cluster

design in which the individual households are the final sampling unit; each province is divided into significant urban centres, cities and rural regions, and then 150-250 private dwellings in each strata are grouped together to create clusters (per the CCHS User Guide). To account for disparities between large, metropolitan cities and small, urban communities, the former are given their own stratum while the latter are grouped into strata based on characteristics such as population, location and median household income. Approximately 40% of interviews were conducted in person using a Computer Assisted Personal Interviewing (CAPI) system, with the remaining 60% being conducted over the telephone using an equivalent system.

The working sample for this analysis consists of the 127,261 respondents who chose to answer "In general, would you say your health is…?" with either "excellent", "very good", "good", "fair" or "poor".[†] Respondents who checked "don't know" or "not stated" were omitted from the sample. Answers were then divided into groups so as to facilitate a binary response in the multivariate regression – individuals who answered "excellent", "very good" or "good" received a value of 1, while individuals reporting "fair" or "poor" health received a value of zero. The broad range of health-related questions in the survey facilitated the construction of an array of relevant predictor variables. These include gender, age, province of residence, education, personal income, employment and immigrant status and a number of specific, health-related variables: whether or not an individual has access to a family doctor or medical insurance, and if care has ever not been received due to availability or cost concerns. Overall, sixteen predictor variables were used in total, five of which pertain to province of residence. This was done to measure the marginal effects of location on self-assessed health from one province to another.

[†] All survey questions pertaining to variables in this analysis can be found in the appendix.

Figure 1: Descriptive statistics for sample population living with prescription drug insurance (med ins. = 1)

Variable	Obs.	Mean	Std. dev	Min	Max
Perceived health	36034	0.852	0.355	0.0	1.0
Gender	36083	0.559	0.497	0.0	1.0
Age	33076	2.749	0.952	1.0	4.0
Atlantic	36011	0.815	0.399	0.0	1.0
Quebec	36083	N/A	N/A	0.0	1.0
Ontario	36076	0.893	0.284	0.0	1.0
Prairies	36025	0.837	0.324	0.0	1.0
British Columbia	36068	0.883	0.292	0.0	1.0
Territories	36079	0.903	0.265	0.0	1.0
Education	35564	2.875	1.274	1.0	4.0
Income	28612	3.612	1.381	1.0	6.0
Family Doctor	36042	0.944	0.230	0.0	1.0
Employment stat.	36041	1.903	0.967	1.0	3.0
Immigrant status	35737	0.827	0.378	0.0	1.0
Care N/A - Area	2961	0.908	0.289	0.0	1.0
Care N/A - Cost	2961	0.901	0.298	0.0	1.0

Figure 2: Descriptive statistics for sample population living without prescription drug insurance (med ins. = 0)

Variable	Obs.	Mean	Std. dev	Min	Max
Perceived health	9748	0.864	0.343	0.0	1.0
Gender	9763	0.546	0.498	0.0	1.0
Age	9118	2.565	1.028	1.0	4.0
Atlantic	9835	0.789	0.302	0.0	1.0
Quebec	9763	N/A	N/A	0.0	1.0
Ontario	9770	0.884	0.302	0.0	1.0
Prairies	9821	0.821	0.364	0.0	1.0
British Columbia	9778	0.865	0.318	0.0	1.0
Territories	9767	0.873	0.334	0.0	1.0
Education	9582	2.761	1.284	1.0	4.0
Income	7692	3.026	1.162	1.0	6.0
Family Doctor	9750	0.890	0.313	0.0	1.0
Employment stat.	9726	1.805	0.894	1.0	3.0
Immigrant status	9622	0.771	0.420	0.0	1.0
Care N/A - Area	1003	0.917	0.276	0.0	1.0
Care N/A - Cost	1003	0.717	0.451	0.0	1.0

Figure 1 and Figure 2 display descriptive statistics for each of the predictor variables based on prescription drug insurance. 45,846 respondents from the sample population chose to answer this question in the survey. The minimum and maximum columns show that twelve of the sixteen variables were coded for binary response, which the exceptions being age, education, income and employment status. Interestingly, mean perceived health is higher in the case of no insurance, which is counterintuitive. Age, education and income have the highest standard deviations, while the two variables pertaining to instances where care was not received – Care N/A – have the lowest. The most prominent discrepancy between the two figures is with regards to income, which decreases nearly a full income bracket in the case of no insurance. The mean also decreases for each of the provinces in the absence of insurance.

Statistical Analysis

This paper utilized a logistic regression model similar to that employed by Law et. al. in their 2012 report on cost-related nonadherence. In addition to providing a functional form for the regression of a categorical variable in self-perceived health, this method allowed for the computing of Odds Ratios (OR), which were used to compare the relationship between the dichotomous outcome variable and the individual components of each predictor relative to a reference at the 95% level of significance. If we define p̂ as the probability that the outcome variable is 1 (representing either excellent, very good, or good health), with any other affirmative response coded as 0, we can write the multiple logistic regression model as follows:

$$\hat{p} = \frac{\exp(b_0 + b_1 X_1 + b_2 X_2 + ... + b_p X_p)}{1 + \exp(b_0 + b_1 X_1 + b_2 X_2 + ... + b_p X_p)}$$

Where b_0 through b_p are the regression coefficients and X represents the independent variables. Substituting in health-related predictor variables, this can also be written in the following standard linear regression format:

$$\text{logit}(\hat{p}) = \log\left(\frac{p(y=1)}{1-(y=1)}\right) = b_0 + b_1 Age_i + b_2 Education_i + ... + b_{16} Insurance_i$$

Where the outcome variable, denoted by y, is expressed as a linear function of the sixteen predictor variables alluded to in the previous section. By taking the exponential of both sides of the regression, the equation can also be rewritten in the form of Odds Ratios:

$$\text{OR} = \frac{p}{1-p} = e^{b0} + e^{b1 Age_i} + e^{b2 Education_i} + ... + e^{b16 Insurance_i}$$

Variables that could not be coded in a binary format were grouped into categories, including education (less than high school, high school, some post-secondary, postsecondary graduate), personal income (no income, < $20,000, $20,000-$39,999, $40,000-$59,999, $60,000-$79,999, $80,000+) and employment status (employee, self-employed, unemployed). Canada's 13 provinces and territories were grouped

into 'Atlantic' (New Brunswick, Nova Scotia, Prince Edward Island and Newfoundland/Labrador), 'Quebec', 'Ontario', 'British Columbia', 'Prairies' (Manitoba, Saskatchewan and Alberta) and 'Territories' (Yukon, Northwest Territories and Nunavut). This decision was rooted in the fact that the provinces grouped together share similar health care systems and demographics. To ensure this assembly did not alter results in any sort of meaningful fashion, individual regressions were run for each and the relationships were the same, implying a province like Prince Edward Island can be used as a proxy for New Brunswick, and vice versa.[‡] Whereas the 2013-2014 CCHS presents 16 different age groups, beginning with 12-14 and ending with 80+, I divided the groups into four subcategories: millenials (18-29), young-middle aged adults (30-49), middle-retirement (50-69) and seniors (70+), omitting the two youngest groups (12-14, 15-17) on the grounds that individuals in this subset are typically dependent on a legal guardian. Individuals in this position are more likely to be listed as a dependent on insurance plans, implying they are only affected by outpatient prescription drug services indirectly. This helped to streamline the regression process without compromising the integrity of important strata contained within the data. To ensure that the survey data was representative of the Canadian population and to account for Statistics Canada's complex sampling design, survey weights were incorporated into all calculations. As bootstrap weights were not made available as part of the Public Use Microdata Files (PUMF), weights were instead rescaled so that the average weight equals 1, which was accomplished by using in analysis a weight equal to the original weight divided by the average of the original weights for the sampled units contributing to the estimator in question. This is the alternative method suggested in the CCHS User Guide for those do not have access to the master files, and is still able to account for the unequal probability of selection amongst respondents.

[‡] Provinces were divided into groups and then coded to be binary (ex. Quebec = 1, otherwise = 0). In terms of Odds Ratios, this means that each region is being compared to the average of the provinces and territories not selected.

Results

Table 1: Prevalence of fair/poor health and no prescription drug insurance amongst participants of the 2013-2014 CCHS

Variable	Sample Pop.	Resp. who reported fair/poor health	Resp. w/o drug insurance	Weighted prevalence (95% CI)
Gender				
Male	57,174	7,919	1,600	20.2 (18.58 - 21.95)
Female	70,288	10,473	2,273	21.7 (20.398 - 23.08)
Age				
18-29	22,067	2,988	941	31.4 (29.39 - 33.54)
30-49	28,364	2,499	470	18.8 (15.79 - 22.38)
50-69	46,291	7,846	1,592	20.3 (18.27 - 22.55)
70+	25,844	6,032	1,115	18.5 (17.07 - 19.73)
Location				
Atlantic	16,148	2,483	509	20.4 (19.04 - 21.855)
Quebec	23,298	4,264	0	N/A
Ontario	42,553	5,097	975	19.1 (17.70 - 20.60)
Prairies	26,881	3,409	726	21.2 (19.64 - 22.87)
Bcolumbia	15,340	1,844	344	18.6 (16.96 - 20.39)
Yukon/NWT/Nunavut	3,242	2,747	308	11.2 (9.93 - 12.62)
Education				
Less than high school	30,632	5,937	1,474	24.8 (22.79 - 26.98)
High school	24,698	4,174	961	23.0 (20.35 - 25.98)
Some postsecondary	5,848	518	95	18.3 (17.34 - 19.30)
Postsecondary graduate	64,208	6,999	1,210	17.3 (16.17 - 18.50)
Personal Income				
No income	1,817	447	138	30.9 (29.35 - 32.52)
Less than $20,000	26,560	6,953	2,393	34.4 (30.71 - 38.52)
$20,000 - $39,999	30,224	4,615	1,691	36.6 (33.37 - 40.13)
$40,000 - $59,999	19,286	2,197	351	15.9 (15.07 - 16.77)
$60,000 - $79,999	10,592	1,296	156	12.0 (11.16 - 13.02)
$80,000+	12,893	1,550	157	10.1 (9.52 - 12.26)
Family Doctor				
Yes	110,917	14,153	2,681	18.9 (17.14 - 20.92)
No	16,313	1,887	574	34.7 (31.12 - 38.68)
Employment Status				
Employee	51,322	6,841	1,162	16.9 (16.09 - 17.91)
Self-employed	10,721	1,531	359	23.4 (21.87 - 25.02)
Unemployed/Not looking	62,862	12,912	5,298	41.0 (38.0 - 44.22)
Immigrant Status				
Yes	17,730	2,183	573	26.2 (24.92 - 27.54)
No	105,702	14,640	2,938	20.0 (18.56 - 21.55)
Care Not Available in Area				
Yes	551	84	20	23.3 (21.38 - 25.38)
No	5,121	718	142	19.7 (17.66 - 21.71)
Care Not Available - Cost				
Yes	722	79	22	28.3 (26.26 - 30.49)
No	4,950	460	83	18.1 (16.61 - 19.71)

*Sample population taken from 2013-2014 CCHS. Each subcategory (ex. 'Male') was coded specifically for individuals reporting fair/poor health, and then once more based on whether or not the respondent had prescription drug insurance. The purpose of this was to show how poor health and lack of coverage are intertwined across various socioeconomic strata. For example, 30.9% of individuals living in poor health without income in Canada do not have medical insurance, compared to 15.9% of those making between $40,000 and $59,999 CAD.

Table 2: Multivariate regression results and odds ratios for self-perceived health

Variable	Parameter Estimate	Robust S.E.	Chi-square	Pr > Chi-sq	OR (95% CI)
Gender					
Male (reference)	0.0141	0.0428	2.9988	0.0833	1.00
Female	-0.1211	0.0765	8.0057	0.0047	0.785 (0.664 - 0.928)
Age					
18-29	0.7511	0.1072	49.1005	<.0001	2.377 (1.682 - 3.361)
30-49	-0.195	0.0774	6.3451	0.0118	0.923 (0.699 - 1.220)
50-69	-0.4411	0.0644	46.8861	<.0001	0.722 (0.567 - 0.918)
70+ (reference)	-0.9894	0.0891	139.2794	<.0001	1.00
Location					
Atlantic	-0.1918	0.0288	44.268	<.0001	0.681 (0.609 - 0.763)
Quebec	-0.00633	0.0286	0.0488	0.8251	0.987 (0.883 - 1.105)
Ontario	-0.0836	0.0277	9.0776	0.0026	1.182 (1.060 - 1.318)
Prairies	0.1161	0.0566	4.2079	0.0402	1.123 (1.005 - 1.255)
Bcolumbia	0.0957	0.0292	10.737	0.0011	1.211 (1.080 - 1.358)
Yukon/NWT/Nunavut	0.684	0.0342	14.538	<.0001	0.913 (0.867 - 0.961)
Education					
Less than high school	-0.3934	0.0919	18.3335	<.0001	0.511 (0.407 - 0.643)
High school	0.1454	0.0848	2.94	0.0864	0.877 (0.712 - 1.079)
Some postsecondary	-0.0291	0.1365	0.0454	0.8312	0.736 (0.513 - 1.056)
Postsecondary graduate (ref)	0.7983	0.0877	83.423	<.0001	1.00
Personal Income					
No income	-0.0169	0.2029	68.9321	<.0001	0.642 (0.361 - 1.143)
Less than $20,000	-0.6875	0.0864	63.3209	<.0001	0.328 (0.227 - 0.474)
$20,000 - $39,999	-0.1603	0.0865	3.4349	0.0638	0.556 (0.388 - 0.797)
$40,000 - $59,999	0.000737	0.1047	0.00244	0.9944	0.654 (0.449 - 0.950)
$60,000 - $79,999	0.4379	0.1519	8.3112	0.0039	1.012 (0.643 - 1.593)
$80,000+ (reference)	0.5632	0.118	77.84	<.0001	1.00
Family Doctor					
Yes (reference)	-0.0905	0.129	2.0642	0.1508	1.00
No	0.1082	0.0645	2.8165	0.0933	1.242 (0.964 - 1.599)
Employment Status					
Employee (reference)	0.277	0.0765	13.1238	0.0003	1.00
Self-employed	0.2131	0.1068	3.9792	0.0461	0.938 (0.672 - 1.310)
Unemployed/Not looking	-0.49	0.0737	44.2025	<.0001	0.464 (0.378 - 0.571)
Medical Insurance					
Yes (reference)	-0.1121	0.0495	5.1361	0.0234	1.00
No	-0.278	0.0506	30.2423	<.0001	0.799 (0.658 - 0.970)
Immigrant Status					
Yes	-0.00952	0.0509	0.035	0.8517	0.981 (0.804 - 1.198)
No (reference)	0.01756	0.0349	0.0026	0.9592	1.00
Care Not Available in Area					
Yes	-0.0741	0.0707	1.0986	0.2946	0.862 (0.653 - 1.138)
No (reference)	0.019	0.1018	0.5952	0.4404	1.00
Care Not Available - Cost					
Yes	-0.0418	0.0584	0.5128	0.4739	0.920 (0.732 - 1.156)
No (reference)	0.0243	0.0989	0.1378	0.7105	1.00

* Sample is 127,261 respondents who provided an answer to survey question regarding self-perceived health ("excellent", "very good" or "good" = 1; "fair" or "poor" = 0)

* Robust standard errors were used after homoscedastic null hypothesis was rejected using the White Test

* Odds Ratios denote a comparison between a subcategory and reference point. For example, respondents who do not have a family doctor were found to be 24.2% more likely to report good health than those who do.

Table 1 displays frequency data for individuals from an array of different socioeconomic classes. Individuals were first coded based on whether or not they reported fair/poor health. Respondents who answered affirmatively were then filtered based on whether or not they had some form of prescription drug insurance. Table 2 displays the results of the multivariate regression measuring the marginal effects of sixteen predictor variable on self-perceived health for all respondents, not just those who had reported poor health. This is intended to show whether various socioeconomic and demographic factors contribute positively or negatively to individual health throughout Canada. A cursory glance at the results in both tables shows that certain variables, like personal income, employment status and education had an expectedly strong bearing on how individuals view their respective health, while others displayed a surprising relationship, or lack thereof.

Gender

Examining Table 1 first, the weighted prevalence of fair/poor health combined with no health insurance were both in the range of the national average for both genders. After weighing the number of respondents to represent the Canadian population, I found that 20.2% of women and 21.7% of men living with fair/poor health did not have some form of prescription drug insurance (full or partial). This is in line with previous research, which has shown women to be more susceptible to Canada's gaps in coverage from a health perspective (Law et al., 2012; Fraser Group, 2000). Following multivariate regression, we see that being female is a statistically significant predictor of health at the 95% level of significance, but not male. Examining the parameter estimates, we see that being male is positively related with health, although the correlation is quite small, while women have a stronger, negative relationship. This is reinforced in the Odds Ratios, which show men as being 21% more likely to report good health than women (Table 2). One potential explanation for these results may be that women require more expensive medication than men, on average, or perhaps earlier in life as they age.

Age

Age produced predictably pronounced results and was statistically significant for three of the four subgroups groups, with the only exception being those in the 30-49 range (Table 2). Per Table 1, approximately 31% of individuals between the ages of 18-29 reported fair/poor health and no insurance, the highest of the four age groups. An interesting, although not unexpected finding was that seniors aged 70+ were the least likely to report a lack of insurance, which is in line with the fact that most are able to obtain public coverage regardless of province. This also could be a contributing factor in the Odds Ratios of Table 2, where the elderly were found to have better health on average than the preceding two age groups. Despite the fact that they had the highest proportion of respondents without insurance, the only age group found to have a positive relationship with health were the millennial subgroup, which is somewhat intuitive as younger people tend to suffer from fewer illnesses and diseases. Individuals in this category were 2.3 times as likely to be coded for good health than the next highest category (70+).

Location

Geographical location generated particularly interesting findings, and to some degree reflected the disparities alluded to earlier. Respondents living in the Atlantic and Prairie regions of Canada were the most likely to report fair/poor health and no medical insurance at 20.4% and 21.2%, respectively (Table 1). Quebec could not be included in Table 1 on the grounds that 0 respondents reported not having medical insurance, while the territories (Yukon/Northwest Territories/Nunavut) had the lowest weighted prevalence at just 11.2%. One potential explanation for this is that a sizeable portion of the populace living in these regions are of Native descent, a demographic that receives full health coverage in Canada. Those living on reserves were also omitted from the survey, as previously mentioned, which explains the small population sample. Examining Table 2, we see that the only region that did not produce statistically significant results at the 95% CI was Quebec, which also

happens to be the only province that provided compulsory coverage to those not covered under private drug plans. The Atlantic region had the strongest negative relationship with health (-0.19) while the Prairies had the strongest positive association (0.11). In terms of Odds Ratios, respondents living in the Atlantic, Quebec or Territory regions were all found to have poor health relative to the Canadian average, while those living in Ontario, the Prairies and British Columbia were above-average.

Education

Acquiring a postsecondary degree was found to have a positive, statistically significant relationship with perceived health, while failing to graduate from high school had the strongest negative relationship. This is in line with prevailing theories on human capital and academic investment. Respondents who failed to graduate from high school were nearly twice as likely to report poor health than those who graduated from a postsecondary institution (referent), with the gap becoming smaller as education increased (Table 2). This is not to say that education, or the lack thereof, is a direct cause of poor health. Rather, low education levels often correspond with income, and thus can be used as a proxy for poverty, which is associated with poor health. One possible explanation for this is greater earning-potential with more years of schooling, which might partially offset the negative effects of expensive prescription drugs. We also see in Table 1 that approximately one in four respondents who failed to graduate from high school reported fair/poor health and no medical insurance, in contrast with just 17% for those with a university degree.

Personal Income

Income represented the highest absolute test values of the predictor variables and were statistically significant at both the 95% and 99% levels of significance for three of the six subcategories. Respondents in the bottom two categories (no income; less than $20,000) displayed significant, negative relationships with health, while those

in the top two income brackets displayed strong positive results. Two data points of particular interest in this analysis were the weighted prevalence and odds ratios for individuals receiving no income in comparison with those in a slightly higher tax bracket (Table 1). Individuals in the lowest income tier were actually found to have a higher likelihood of reporting poor health than those not receiving any form of personal income, which brings to mind the fact that most provinces offer public medical insurance to those in the most disadvantaged subgroups. This also held true for Table 1, with the bottom two income brackets having a higher percentage of individuals with poor health and no insurance (34.4% and 36.6%) than respondents with no income (30.9%). Individuals making more than $80,000 CAD were more than three times as likely to be coded for good health than those making under $20,000 per annum (Table 2).

Family Doctor

Results for individuals reporting they do not have a regular family physician were unexpected, displaying a positive relationship with health (0.10 – Table 2), though not at a significant level, and a higher OR than those with a family doctor (1.242). One explanation for this may be that individuals in good health do not feel the need to seek out the diagnosis of a physician. With that in mind, individuals in this category were nearly twice as likely to report fair/poor health and no medical insurance (34.7% vs. 18.9%) in Table 1, so more research is needed.

Employment Status

Individuals who identified themselves as either employees or self-employed both displayed positive relationships with health, although results were only significant in the case of the former (Table 2). The divergence in Odds Ratios between these two subgroups was also not as pronounced as expected, given the fact that self-employed individuals are unable to benefit from employee-sponsored medical coverage in Canada. This could suggest that many individuals instead choose to purchase their own, private plans, or simply purchase necessary prescriptions out of

pocket. Those listed as unemployed or out of the labour force were more than two times as likely to report sub-optimal health (Table 2). 23.4% of individuals identifying as self-employed reported poor health and no insurance, significantly less than the 41% of those identifying as unemployed. Employees had the lowest percentage at just 16.9% (Table 1).

Medical Insurance

Medical insurance was found to be a significant predictor of self-assessed health, although the disparity in odds ratios for coverage versus no coverage was not as prominent as expected. One possible explanation for this is that the survey question does not stipulate whether or not an individual has full or partial coverage, so individuals in the 'yes' category could still be paying substantial costs out-of-pocket. Parameter estimates were also negative for both coverage and no coverage, which was also somewhat surprising. More research is needed before any definitive conclusions can be inferred, but these results would seem to suggest that the marginal effects of prescription drug insurance on self-assessed health are not as pronounced as previous studies would suggest.

Immigrant Status

Immigrant status was not a statistically significant predictor of fair/poor health, although individuals hailing from other countries were slightly less likely (1.9%) to report good health than those hailing from Canada (Table 2). Results were slightly more pronounced in Table 1, which found 26.2% of immigrants reporting poor health and no insurance, compared with 20% of Canadian respondents.

Care Not Received

These variables consisted of two-part questions, in which respondents were asked if they had not received proper care in the previous 12 months, and were then asked to clarify whether it was due to availability or cost concerns. This explains the small population sample. Results were not significant for either. This finding was

surprising, especially for cost concerns, as not being being able to afford care would on the surface appear to imply that an ailment or injury was not remedied through the health care system. Again, additional research is needed to identify whether this is an anomaly or a trend. In terms of prevalence, individuals without access to care were less likely to have medical coverage, which is to be expected.

Statistical Tests

A number of statistical tests were run to ensure the integrity of the data. Predictor variables were tested for multicollinearity using a Variance Inflation Factor (VIF) option, which measures the extent to which the variance of estimated regression coefficients are inflated, compared to if the regressors were not linearly related. None of the VIF and tolerance (1/VIF) values were particularly worrisome for the eleven predictor variables measured (see figure 5 in appendix). To check whether the observed proportions of each categorical variable differed significantly from the hypothesized distribution, a Hosmer-Lemeshow test of goodness-of-fit test was used. This tests the null hypothesis that there is no difference between the observed and predicted values of the regressors used in the logistic regression. The test showed a good degree of calibration (χ^2 = 7.6528; DF = 16; Pr = 0.4681), implying the model fits the data fairly well. A White heteroscedasticity test was used to test the null hypothesis that the residual variances are constant. This produced significant results initially, which were corrected for using robust standard errors in SAS (see Table 2). Lastly, an adjusted R-squared test of the logistic regression showed that 15.27% of the variability in individual's self-perceived health can be attributed to the predictor variables used. This is not surprising given the incredibly wide range of factors that can influence how individuals feel about their health (diet and exercise for instance, two essential elements of general well-being, were not included in the analysis).

Limitations

There are several data traits that may have influenced the results found within the methodology section of this analysis. Firstly, and as alluded to previously, bootstrapping methods were not made available for the Public Use Microdata Files, as they are reserved for Statistics Canada data analysts and partner agencies. The method used in its place – rescaling the weights so that the average weight is one – is unlikely to provide estimations of variance as precise as if bootstrapping had been used, due to the stratified and clustered design of the survey. Secondly, and as noted in the CCHS User guide, the selection of individual respondents is designed to slightly over-represent the youth demographic (aged 12-19). Although steps were taken to minimize the effects of this distribution, removing the 12-14 and 15-17 age groups in the regression analysis, it is still conceivable that this influenced respondent answers and thus the quantitative analysis. An individual living at home with their parents does not necessarily need income or medical insurance in order to remain in good health, whereas these features would likely be paramount to an individual living independently. Further, with self-reported data, there is always the possibility of cognitive and social biases variables, which may have affected respondent answers to a degree. Omitted variables must also be taken into account, particularly when focusing on a variable as intricate and complex as health. In selecting the categorical variables to be used in analysis, I chose traits that I felt were relevant to all Canadian citizens, but there were still some important factors that could not be included, such as exercise regimens or cost-related non-adherence. Lastly, the survey question pertaining to prescription drug insurance did not include any follow-up questions concerning the extent of coverage, instead grouping all individuals with some form of coverage together. As noted repeatedly throughout this paper, coverage differs significantly based on individual characteristics and location, so an affirmative answer does not definitively imply a respondent is able to afford all the coverage they require.

Concluding Discussion

Canada's current system with regards to prescription drugs leaves much to be desired. The country spends significantly more per capita on medication than most OECD countries, is affronted by unnecessary rising costs, and fails to provide suitable coverage to a large portion of the population. This third point defies two of the core principles on which the the Canada Health Act is built – comprehensiveness and accessibility – and yet the nation has declined to take any sort of significant steps forward to expand universal healthcare to include prescription drug coverage.

This aim of this study was to analyze various socioeconomic determinants to assess how they affect individual health, and in doing so, to underscore the vulnerable position that many individuals find themselves in as a result of the patchwork system currently in place. To accomplish this, two sets of quantitative analysis were used. The first, Table 1, measured the percentage of respondents in each socioeconomic stratum that reported fair or poor self-perceived health, who were then categorised based on whether or not they had some form of prescription drug coverage to present a weighted prevalence of each. The second, Table 2, consisted of a multivariate logistic regression to analyze the marginal effects of sixteen predictor variables on self-perceived health. This included the direction and magnitude of the relationship, in addition to a comparison of each subcategory relative to a categorical benchmark. The results suggest that age, location, education, personal income and employment status all have a significant bearing on self-assessed health, which defies the most elementary notion of universal health care. Further, the results show tremendous variation within each category. An individual living in New Brunswick is nearly twice as likely report fair/poor health and no insurance as someone living in the Northwest Territories, while 36% of individuals in low income brackets reported a lack of coverage in contrast with just 10% of respondents earning $80,000 CAD or more. These results suggest that the number of Canadians living in poor health, without insurance, is much higher than

previously believed, and would appear to reinforce the arguments put forth in favor of universal prescription drug coverage, or 'pharmacare'.

Individuals may not be able to choose their tax bracket or postal code, but they should have full autonomy when it comes to their health, particularly in a high-income nation such as Canada. If this is to be achieved, amendments are needed at the provincial, territorial and federal levels of government. Evidence from other prominent OECD countries such as Sweden, the United Kingdom and New Zealand has shown that it is entirely feasible to strike an appropriate balance between the promotion of a nation's pharmaceutical sector and the well-being of its populace, and the creation of a National Drug Agency would be an excellent place to start. This would help streamline the introduction of new prescription drugs into the Canadian market, benefitting firms and consumers, and would facilitate much more purchasing power for provinces, as they could negotiate drug prices as a collective rather than individually. With regards to insurance, if provinces are unable or unwilling to band together to provide more comprehensive coverage, then at the very least, they should each explore alternative methods of fiscal stimulus to widen the safety net currently being provided. Quebec's mandatory provincial drug program, while not without its challenges, is a tremendous step in the right direction. It is time for the rest of Canada to follow suit.

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Appendix

Figure 3: Map of Canada and its provinces

Source: Wikipedia – "Provinces and Territories of Canada"

(https://en.wikipedia.org/wiki/Provinces_and_territories_of_Canada)

Survey questions on which the predictor variables are based

Variable: Gender
Question: Enter the respondent's sex. If necessary, ask: Is respondent male or female?

Variable: Age
Question: What is your age?

Variable: Province
Question: Province of residence of respondent (G)

Variable: Education
Question: Highest Level of Education – Respondent (4 levels)

Variable: Personal Income
Question: Total personal income from all sources - (D, G)

Variable: Regular Family Doctor
Question: Do you have a regular medical doctor?

Variable: Employment Status
Question: Are you an employee, self-unemployed or looking for work?

Variable: Immigrant status
Question: Were you born in Canada?

Variable: Medical Insurance
Question: Do you have medical insurance that covers all or part of your prescription medications?

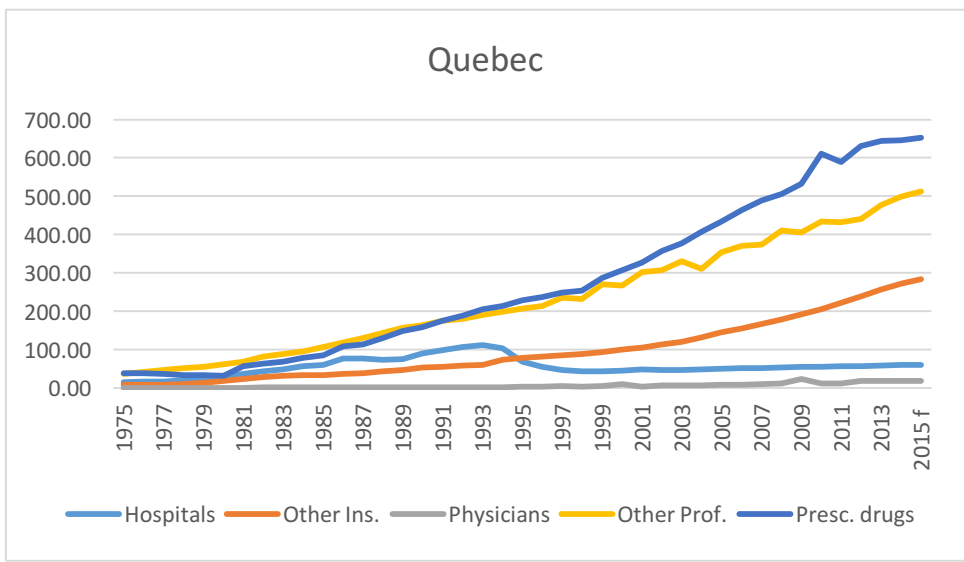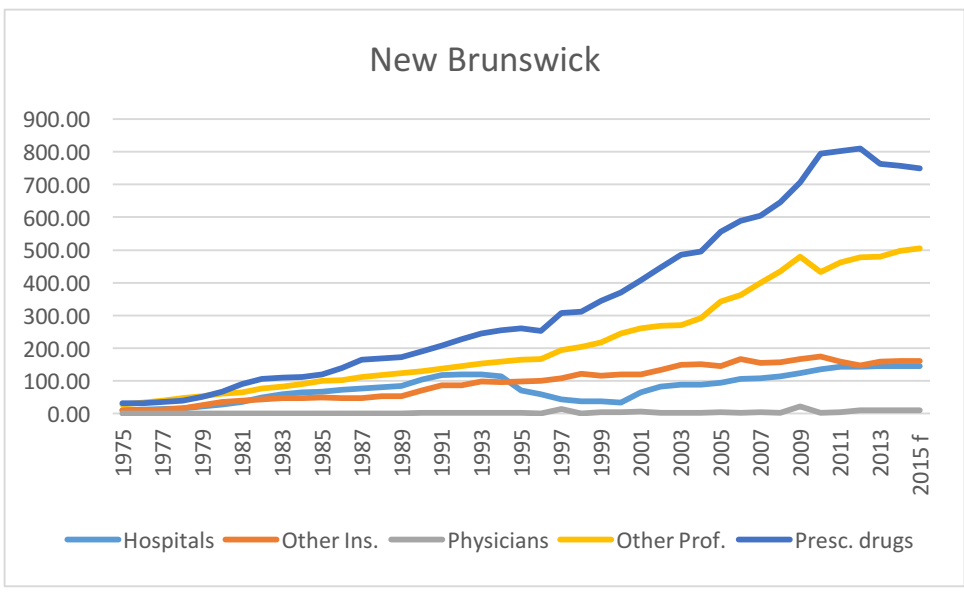**Variable:** Care not received – Not available
Question: Thinking of the most recent time, why didn't you get care? – Not available in the area
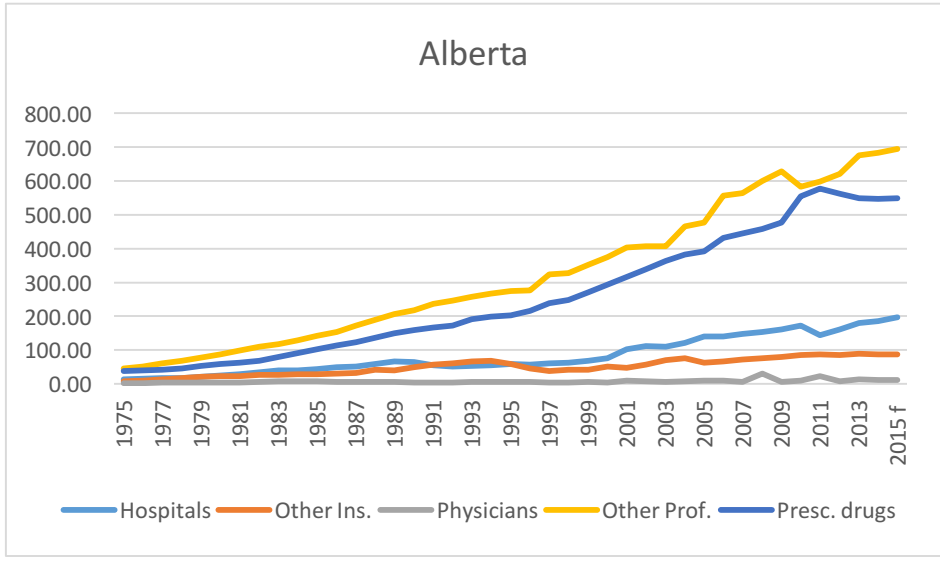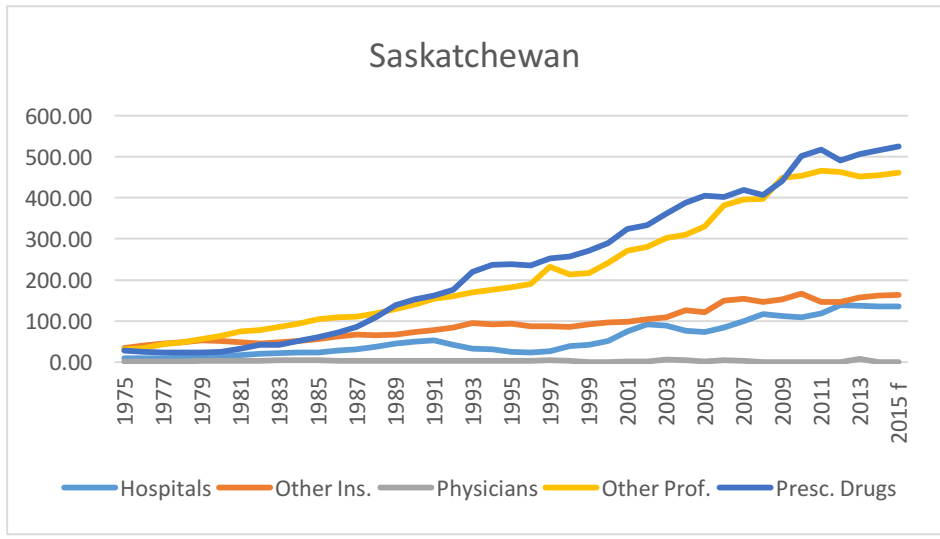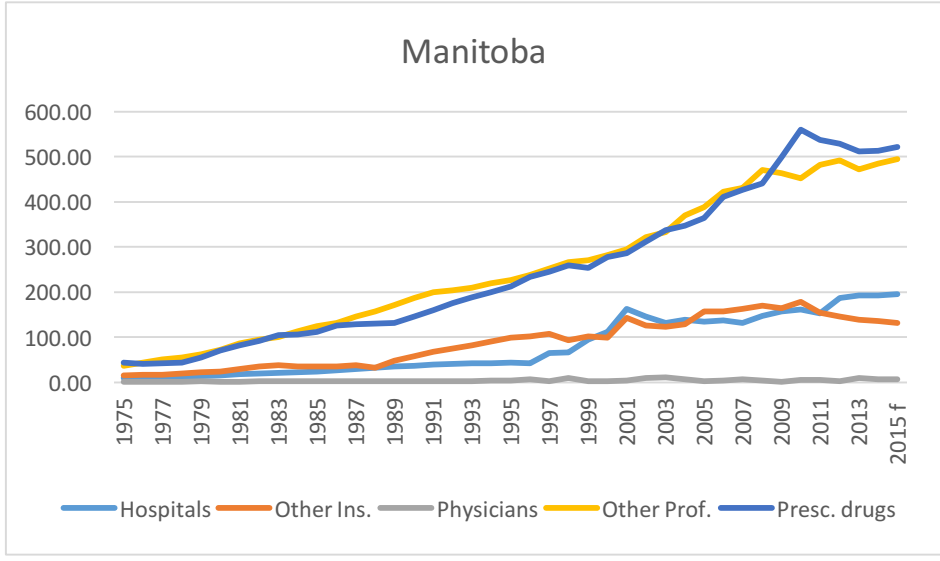
Variable: Care not received – Cost
Question: Thinking of the most recent time, why didn't you get care? – Cost

Figure 4: Private Sector Health Expenditures, 1975-2014 (per capita - by province) – Source: Canadian Institute for Health Information (CIHI)
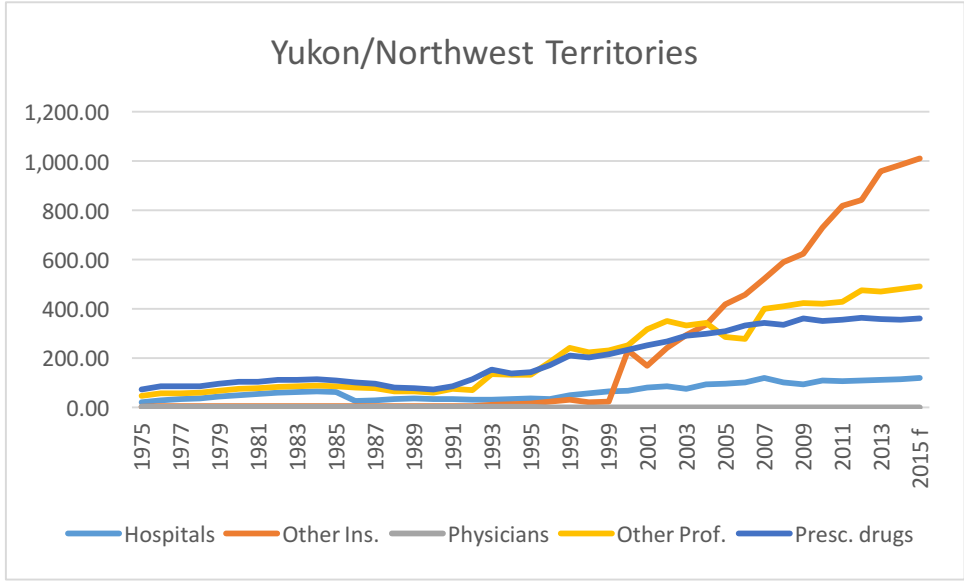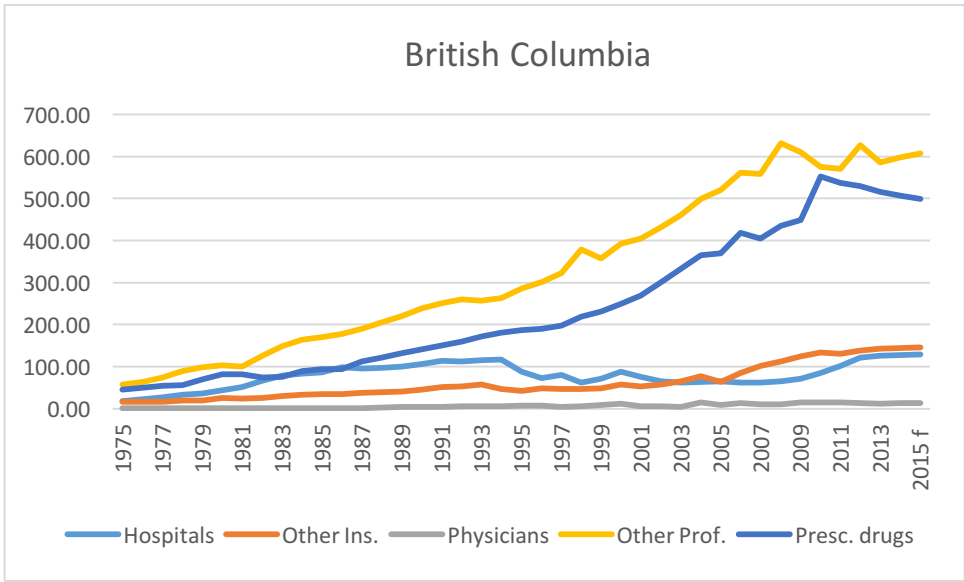

Newfoundland & Labrador

Prince Edward Island

Nova Scotia

New Brunswick

Quebec

Ontario

Manitoba

Saskatchewan

Alberta

British Columbia

Yukon/Northwest Territories
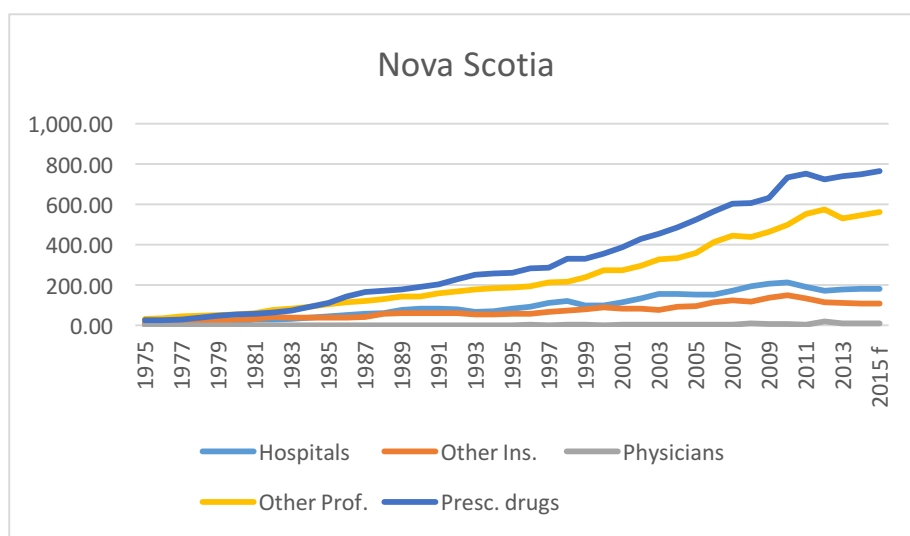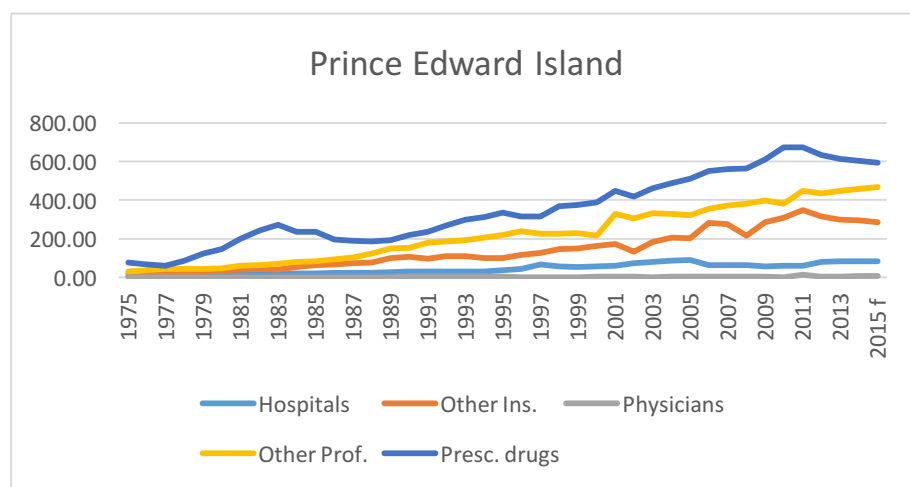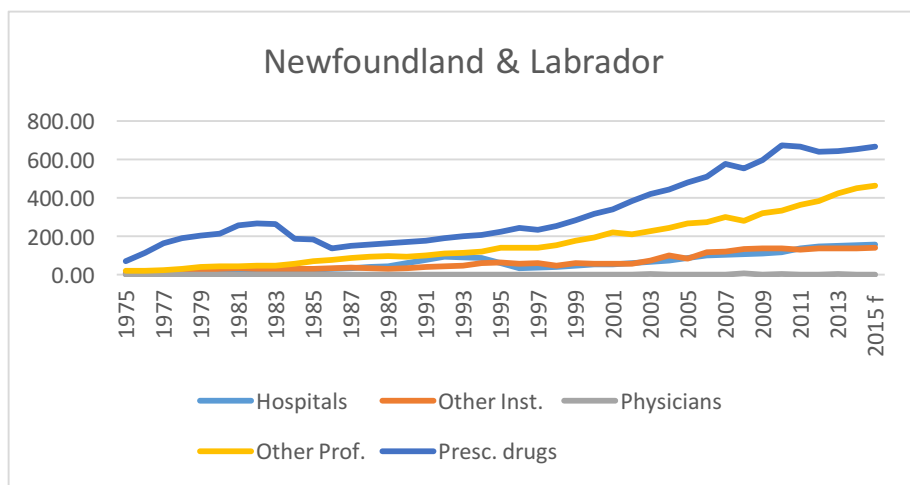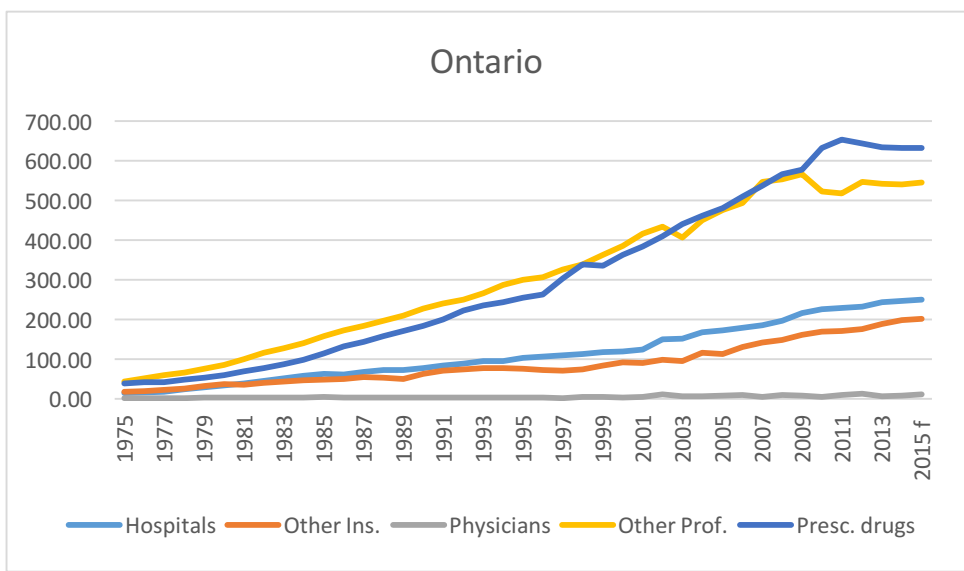
Figure 5: Multicollinearity Test (Variance Inflation Factor)

Variable	Tolerance	Variance Inflation
Gender	0.9443	1.05898
Age	0.84253	1.1869
Atlantic	0.19143	5.22378
Quebec	0.14943	6.69205
Ontario	0.10631	9.40685
Prairies	0.13652	7.325
British Columbia	0.19845	5.0391
Yukon/Northwest Territories/Nunavut	0.95286	1.04947
Education	0.89405	1.11851
Personal Income	0.78572	1.27273
Family Doctor	0.88372	1.13158
Employment Status	0.81882	1.22127
Immigrant Status	0.98557	1.01464
Medical Insurance	0.89016	1.12339
Care Not Received - Not Available	0.96788	1.03318
Care Not Received - Too Costly	0.90722	1.10227