

**THE DISTRIBUTION AND DETERMINANTS OF CATASTROPHIC OUT-
OF-POCKET PRESCRIPTION DRUG EXPENDITURES IN CANADA**

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By

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Abstract

Background: As the need to achieve the financial protection goal of Universal Health Coverage (UHC) continues to grow globally, it is imperative to develop appropriate policy interventions to address the financial risks that out-of-pocket prescription drug expenditures (OOPDE) in Canada poses. Empirical studies of the prevalence and determinants of catastrophic OOPDE (expenditure that poses a significant threat to households' living standards) in Canada are very few and there is a paucity of scholarly works in this regard.

Objectives: i) to assess the current prevalence of financial catastrophe and impoverishment from OOPDE; ii) to analyze the factors that are possibly associated with catastrophic OOPDE; and iii) to examine the implications of the proposed national Pharmacare plan on the distribution of OOPDE.

Methods: This study used the 2016 Statistics Canada Survey of Household Spending; 11,446 households were included in the analysis. Catastrophic OOPDE was analysed at several thresholds using a novel budget share – capacity to pay approach. Concentration indices were constructed to determine which households overshot their budget shares. Canada's official poverty line was used to construct a Pen's parade to show impoverishment from OOPDE. Further, multivariate logistic and partial proportional odds regression models were fitted to investigate the determinants of catastrophic OOPDE.

Results: Residents who are in the working poor income category in Quebec and Prairie provinces had a higher risk of incurring catastrophic OOPDE compared to the reference group – the households with higher than average income living in Ontario. Type of employment and education were also associated with catastrophic OOPDE. Also, households with a lower capacity to pay experienced a higher prevalence of incurring catastrophic spending. The Pen's parade also showed most households that fell below the poverty line as a result of OOPDE were in the lower half of the income distribution.

Conclusion: This study revealed that despite the existing public-private mix of prescription drugs insurance, some households are being drawn into poverty and for some others, poverty is deepened when they make OOPDE. The findings suggest, particularly based on the experience of Quebec, that the presence of a mandatory insurance for all residents does not necessarily better protect them from financial catastrophe compared with other insurance programs. Instead, the comprehensiveness of the health insurance package determines the effectiveness of a health insurance program.

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Every desirable and beneficial gift comes out of heaven. The gifts are rivers of light cascading down from the Father of Light. There is nothing deceitful in God, nothing two-faced, nothing fickle. James 1:17

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Dedication

I dedicate this thesis to my late father, friend, and love - Engineer Matthew Kojo Ocran. Your value for education and research has continually fuelled my passion. I hope you are proud of me as you always told me!

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List of Abbreviations

AB	Alberta
BC	British Columbia
BRR	Balanced Repeated Replication
CHA	Canada Health Act
CIHI	Canadian Institute for Health Information
MB	Manitoba
MBM	Market Basket Measure
MVT	Median Voter Theory
NB	New Brunswick
NL	Newfoundland and Labrador
NPS	National Pharmaceutical Strategy
NS	Nova Scotia
OECD	Organization for Economic Cooperation and Development
ON	Ontario
pCPA	pan-Canadian Pharmaceutical Alliance
PEI	Prince Edward Island
PPO	Partial Proportional Odds
SDG	Sustainable Development Goal
SHS	Survey of Household Spending
SK	Saskatchewan
UHC	Universal Health Coverage
WHO	World Health Coverage

CHAPTER ONE

INTRODUCTION

1.1 Introduction

The comprehensiveness principle of the Canada Health Act (CHA)¹ requires the provision of medical services that are "medically necessary" to all Canadian residents (Government of Canada, 1984; Flood & Chowdury, 2002; Health Canada, 2005). However, there is ambiguity around the term "medically necessary," and there has been no universal public funding for such areas as prescription drugs, home-based nursing and other health innovations (Caulfield & Zarzeczny, 2014; Marchildon, 2005; Caldbick et al., 2015). Public prescription drugs programs in Canada, for example, are financed by individual provinces (Daw & Morgan, 2012; Kapur & Basu, 2005). These prescription drugs programs vary between provinces regarding who has coverage and what types of prescription drugs are covered (Anis, Guh & Wang, 2001; Barnes & Andersen, 2015; Demers et al., 2008; Sutherland & Dinh, 2017). In 1997, for instance, Quebec introduced a mandatory prescription drug coverage for its residents. The program is mandatory because all Quebec residents need to have either government or employer coverage for prescription drugs (Daw & Morgan, 2012). Notwithstanding, premiums for the program have increased in recent times, making it unaffordable to a lot of Quebec residents (Picard, 2017).

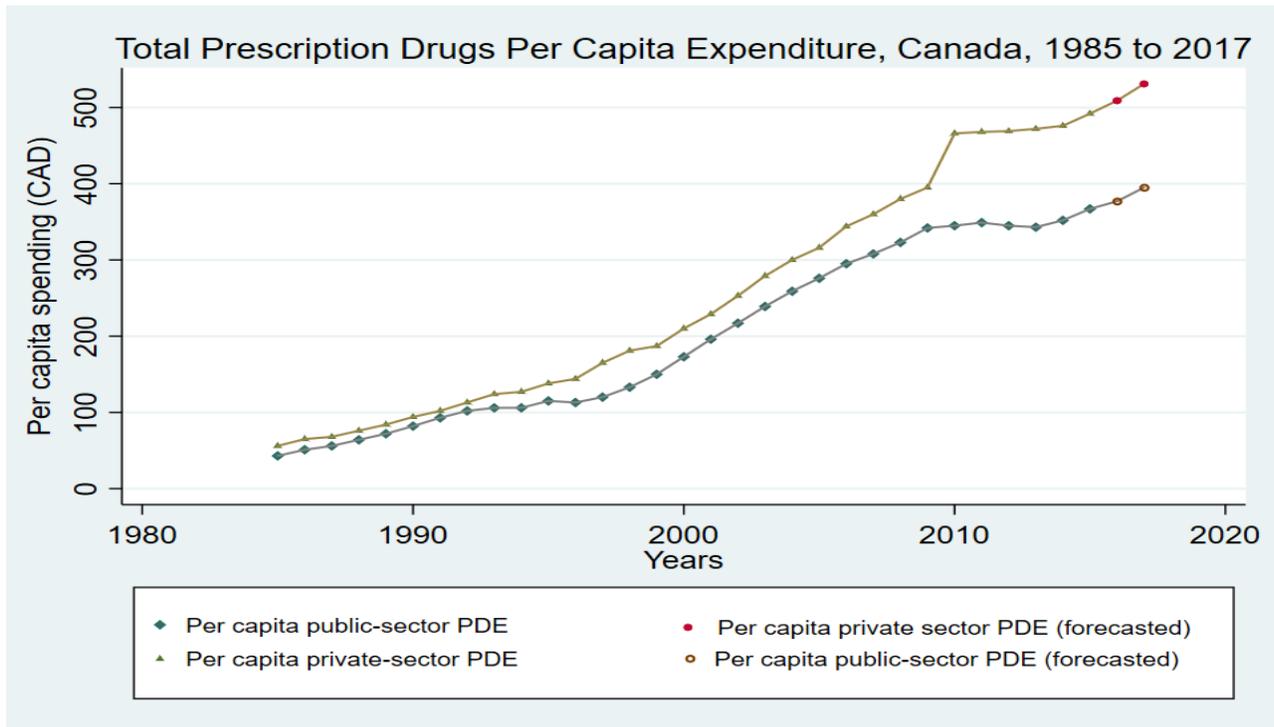
Further, other provinces have public prescription drugs coverage for seniors and social assistance recipients, but these programs also require income-based deductibles and copayments, which limit affordability (Caldick et al., 2015; Hoskins, 2018; Law et al., 2012; McLeod et al.,

¹ The Canada Health Act (CHA) is the federal government's legislation regarding the dynamics of a publicly financed health care system. The primary objective of the CHA is "to protect, promote and restore the physical and mental well-being of residents of Canada and to facilitate reasonable access to health services without financial or other barriers." (Canada Health Act, 1984, C.6, sec.3).

2011, Morgan & Boothe, 2016; Morgan, Daw & Law, 2013). Residents other than seniors or social assistance recipients mostly have employer-provided private insurance plans (Daw & Morgan, 2012; Kapur & Basu, 2005; Law et al., 2012; McLeod et al., 2011). However, the rise in part-time employment has also led employers to significantly reduce employee drug coverage plans for working-class Canadians (Picard, 2017; Barnes & Andersen, 2015). This disparity in prescription drug coverage between and within provinces for Canadian households is also known as the Canadian “patchwork” of prescription drugs program (Gagnon, 2014; Morgan, Daw & Law, 2013). Because of the “patchwork” prescription drug programs, some Canadian residents must pay out-of-pocket to fill their prescription drugs (Caldbick et al., 2015; Morgan et al., 2015). Around 67 percent of households are exposed to out-of-pocket prescription drug expenditures (Law et al., 2012). In total, Canadians paid approximately \$6.5 billion as out-of-pocket payment in filling their prescriptions in 2014 (Law et al., 2018).

A lack of universal prescription drug coverage, therefore, implies some Canadians are not able to afford the needed prescription drugs (Barnes & Andersen, 2015). The problem of access to prescription drugs affects at least 23 percent of Canadian households (Angus Reid Institute, 2015). According to Kennedy and Morgan (2006), five to ten percent of Canadians cannot fill their prescription drugs due to cost and one in twelve Canadians who are 55 years of age and above still suffer from cost-related non-adherence. Another study found that one in ten Canadians cannot fill their prescription drugs due to the prohibitive cost associated with paying from out-of-pocket (Law et al., 2012). Notwithstanding, pharmaceutical expenditure for prescribed drugs, particularly for private sector prescribed drugs (out-of-pocket payment and private insurers payment), continues to rise in Canada (Caldbick et al., 2015, CIHI, 2013). The graph below illustrates a visual appraisal of the phenomena described above.

Figure 1.1: Total private and public sector prescription drugs per capita spending, Canada 1985 to 2017



Author’s Computation

Data Source: National Health Expenditure Database, Canadian Institute for Health Information.

Out-of-pocket prescription drug expenditure is termed “catastrophic” if they result in a significant reduction in standards of living for the households either in the short or long run (Kawabata, Xu & Carrin, 2002; Stiglitz, 1988; Van Doorslaer et al., 2006; Wagstaff & Van Doorslaer, 2003). That is, if out-of-pocket prescription drug expenditures as against total expenditure in a given household (this ratio is also known as a budget share) exceeds a given threshold such that living standards are disrupted, it is catastrophic for the household (Caldbeck et al., 2015; McLeod et al., 2011). The financial burden households experience as a result of catastrophic out-of-pocket health payments is crucial and has significant implications for policy (Elgazzara et al., 2010; Kimani, 2014; Whitehead, Dahlgren & Evans, 2001; WHO, 2005). First, catastrophic out-of-pocket health expenditures are not invariably correlated with high health care

payments (Su, Kouyate & Flessa, 2006; Wyszewianski, 1986, Xu et al., 2003), and are not predictable (Akazili et al., 2017; Arrow, 1963; Kimani, 2014; Kwesi, Zikusooka & Ataguba, 2015), hence, such payments may be a significant cause of household poverty. Payments may also cause households to divert their limited household resources to other household necessities such as food, shelter etc. or even sell their assets/borrow to finance such health care payments (Berki, 1986; Foster, 1994; Löfgren, 2014; McIntyre et al., 2006; O'Donnell et al., 2008; Russell 2004; World Bank, 1993; Yip & Hsiao, 2008). Also, households may forgo filling of prescription drugs altogether, thereby resulting in private costs from health complications, and social costs on the health system (Baeza & Packard, 2005; Gertler & Gruber, 2002; Kesselheim et al., 2015; Law, Kratzer & Dhalla, 2014; Sanmartin et al., 2014; WHO 2010).

On a global level, it is established that every welfare state's goal is to finance its health care in a way that allows its various population groups to have access to the quality health care services they need without resulting into financial difficulty or bankruptcy (Akazili, 2010, Limwattanom, Tangcharoensathien & Prakongsai, 2007; WHO, 2010). The goal described above is documented in literature as the World Health Organizations' (WHO) Universal Health Coverage (UHC) goal (Baeza, & Packard, 2006; Garret, Chowdhury & Pablos-Mendez, 2009; Gwatkin & Ergo, 2011; Kutzin, Jakab & Cashin, 2010; Ngcamphalala, 2016). Therefore, compared with market-based health care allocation, UHC seeks to achieve equity in health financing, quality and access levels (Baeza, & Packard, 2006; Bump, 2010; Chuma & Okungu, 2011; Dye, Reeder & Terry, 2013; Mathauer, 2015; Prinja, Kaur & Kumar 2012; Mills et al., 2012; Rodin & De Feranti, 2012). This implies a health system financing scheme with a substantial dependence on out-of-pocket payment is adjudged as inequitable and unfair primarily because of the potential adverse consequences on its vulnerable population (Ataguba, 2012; Carrin et al., 2008; Kimani, 2014; Knaul et al., 2006;

Kwesiga, Zikusooka & Ataguba, 2015; Löfgren, 2014; Ngcamphalala, 2016; Szende & Culyer, 2006; WHO, 2010). Conversely, a fair and equitable health system financing scheme should protect its population from the catastrophic implication of out-of-pocket health care spending (Ataguba, 2012; Akazili et al., 2017; Brearly, Marten & O’Connell, 2013; Bhojani et al., 2012; Wagstaff & Van Doorslaer, 2003).

As a result, financial protection for Canadian households against catastrophic out-of-pocket prescription drug expenses remain a vital policy challenge to be addressed (Law et al., 2012). As such, there is a need for policy interventions to mitigate the negative consequences of catastrophic out-of-pocket prescription drug expenditures (Filmer, Hammer & Prichett, 2002; Hoskins, 2014; Kimani, 2014; Musgrove, 2000). In the past five decades, several commissions have considered comprehensive prescription drug programs that are accessible to and affordable for all Canadians. These proposals were from (1) the 1964 Royal Commission on Health Services, (2) 1997 National Forum on Health, (3) 2002 Royal Commission on the Future of Health Care, and (4) 2016-2018 working group and task force on national Pharmacare (Morgan et al., 2015; Morgan & Boothe, 2016; Morgan et al., 2016). However, none of these proposals for a comprehensive prescription drug program have been implemented (Morgan & Boothe, 2016). Estimating the distribution of the financial burden experienced by Canadian households because of out-of-pocket prescription drug expenditures is, therefore, the first step towards understanding these initiatives and addressing the policy issue (Merlis, 2003; Xu et al., 2003).

1.2 Scholarly Context and Rationale for the Study

As documented above, when health payments exceed a particular share of total household expenditure, such payments are termed catastrophic (Pradhan & Prescott, 2002; Xu et al., 2003).

Although the choice of the threshold is value-laden, a 10 percent threshold is predominantly favoured in the literature of health care financial burden (Ranson 2002; Wagstaff & Van Doorslaer, 2003). Scholars believe that this threshold represents the point at which households are forced to forgo basic needs, incur debt, or become poorer (not being able to afford subsistence living) (Russell, 2004). Conversely, Kawabata, Xu and Carrin (2002) and Xu et al., (2003) proposed the use of “capacity to pay” at a threshold of 40 percent.

While the distribution of the financial burden from out-of-pocket health payments using budget shares have been conducted in many countries such as the USA, Georgia and Thailand, etc., surprisingly, there is a paucity of evidence regarding the financial burden of out-of-pocket prescription drug expenditures in Canada (Frenk, Lozano & Gonz´alez-Block, 1994; Pannarunothai & Mills, 1997; Skarbinski, 2002; Van Doorslaer et al., 2006; Xu et al., 2003). For example, to the best of my knowledge in the last decade, only two scholarly works by McLeod et al., (2011) and Caldbick et al., (2015), have attempted to critically assess the financial burden of out-of-pocket prescription drug expenditures in Canada. McLeod et al., (2011) used household-level data from the 2006 Survey of Household Spending by Statistics Canada, while Caldbick et al., (2015) used the 2009 data of the same survey.

McLeod et al., (2011) categorized the Canadian population into three groups (seniors, general population, and social assistance recipients) and assessed the financial burden from out-of-pocket prescription drug expenditures in Canada. This study indicated that the general population in Canada compared to seniors and social assistance recipients experienced a relatively lower catastrophic financial burden from out-of-pocket prescription drug expenditures. However, as suggested in the literature, there exists no consensus on the threshold budget share of household expenditure for analytical purposes. Therefore, Calbick et al., (2015) argued that McLeod and

colleagues' use of a single threshold of 10 percent might have underestimated the prevalence of the catastrophic financial burden Canadian households experienced. Hence, Caldbick et al., (2015) used three lower budget share thresholds of 3 percent, 6 percent, and 9 percent. The scholars showed that as high as 8.2 percent of Canadian households experienced a catastrophic financial burden from out-of-pocket prescription drug expenditures.

Notwithstanding, the use of the budget share derived by the fraction of out-of-pocket prescription drug expenditures to total household expenditure is problematic for policy formulation. The methodology does not allow for the fact that wealthier households, when compared to poorer households, have a higher probability of exceeding the catastrophic threshold without resulting in financial difficulty or poverty (Wasgstaff & Van Doorslaer, 2003). Also, the use of budget share does not differentiate among households concerning the disparity in household necessities' expenditure (Wagstaff & Van Doorslaer, 2003). Lastly, the use of budget share implies that all households have equal weight in the estimation of the financial burden. That is, all households are counted as equal regardless of the differences in household size (total number of individuals in the household) (Xu et al., 2007). However, due to economies of scale for example, a household's food requirement is not necessarily a proportional increase of the household's size (a household of three doesn't necessarily eat directly thrice as much food). Hence, there is the need to employ an "equivalence/proportional scale" in order to ensure accurate comparability to estimate the financial burden (Kimani, 2014; Xu et al., 2003).

In light of the limitations of the budget share methodology, other studies have employed statistical simulation to explain differences in prescription drugs coverage for the Canadian population (Demers et al., 2008; Grootendorst, 2002; Kapur & Basu, 2005; MacDonald & Potvin, 2004; Morgan et al., 2015) . Although these simulation studies are essential for policy formulation,

they do not capture the actual financial burden resulting from out-of-pocket payments for prescription drugs at the basic decision-making unit level of the household (McLeod et al., 2011). That is, simulation studies hide the household and individual level distribution of the financial burden and focus on the population level. Moreover, simulation studies are based on strong assumptions that skew the direction of the results of an analysis. For example, in the work of Demers et al. (2008), where premiums for senior residents in New Brunswick were wrongfully assumed to be \$60 per year as against the correct figure of \$89 per month. The disparity led to significant changes in the distribution of financial burden as well as in conclusion, earlier reported (McLeod et al., 2011; O’Sullivan, 2008).

In this study, I offer an extension to the literature on the financial burden of prescription drug expenditures in Canada by employing a method (an adjusted budget share) that accounts for the limitation in the budget share methodology. An improvement to the budget share methodology is used to account for household necessities by defining total expenditure in the budget share as less of household necessities. This new total expenditure is also known as “non-discretionary expenditure” (Xu et al., 2003). The threshold of interest for most countries is 40 percent, but this study determined catastrophic events at 3.4 percent, 6.73 percent, and 12 percent as indicated by Canadian data and compared the results. This approach better captures the differences between households concerning their income. Also, unlike what has been in the Canadian literature so far, I use the method of “equivalence scale” to obtain an equivalent household size as a unit of analysis as opposed to the use of the given household size in the survey (Deaton & Zaidi, 2002; Kimani, 2014).

Further, as a review of the existing literature suggests, it has been almost ten years since the last study of the financial burden of out-of-pocket prescription drug expenditures in Canada. The

present study uses the 2016 Survey of Household Spending (SHS), provided by Statistics Canada, to understand the current financial burden of out-of-pocket prescription drug expenditures on Canadian households. The need to understand the financial burden Canadian households experience because of out-of-pocket prescription drug expenditures is justified in that the information is necessary for policy response design, formulation and appropriate targeting (Kimani, 2014; Löfgren, 2014).

1.3 Problem Statement

As indicated above, out-of-pocket payment for prescription drugs poses a significant financial burden on some Canadian households (Caldbick et al., 2015; Law et al., 2015; Law et al., 2018). Sometimes, the cost of out-of-pocket payments for prescription drugs on Canadian households are high enough to expose them to poverty or prevent them from seeking the necessary treatments altogether (Kapur & Basu, 2005; McLeod et al., 2011; Morgan et al., 2015). When households must reduce their necessary expenditure to cope with health expenditure, expenditure is catastrophic (Kawabata, Xu & Carrin, 2002). Notwithstanding, the Canadian health care system has continued to witness path-dependent health policy changes that have prevented departure from the initial designation of medically necessary services to include prescription drugs (Bhatia & Coleman, 2003; Canada, 1998; Canada, 2002; Dewa, Hoch & Steele, 2005; Fierlbeck, 2013; Marchildon, 2007; Marchildon, 2014; Morgan, Daw & Law, 2013; Romanow, 2002; Wireko, 2015).

For three very plausible arguments, Canada, as a country, presents a unique opportunity for the study of the financial burden of prescription drug payments. First, Canada is the only country with a universal and publicly funded health insurance system without a universal and publicly funded insurance for prescription drugs (Boothe, 2017; Morgan, Daw & Law, 2013; Taber, 2015).

Compared to other Organization for Economic Cooperation and Development (OECD) counterparts, Canada's per capita spending on prescription drugs has consistently ranked among the highest (Beall, Nickerson & Attaran, 2014; Boothe, 2016; Church, 2015; Gagnon, 2014; Morgan et al., 2015). Moreover, in 2017, Canada had the third-highest drugs prices among other OECD member countries (Picard, 2017). Although the pan-Canadian Pharmaceutical Alliance (pCPA) has made significant savings for drugs via bulk purchasing, administrative costs are still high because of the absence of a nationally coordinated framework, transparency and cooperation among provinces (Benefits Canada, 2016; Dutt, 2014; 2016; Gagnon, 2014; Grant, 2018; Kaur et al., 2014; Picard, 2018). Canada's high per capita drug spending implies that Canadians are more exposed to financial catastrophe due to prescription drug expenditures when compared to other OECD countries (Ngcamphalala, 2016; Xu et al., 2003).

Second, in the absence of a universal and publicly financed prescription drugs program, empirical evidence continues to show that cost-related non-adherence significantly limits access to prescription drugs in Canada (Dewa, Hoch & Steele, 2005; Law et al., 2012; Morgan & Boothe, 2015, Tang, Ghali & Manns, 2014). It is documented that the intensity of cost-related non-adherence is as high as 36 percent among Canadians and Canadians sometimes have to skip or split prescription drugs doses to ensure that they use the drugs for a longer time (Gupta et al., 2018, Law et al., 2018; Taber, 2015). Evidence also suggests that, the intensity of cost-related non-adherence in Canada depends on factors such as income, employment status, province of residence, age, etc. which is against the universality principle² of the Canada Health Act (Gupta et al., 2015; Hennessy, Sanmartin & Ronksley, 2016; Kennedy & Morgan 2006; Morgan & Lee,

² The universality principle of the CHA documents that provinces ensure that all their residents who are insured be entitled "to the insured health services provided for by the plan on uniform terms and conditions" (Canada Health Act, 1984, sec. 9; p. 6)

2017; Piette et al., 2006; Sutherland & Dinh, 2017; Tamblyn et al., 2014). In this regard, this study's results can serve as a policy blueprint for other countries with similar realities as Canada regarding out-of-pocket health expenditures.

Lastly, the federal government proposed the introduction of legislation that institutionalizes Canada's first official poverty line through the "Poverty Reduction Act" (Canada, 2018). The poverty line is defined as the required minimum income level needed to meet the necessities of life (O'Donnell et al., 2008; Kakwani, 2010). On August 21, 2018, the federal government of Canada published the document "Opportunity for All: Canada's First Poverty Reduction Strategy" that signifies the first politically backed up plan towards poverty reduction in Canada (Canada, 2018, Corak, 2018; Homer, 2018). The document juxtaposes the positive and normative judgements of poverty by analyzing the expenditure costs for modest living as well as other costs regarding experiences, stories and views of Canadians with lived experiences of poverty (Canada, 2018). The targets of Canada's first Poverty Reduction Strategy³ were set against the poverty rate in 2015 1.) decrease poverty rate in Canada by 20 percent in the year 2020 2.) decrease poverty rate in Canada by 50 percent in the year 2030 (Canada, 2018). Specifically, Canada's official poverty line is a Market Basket Measure (MBM)⁴ that will be subject to continuous updates and improvements every five years (Corak, 2018; Homer, 2018). The foundation of any poverty-related analysis depends on the theory of poverty line and having a homogenous poverty line is important for unmasking horizontal inequality⁵ in the society (Kakwani, 2010). It is important to

³ Canada's first Poverty Reduction Strategy encompasses dignity; opportunity and inclusion; and resilience and security. (Statistics Canada. (2018). Canada's First Poverty Reduction Strategy. Retrieved from <https://www.canada.ca/en/employment-social-development/programs/poverty-reduction/reports/strategy.html> 19th November, 2018

⁴ MBM "is a measure of low income based on the cost of a specified basket of goods and services representing a modest, basic standard of living." (Statistics Canada. 2011). Market Basket Measure. Retrieved from <https://www12.statcan.gc.ca/nhs-enm/2011/ref/dict/pop165-eng.cfm>, 19th November, 2018)

⁵ Horizontal inequality is defined as the inequality that results among a population group that are bounded by factors such as race, age, class, ethnicity, gender, politics, culture etc. (Stewart, Brown & Cobham 2009). Horizontal

note that Canada's first Poverty Reduction strategy is in line with the United Nations Sustainable Development Goal (SDGs) number one to "End poverty in all its forms everywhere by 2030" (Kenny, 2015).

Despite the arguments presented above, little research has been done on the financial burden and catastrophic effects of out-of-pocket prescription drug expenditures in Canada. The very few analyses carried out on the financial burden of out-of-pocket prescription drug expenditures in Canada (Caldbeck et al., 2015; McLeod et al., 2015), as earlier documented, used a limiting budget share methodology that has implications for horizontal inequality and policy formulation in general. Further, currently, to the best of my knowledge, no study in Canada has examined the impoverishing effects of out-of-pocket prescription drug expenditures in Canada. This study estimates the catastrophic impact of out-of-pocket prescription drug expenditures on Canadian households using an improved methodology as well as a recent data set. Also, for the first time in Canada, estimates the impoverishing effects of out-of-pocket prescription drug expenditures using the newly determined national poverty line.

In summary, the first step to developing appropriate policy responses to the arguments above is, therefore, an investigation of the extent of catastrophic and impoverishing effects out-of-pocket expenditure for prescription drugs in Canada (Filmer, 2002; Merlis, 2003; Musgrove, 2000; Xu et al., 2003). This study fills this literature gap by assessing the catastrophic and impoverishing effects of out-of-pocket drug payment of different types of households and provides a better understanding of the financial protection effects of drug coverage programs.

inequality is important because it tends to be transgenerational and has connotations of marginalization, injustice and deprivation and can ultimately lead to violence and social instability if not checked (Stewart, 2016). Vertical inequality is the inequality that occurs among individuals and households at large (Stewart, Brown & Cobham 2009).

1.4 Purpose/Objectives

This dissertation estimates the catastrophic and impoverishing effects of out-of-pocket prescription drug expenditures in Canada. The study examines the determinants of the catastrophic out-of-pocket prescription drug payments in Canada. The study also analyzes the implications of a national Pharmacare plan for the distribution of financial catastrophe on Canadian households.

1.5 Research Questions

1. What is the prevalence and intensity of catastrophic out-of-pocket prescription drugs expenses in Canada?
2. What are the possible factors associated with catastrophic out-of-pocket prescription drug expenditures in Canada? That is, what types of households are more likely to incur catastrophic expenditure?
3. What is the implication of the proposed national Pharmacare proposals on the distribution of catastrophic of out-of-pocket prescription drugs expenses for different Canadian households?

1.6 Main Summary of the Thesis

Based on the analysis of this thesis, none of the initial approaches applied in the existing literature measuring the financial risk protection of prescription drug payments programs in Canada unmask vertical inequality. Rather, to measure the level of financial protection, studies must use an improved methodology as well as measure the potential implication for impoverishment across households and provinces. Given that Canada has a mix of mandatory, employer-based, private, provincial and federally administered prescription drugs programs, the combined assessment of the catastrophic and impoverishment estimates indirectly evaluates and indicates the realities of the extent to which such programs protect Canadian residents. The results of this thesis' analysis

show in summary the following; with the use of Canada's newly instituted official poverty line, the identified working poor income category residents of Prairie and Quebec provinces had a higher risk of incurring catastrophic out-of-pocket prescription drugs expenditure compared to other residents with higher than average income living in Ontario. Also, level of education was indirectly related to the risk of incurring catastrophic out-of-pocket prescription drugs payments in Canada. The Pen's parade also showed most households that fell below the poverty line as a result of out-of-pocket prescription drugs expenditure were in the lower half of the income distribution. Furthermore, across provinces, poverty among the already poor is deepened in Prince Edward Island, Alberta, and slightly in Ontario, when they make an out-of-pocket prescription drugs expenditure. In all other provinces, individuals are brought into poverty when they fill their prescription drugs. Manitoba and Nova Scotia had the largest population that fell into poverty due to out-of-pocket prescription drug payments, and British Columbia had the least population proportion falling below the poverty line due to non-reimbursed drugs payments.

This thesis, therefore, contributes to the financial risk protection literature in Canada by showing for the first time how out-of-pocket prescription drug payments lead to impoverishment and/or the deepening of poverty in Canada. The combined estimates of catastrophic and impoverishment from out-of-pocket prescription drug payments also showed the significant implication that cost sharing has for household welfare. However, this study introduces the use of a Partial Proportional Odds model to assess the severity of the determinants of catastrophic prescription drug payments across provinces and income categories. The results showed that the comprehensiveness and cost-sharing dynamics of an insurance program determines whether such programs achieve the financial protection goal. Finally, the findings from the simulation analysis suggest that instituting a universal coverage for drugs is not cost prohibitive and the government

has a more significant role to play in achieving a universal coverage for prescription drugs similar to Medicare in Canada.

1.7 Organization of the Thesis

This thesis is structured into six chapters. The objectives of this thesis were examined in manuscript style. Chapter One has laid the general overview, scholarly context, purpose and research questions. Chapter Two discusses the underpinnings of Universal Health Coverage (UHC) and provides the theoretical understanding/contextual framework for the study. This chapter also provides information on the jurisdictional power of the administration of health care in Canada and the resulting implication on the distribution gaps for prescription drugs program. Chapter Three – Manuscript 1, investigates the prevalence and intensity of catastrophic out-of-pocket prescription drug expenditures in Canada. Here, based on published empirical literature review of financial risk protection, a conceptual framework showing the short run implication of out-of-pocket payments is made. The adjusted household budget is also explained and methodology for the analysis is explained in detail. Impoverishment estimates of out-of-pocket prescription drug payments is also presented in this chapter. Chapter Four – Manuscript 2, presents the determinants of catastrophic out-of-pocket prescription drug payments. Guided by the factors associated with out-of-pocket prescription drug payments in Canadian literature, Multivariate logistic and Partial Proportional Odds regression models were specified for the variables. Visual appraisal of the interaction variables is also included in the chapter for a better understanding of the dynamics of the determinants of catastrophic out-of-pocket prescription drugs payments. Chapter Five – Manuscript 3, shows the simulation estimates of the effects of a national Pharmacare plan on catastrophic out-of-pocket prescription drug payments. This chapter analyses the effect on catastrophic estimates of reducing the financial burden of out-of-pocket prescription

drug payments on the population. Chapter Six summarises the findings of this study and presents the conclusion of the thesis.

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CHAPTER TWO

UNDERPINNINGS OF UNIVERSAL HEALTH COVERAGE

2.1 Introduction

This chapter focuses on explaining the theoretical foundation of Universal Health Coverage (UHC). Establishing the foundation of UHC is necessary for this study both as a means of understanding the drive towards achieving equity and the relative level of equity achieved in health care in Canada, which is the leading research objective of this paper. That is, the theoretical understanding will help establish a contextual framework for this study.

2.2 Background

UHC is one of the most generally shared goals in health systems around the world (Backman et al., 2009; Frenz & Vega, 2010; Gwatkin & Ergo, 2010; Polynin, 2015; Stuckler et al., 2010). Following from the various reports on UHC, the Ottawa 1986's WHO conference on health promotion, the Geneva 2005's World Health Assembly and the Beijing 2012's Global Symposium on Health Systems Research, this global health goal has increasingly garnered attention in recent times (Beland et al., 2014; Bump, 2010; Dye, Reeder & Terry, 2013; Kelsall, Hart & Laws, 2016; Patcharanarumol et al., 2011; Savedoff et al., 2012). UHC seeks to capture core health standards and interventions such as improved access, health insurance, improved health outcomes, financial risk protection by the reduction of out-of-pocket payments, quality health care services, comprehensive health service coverage and most importantly, health equity (Dye, Reeder, & Terry, 2013; Mills et al., 2012; Polynin, 2015; Stuckler et al., 2010). Hence, the quintessence of UHC is to achieve health equity such that all individuals in a society have access to the health care services they need without resulting in financial difficulty or bankruptcy (Latko et al., 2010; WHO,

2005; WHO, 2015).

Against this backdrop, there has been a growing interest in health equity research. This is because, beyond achieving efficiency, government players are also now more interested in the equity implications of health policies (van Doorslaer & Masseria, 2004; Wagstaff, 2011). Therefore, applied health equity research has become the focus of policies and programs in health over the past two decades (Gwatkin et al., 2005). Also, with the help of technology and an increased data scope, health equity research remains on the rise (Chuma & Okungu, 2011; Wagstaff & van Doorslaer, 2000).

Further, achieving equity in UHC is a function of three interconnected preconditions – revenue collection, financial risk pooling, and purchasing (Kutzin, 2001). This process is also known as the collective financial risk pooling mechanism and cross-subsidization, and politics are inevitably involved (Mathauer, 2015; Prinja, Kaur & Kumar, 2012). In other words, the equity hypothesis of UHC implies that all individuals regardless of their peculiarities, e.g. financial, religious, ethnic, or social class etc. obtain based on needs the benefits of the aggregation and administration of revenue from the collective financial risk pooling mechanism (Garret, Chowdhury & Pablos-Mendez, 2009; Gwatkin & Ergo, 2011).

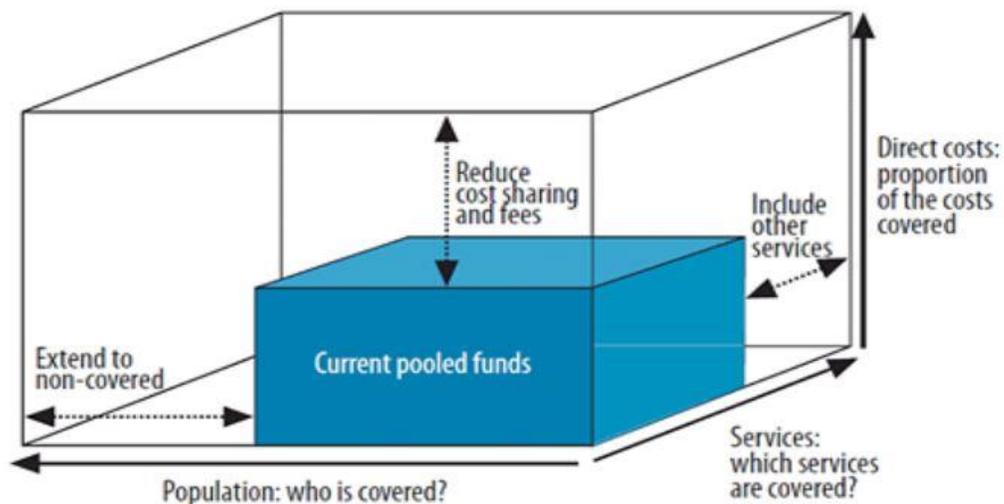
As documented above, the focus of this study is on Canada's programs on prescription drugs because of this unique reality of Canada's health system among other developed countries that have made progress towards UHC (Morgan & Boothe, 2016). Again, Canada's health system does not include universal coverage of prescription drugs (Clemens & Esmail, 2012; Gamble & Deber, 2004; Giacomini, 2005; Marchildon, 2014). The effects of the absence of universal coverage for prescription drugs in Canada is evident concerning the disparities in access, individuals' financial burden, as well as overall health system costs (Morgan et al., 2015). Also, the disparities which

largely depend on factors such as residents' province of residence, income, workplace etc. are documented to restrict residents' ability to get prescription drugs based on medical needs (Gupta et al., 2018). The disparities ultimately lead to inequities in the health care system in Canada and a precise antithesis to the equity hypothesis of UHC (Boothe, 2012; Holmes, 2012; O'Brady, Gagnon & Cassels, 2015). A comprehensive review of the dynamics of the effect of disparities in health service access and utilization on UHC equity can be found in Frenz & Vega (2010).

2.3 The Ideological Underpinnings of UHC

Following from the previous section, it is essential to understand the theoretical underpinnings of Universal Health Coverage (UHC) (Kutzin, 2013; Starfield & Shi, 2002). The World Health Organizations' 2010 World Health Report explains this concept in a diagram that is reproduced below (WHO, 2010).

Figure 2.1: Universal health coverage cube



Source: WHO (2010) – World Health Report 2010 – health financing: the path to universal coverage

In the cubic representation of UHC above, the WHO captures UHC as a system that aims to improve 1). The range of services provided 2). Advance coverage of the total population and 3). Makes progress toward an increased share of pooled funding in the total funding for health care to reduce cost-sharing, deductibles, and fees (Bhasin & Bhardwaj, 2018; Klazienga, 2010; Ranjan, 2017). Each component of the cube is weaved with equity concerns, e.g. should health care be regarded as a fundamental human right? How much should individuals pay for health services, and how should such payments be prorated? Who should oversee health care management - the public or the private sector or both? What criteria should guide the types of services covered? When can health care services be regarded as needed, and who should benefit from the service? (Frenk & De Ferranti, 2012; Frenz & Vega, 2003; Polynin, 2015; Ranjan, 2017).

The volume of the cube represents the varying level of progress a country makes towards achieving UHC and equity (Ranjan, 2017; WHO, 2013). The higher the volume of the cube filled, the better the country does on the UHC index. For example, when a country makes progress towards financial risk protection of its population by the reduction of out-of-pocket health expenditure at the point of service delivery, the spiral effect of financial catastrophe, impoverishment, and poor health outcome is significantly reduced (Lagomarsino et al., 2012; Ranjan, 2017; Xu et al., 2003). But no country has successfully entirely filled the cube because of constraints such as legal, financial, political/power, institutional, human and social capital, vested interest groups etc. (Bhasin & Bhardwaj, 2018; Bobadila, 1998; Mills, 2010; Polynin, 2015; Savedof et al., 2012; Stuckler et al., 2010). It is important to note that political constraint is the most crucial factor that determines the conception and trajectory of UHC in a country (Sengupta, 2013). These constraints are deeply embedded in the historical explanations for why Pharmacare

was not included in Canada's publicly financed health insurance system (Medicare) and are explained in chapter five of this thesis.

In the ideal UHC system, of importance is the dichotomy between the government as the health provider and the patient as the buyer of services, and this is a signet of reforms in government establishments in general (Allotey et al., 2012). That is, the dichotomy between the service provider and the service receiver is apparent (Sengupta, 2013). Advocates of the UHC model highlight that the state has a role to play in ensuring the sustainable, equitable, as well as accountable financing of health care, in addition to functioning governance and organization of health service provision (Laurell, 2007; Ranjan, 2017; Sengupta, 2013). The state's role is to ameliorate the negative consequences of a purely private provision of health service that results from negative externalities as well as market failure. For example, because of the price tag to services as well as strong profit motives in a purely private market, overpricing of health services that lead to catastrophic and impoverishing payments might occur (Ranjan, 2017; Sengupta, 2013). Also, a weak, purely public provisioning of health services can result in catastrophic and impoverishing health payments, hence the need for a mix of both the public and private markets (Sengupta, 2013).

Despite the many criticisms against this model, it has, on several occasions, been successfully defended by its chief proponents (Bump, 2015; Reid, 2017; WHO, 2013). Among the drawbacks of the cube, however, is the fact that it obscures the specificity of the substantial disparities in coverage across population segments and broad categories in terms of national averages (Roberts, Hsiao & Reich, 2015). That is, it fails to explain what groups experience what coverage, and services. Another limitation is that trade-offs of benefits of service users are not explicitly defined (WHO, 2014). The cube also fails to show how changes in any of its dimensions

lead to desired health outcomes (Roberts, Hsiao & Reich, 2015). For an overview of the multi-country dynamics of Universal Health Coverage, see Sengupta (2013).

2.4 Canada's Prescription Drugs Program Gap and Distribution

According to the Canada Health Act⁶ (CHA), the federal government provides, maintains, administers, and delivers health care to a subgroup of the Canadian population (i.e. indigenous people, veterans, refugees, and prison inmates), while provincial and territorial governments are responsible for the other Canadian population groups (Government of Canada, 1984; Phillips, 2016). The CHA legislated the elimination of extra-billing and user fees for hospital services, physician services, and prescription drugs administered in the hospital setting (inpatient prescription drugs). Hence, programs for prescription drugs used outside of the hospital (outpatient prescription drugs) in Canada are designed entirely differently from the provisions of the CHA. Outpatient prescription drugs program in Canada are designed by provinces and are based on factors such as financing mechanism, targeted population, and the specific prescription drugs covered (formulary) (Phillips, 2016).

Specifically, provincial prescription drug programs are subdivided into several plans as low as one in number in Quebec and as high as 28 in Prince Edward Island (Phillips, 2016). The programs use a targeted design – either specific illness or population subgrouping - to ensure coverage (Marchildon, 2004). In all provinces, it is observed that unlike obtainable with seniors and the general population aged under 65, social assistance recipients do not pay any premiums.

⁶ It is important to note that the provision of CHA in general health care in Canada is not without limitation. The federal government of Canada sets the health regulations and makes cash transfers to provinces and territories based on the principles of universality, portability, comprehensiveness, public administration, and accessibility. Notwithstanding, the delivery of health care is still largely under the jurisdictional powers of the provinces and territories and enforcement of the principles have not been as strict as expected. This decentralization in provision and delivery leads to varying leads of equity achieve in health care in the country (Allin, 2008; Martin et al., 2018).

Hence, the general population and seniors are hardest hit by the financial burden of prescription drug payments in the form of significant deductibles, premiums, and copayments (Boychuk & Banting, 2008). As shown in Table 2.1 below, most provinces also use income-based metric for coverage, and this negatively affects equity and cost adherence in general since the burden of payment rests on individuals rather than a pooled pre-payment mechanism. Still, provincial governments offer some form of coverage, particularly for individuals who experience high costs of prescription drugs relative to their income using a deductible cap. The specificity of this for the years 2018/2019 is given in table 2.1 below.

Table 2.1: Provincial variation in deductible cap for catastrophic prescription drugs coverage

PROVINCE	AND	Name of Plan	Criteria	Deductible Cap
NEWFOUNDLAND LABRADOR (NL)		<ul style="list-style-type: none"> Assurance plan 	<ul style="list-style-type: none"> Net income level Prescription drug costs 	<ul style="list-style-type: none"> 5% of net income for those earning below \$40,000 7.5% of net income for those earning between \$40,000 and \$75,000 10% of net income for those earning between \$75,000 and \$150,000
PRINCE EDWARD ISLAND (PEI)		<ul style="list-style-type: none"> Catastrophic drug program 	<ul style="list-style-type: none"> Household annual income 	<ul style="list-style-type: none"> 3% of household annual income up to \$20,000 5% of household annual income if between \$20,000 to \$50,000 8% of household annual income if between \$50,000 to \$100,000 12% of household annual income greater than \$100,000
MANITOBA (MB)		<ul style="list-style-type: none"> Pharmacare program 	<ul style="list-style-type: none"> Adjusted family income (accounts for spousal income and dependents) 	<ul style="list-style-type: none"> 3% of adjusted family income up to \$15,000 6.98% of adjusted family income from \$75,001 and greater
NOVA SCOTIA (NS)		<ul style="list-style-type: none"> Family Pharmacare program 	<ul style="list-style-type: none"> Family size Annual Income 	<ul style="list-style-type: none"> No fixed value. Maximum annual deductible varies with criteria
ONTARIO (ON)		<ul style="list-style-type: none"> Trillium drug program 	<ul style="list-style-type: none"> After-tax household income 	<ul style="list-style-type: none"> 3% to 4% of household after tax income. In addition to paying up to \$2 per person per prescription filled or refilled
SASKATCHEWAN (SK)		<ul style="list-style-type: none"> Special support program 	<ul style="list-style-type: none"> Adjusted total family income (accounts for number of dependents) 	<ul style="list-style-type: none"> 3.4% of Adjusted total family income

BRITISH COLUMBIA (BC)	<ul style="list-style-type: none"> Fair Pharmacare 	<ul style="list-style-type: none"> Family net income 	<ul style="list-style-type: none"> No deductible or family maximum for those earning less than \$13,750 No deductible for those earning between \$13,750 and \$30,000 but varying family maximum Varying percentage range of family net income. Lowest range is 2.92% of family net income for \$30,001 to \$31,667 4% for family net income of \$70,833.01 to 79,167.00
QUEBEC (PQ)	<ul style="list-style-type: none"> Public prescription drug insurance program 	<ul style="list-style-type: none"> Net family income 	<ul style="list-style-type: none"> \$19.90 monthly deductible Cap - \$90.58 monthly Cap - \$1087 yearly
ALBERTA (AB)	<ul style="list-style-type: none"> Non-group coverage 	<ul style="list-style-type: none"> Residency 	<ul style="list-style-type: none"> No existing deductible but upper limit of \$25 per prescription
NEW BRUNSWICK (NB)	<ul style="list-style-type: none"> New Brunswick drug plan 	<ul style="list-style-type: none"> Annual family income 	<ul style="list-style-type: none"> No documented deductibles

See Appendix 2.6 for detailed references

Notwithstanding, evidence-based research continues to show that despite provincial efforts towards reducing the prevalence of catastrophic drug expenditures, there exist disparities and equity concerns in the country. First, the financing mechanism employed, which relies heavily on copayments, premiums and deductibles imply that a certain proportion of Canadians are still underinsured (Kapur & Basu, 2005; Caldbick et al., 2015). Further, the jurisdictional power of each province allows for disparities in the formulary used across the country, and there exists no uniform standard national formulary for prescription drugs (Phillips, 2016). Lastly, the continuous experience of pharmaceutical innovations increasingly drives up costs of drugs coupled with the fact that Canada is an ageing population, and provincial governments are under pressure to find cost-effective means of sustaining the programs (Health Council of Canada, 2009). As noted in chapter one, catastrophic out-of-pocket health expenditures are not invariably correlated with high health care payments and are not predictable; hence, such payments may be a significant cause of

household poverty. There is, therefore, the need to understand the level of equity achieved concerning prescription drugs using the UHC cube in the face of constraints such as ageing population, rising drug cost, patchwork financing, and no national drug formulary in Canada.

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2.6 Appendix

Table 1.2: Links to provincial prescription drugs coverage deductible cap

Provinces	Website
NL	https://www.health.gov.nl.ca/health/prescription/nlpdp_plan_overview.html
PEI	https://www.princeedwardisland.ca/en/information/health-pei/drug-programs
MB	https://www.gov.mb.ca/health/pharmacare/estimator.html
NS	https://novascotia.ca/dhw/pharmacare/nova-scotians.asp
ON	https://www.ontario.ca/page/get-coverage-prescription-drugs#section-6
SK	http://formulary.drugplan.ehealthsask.ca/PDFs/Special_Coverages_Mar2017.pdf
BC	https://www2.gov.bc.ca/assets/gov/health/health-drug-coverage/pharmacare/income_bands_regular_2019.pdf
PQ	http://www.ramq.gouv.qc.ca/en/citizens/prescription-drug-insurance/Pages/rates_effect.aspx
AB	https://www.alberta.ca/non-group-coverage.aspx?utm_source=redirector
NB	https://www2.gnb.ca/content/gnb/en/departments/health/MedicarePrescriptionDrugPlan/TheNewBrunswickPrescriptionDrugProgram/BeneficiaryGroups.html

CHAPTER THREE

THE DISTRIBUTION OF CATASTROPHIC AND IMPOVERISHING OUT-OF-POCKET PRESCRIPTION DRUG PAYMENTS IN CANADA

3.1 Introduction

This chapter presents the prevalence and intensity of financial catastrophe from out-of-pocket prescription drug expenditures in Canada. This chapter used a new to Canadian data budget share approach to determine the distribution of financial risks from such payments. Further, indices to determine which households overshot their budget shares were constructed. This chapter concludes by presenting the impoverishment estimates as well as the effect on income distribution.

3.2 Out-of-pocket Healthcare Payments and Financial Protection

The strong and regressive effect of out-of-pocket health care payment on household financial catastrophe and impoverishment is well documented in literature (Brearley, Marten & O'Connell, 2013; Kimani, 2014; Leive & Xu, 2008; Ngcamphalala & Ataguba, 2018; Wagstaff & Van Doorslaer, 2003; WHO, 2010; Yardim, Cilingiroglu & Yardim, 2010). In other words, although most health care systems in the world have either a public or private health insurance system, the presence of out-of-pocket payment reduces financial protection and has potential to unsettle households' living standards, productivity and welfare in general (Baeza & Packard, 2005; Tomini, Packard, & Tomini, 2013; WHO, 2010). Hence, as one of the six building blocks of a health system, the importance of health system financing cannot be overemphasized (Hort et al., 2010; WHO, 2007). Health system financing is a policy instrument that shapes the achievement of the health systems' goals of financial risk protection and good health outcomes (Ngcamphalala & Ataguba, 2016; WHO, 2007; WHO, 2010). As the global drive towards UHC continues, the

assessment of a health systems' financial protection level is, therefore, necessary for the formulation of targeted policies to ensure that residents are protected from financial catastrophe and impoverishment.

As noted in chapter one, out-of-pocket health expenditures are termed “catastrophic” if they result in significant reduction in standards of living for the households either in the short or long run (Kawabata, Xu & Carrin, 2002; Stiglitz, 1988; Van Doorslaer et al., 2006; Wagstaff & Van Doorslaer, 2002). That is, if out-of-pocket health expenditure as against total expenditure in a given household (this ratio is also known as a budget share) exceeds a given threshold such that living standards are disrupted, it is catastrophic for the household (Caldbeck et al., 2015; McLeod et al., 2011). It is important to note that, the financial burden households experience as a result of catastrophic out-of-pocket health payments is crucial and has significant implications for policy (Elgazzara et al., 2010; Kimani, 2014; Whitehead, Dahlgren & Evans, 2001; WHO, 2005). First, catastrophic out-of-pocket health expenditures are not invariably correlated with high health care payments (Su, Kouyate & Flessa, 2006; Wyszewianski, 1986; Xu et al., 2003), and are not predictable (Akazili et al., 2017; Arrow, 1963; Kimani, 2014; Kwesiga, Zikusooka & Ataguba, 2015), hence, such payments may be a significant cause of household poverty. Payments may also cause households to divert their limited household resources to other household necessities such as food, shelter etc. or even sell their assets/borrow to finance such health care payments (Berki, 1986; Foster, 1994; Löfgren, 2014; O'Donnell et al., 2008; Russell 2004; World Bank, 1993; Yip & Hsiao, 2009). Also, households may forgo seeking treatment altogether, thereby resulting in private costs from health complications, and social costs on the health system (Baeza & Packard, 2005; Gertler & Gruber, 2002; Kesselheim et al., 2015; Law, Kratzer, & Dhalla, 2014; Sanmartin et al., 2014; WHO 2010).

Since most scholarly works done in the health financing equity field have focused on developing countries, little is known about the distribution of financial catastrophe and impoverishment residents of developed countries face. For example, in Canada, the distribution and intensity of the financial burden from out-of-pocket payments for prescription drugs have been a subject of much debate, but not much empirical work has been done in this regard. Public prescription drugs programs in Canada, are financed by individual provinces (also known as the Canadian “patchwork” of prescription drugs program) (Daw & Morgan, 2012; Kapur & Basu, 2005; Gagnon, 2014; Morgan, Daw & Law, 2013). These prescription drugs programs vary between provinces regarding who has coverage and what types of prescription drugs are covered (Anis, Guh & Wang, 2001; Barnes & Andersen, 2015; Demers et al., 2008). As shown in table 2.1 of this thesis, individual provinces use different eligibility criteria and deductible caps to fund catastrophic spending; this significantly diminishes health equity. As a result of the “patchwork” prescription drug programs, some Canadian residents must pay out-of-pocket to fill their prescription drugs (Caldbeck et al., 2015; Morgan et al., 2015). It is estimated that around 67 percent of households are exposed to out-of-pocket prescription drug expenditures (Law et al., 2012). In total, Canadians paid approximately \$6.5 billion as out-of-pocket payment in filling their prescriptions in 2014 (Law et al., 2018). A lack of universal prescription drug coverage, therefore, implies some Canadians are not able to afford the needed prescription drugs (Barnes & Andersen, 2015). The problem of access to prescription drugs affects at least 23 percent of Canadian households (Angus Reid Institute, 2015). According to Kennedy & Morgan (2006), five to ten percent of Canadians cannot fill their prescription drugs due to cost and one in twelve Canadians who are 55 years of age and above still suffer from cost-related non-adherence. Another study

found that one in ten Canadians cannot fill their prescription drugs due to the prohibitive cost associated with paying from out-of-pocket (Law et al., 2012).

Despite the results of these studies and the alarming figures they present, little analysis has been conducted into the measurement of financial protection Canadians experience in the existing patchwork drug benefit system. Estimating the distribution of the financial burden experienced by Canadian households because of out-of-pocket prescription drug expenditures is, therefore, the first step towards addressing the policy issue (Merlis, 2003; Xu et al., 2003).

3.3 Review of Empirical Studies

3.3.1 Literature Review

When health payments exceed a particular share of total household expenditure, such payments are called catastrophic (Pradhan & Prescott, 2002; Xu et al., 2003). Although the choice of the threshold is value-laden, a 10 percent threshold is predominantly favoured in the literature (Ranson, 2002; Wagstaff & Van Doorslaer, 2003). Scholars document that this threshold represents the point at which households are forced to forgo basic needs, incur debt or become poor (Russell, 2004). Conversely, Kawabata et al., (2002), WHO (2005) and Xu et al. (2003) proposed the use of “capacity to pay” at a threshold of 40 percent. The capacity to pay is defined as a household’s income less subsistence spending.

Xu et al. (2003) used cross-sectional data from 59 countries to analyze the distribution of catastrophic health payments. The scholars documented that households incurring catastrophic health payments were as low as 0.01 percent in France, 0.1 percent in Costa Rica and as high as 10.3 percent in Brazil and 10.45 in Vietnam. A similar study was carried out for 11 Asian countries. The results of the analysis showed, countries such as Thailand, Malaysia and Indonesia had a low

prevalence of catastrophic spending when compared to countries such as Bangladesh, Vietnam and India (Van Doorslaer et al., 2006). About 20 percent of households finance their health care from borrowing and a similar percentage experience cost-related non-adherence in Georgia (Skarbinski, 2002). A similar result is documented for Mexico, where the poor must sometimes forgo treatments due to the cost of health care (Frenk, Lozano & González-Block, 1994). Analogous research for Latin American countries such as Mexico, Guatemala, Peru, and the Dominican Republic are also well documented in the Pan American Health Organization (2004).

Furthermore, several studies have shown that in certain countries, the rich (households in the highest income quartile) spend a lower share of their budget on out-of-pocket health spending (Hotchikss et al., 1998). For instance, in Thailand, the poor were found to have a higher budget share than the rich (Pannarunothai & Mills, 1997). It is also imperative to note that in countries with high dependence on private insurance and out-of-pocket payments, the rich are favoured in the health financing scheme (Merlis, 2003; Wagstaff et al., 1999). An example of this is the case of prescription drug payment in Canada.

In this regard, two Canadian studies have used nationally representative survey data sets – the 2006 and 2009 SHS to estimate the financial burden for households from out-of-pocket prescription drug payments (Caldbick et al., 2015; McLeod et al., 2011). Both studies used the budget share methodology advanced by Wagstaff & Van Doorslaer (2003). In their work, Caldbick et al., 2015 analyzed the distribution of financial burden by province, age, income, gender, and education. The results showed that education and income had a negative relationship with the financial burden, while gender showed no significant variation. However, as much as 1.1% of Canadians experienced catastrophic payments at a 9% threshold and 8.2% of Canadians at a 3% threshold. The study also documented significant interprovincial variations in catastrophic burdens

due to the existing patchwork system. An earlier study by McLeod et al., (2011) analyzed the provincial variation of financial burden using the distribution of insurance coverage – general population, social assistance recipients, and senior households. Using a bell curve, the study concentrated on the distribution of households at the median and 95th percentile. The results showed that there existed little variation among provinces and, generally, a low financial burden as well as catastrophic expenditure for Canadian households. As documented earlier, the budget share approach does not differentiate among households with regards to their expenditure on necessities, and this implies that all households have equal weight in the estimation of the financial burden. Hence, for this study, Xu et al., (2003's) capacity to pay approach will be used. The approach is explained in the next section.

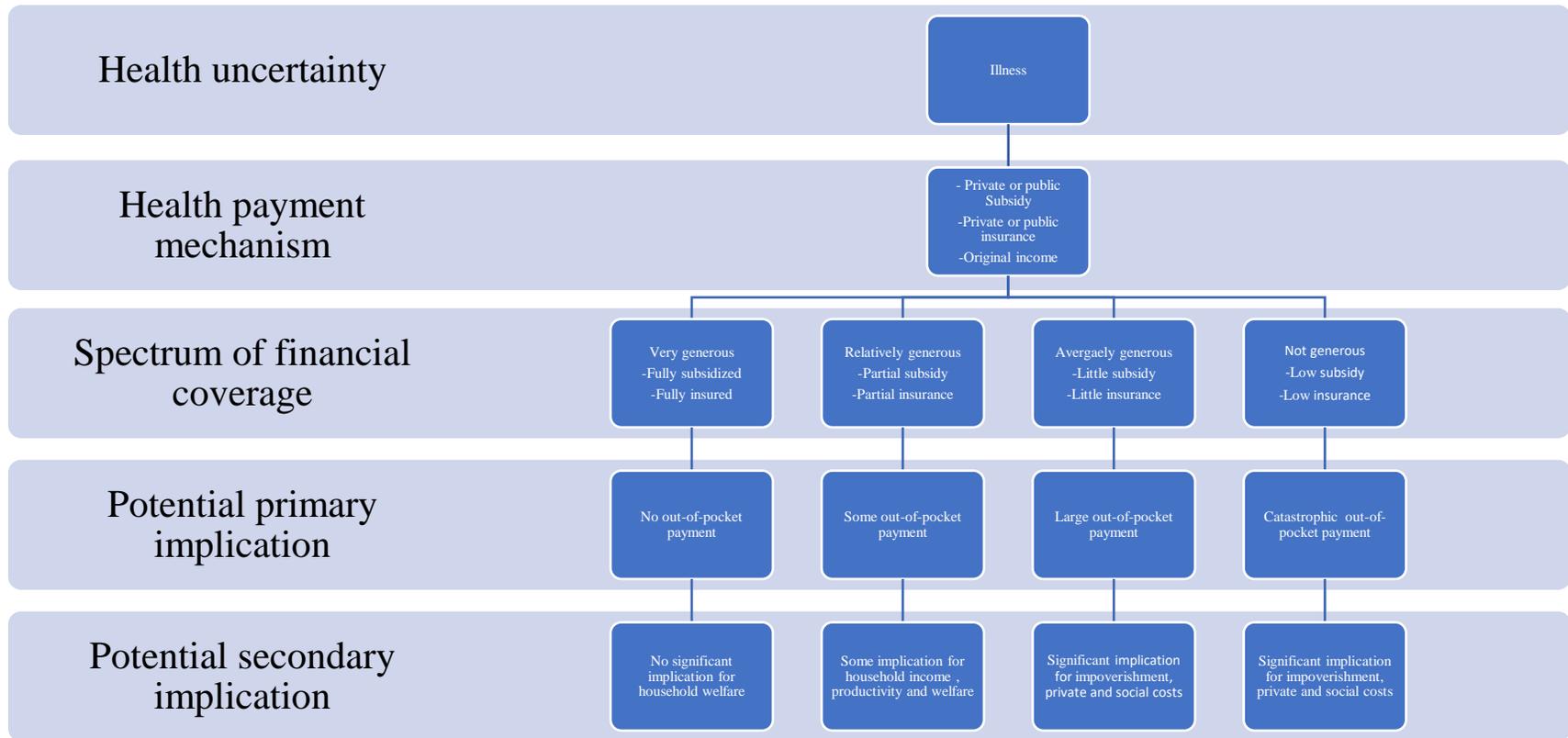
Further, while models used to assess catastrophic payments are insightful, they fail to explain the impact of such payments on households with respect to poverty (Goudge et al., 2009). Hence, it remains important to explain the impoverishment resulting from out-of-pocket payments. This is because depending on household's income, a low out-of-pocket payment does not necessarily mean the absence of impoverishing payments. In this regard, the use of poverty line has been advanced. A poverty line is defined as the estimated minimum level of income needed to secure the necessities of life (O'Donnell et al., 2008). A household's total expenditure less of out-of-pocket payments is then evaluated against a given fixed poverty line (Wagstaff & Van Doorslaer, 2003). The main idea behind the model is the Grossman-Wagstaff theory of demand for health. The theory states that health care costs are represented by the opportunity cost of a household's consumption when purchasing health care (Grossman, 1999). Also, according to the theory, health care is a derived demand, which is demanded first as a commodity to be consumed for utility as well as an investment for healthy days (Kimani, 2014). Although the use of poverty indices has

been criticized for not incorporating indirect costs of out-of-pocket payments, the model continues to be favoured mainly in the field of health equity research (Ngcamphalala, 2016; Wagstaff & van Doorslaer, 2003). It is imperative to note that no study has examined the impoverishment effect of out-of-pocket prescription drug payments on households in Canada. This study fills this literature gap.

3.3.2 Conceptual Framework

At a given level of household income in the short run, the diagram below shows the effect of a health uncertainty (defined as an episode of illness and payment for prescription drugs in this thesis) on that household. The diagram shows the step by step potential household implications using a wide range of health payment mechanisms and their associated spectrum of coverage. Hence, a conceptual framework for this study is drawn below.

Figure 3.1: Conceptual framework for this study.



Source: Author

3.4 Study Methods and Data

3.4.1 The Data

Statistics Canada's 2016 Survey of Household Spending (SHS) was used for this study. The SHS is a two-staged sampling design that covers the ten provinces of Canada. The sample consists of 17 590 households. The response rate was 65.5 percent. The territories of Canada were not included in this analysis because the proportion of their population is small, and several federal programs cover the population.

The 2016 data used was the annualized household level SHS. The data is weighted to represent the total population. For SHS's weights and methodology, please refer to the website provided in the reference section (Statistics Canada, 2017).

3.4.2 Method

3.4.2.1 Household Budget – *a definition*

To measure catastrophic payments, a budget share of out-of-pocket drug expenditure in the household resource is usually constructed (O'Donnell et al., 2008). The idea behind the budget share method is that spending a large portion of the household's resources on health care must be at an opportunity cost of consuming other goods and services. Two variables are important to construct the budget share. The variables are household's out-of-pocket payments for prescription drugs (numerator) and a measure of household resources (denominator) (Xu et al., 2003). To measure household resources, three approaches exist income, expenditure, and consumption (Berki et al., 1986; Wagstaff & van Doorslaer, 2003). If income is used as a denominator in the share above, the opportunity cost of prescription drug expenditures is directly evident on consumption and expenditure of other goods and services and not directly on income. This use of income as a

denominator is considered an advantage because the source of a household's income is most times fixed and predictable, unlike consumption or expenditure patterns (O'Donnell et al., 2008). That is, due to the predictability and stability of incomes in general over time, the effect of health expenditure is quickly evident on the budget share.

However, depending on whether prescription drug expenditures are financed by current income or saved income over time, the opportunity cost of prescription drug expenditures on household resources may be experienced in the short term or long term, respectively. This disparity in the long run or short-run effects is not easily captured in household surveys. In other words, the stability of income ignores whether that income is just only the household's current income or current income plus savings or credit facility. The latter household has more coping strategies than the former, and this is overlooked in the survey design. Also, most survey respondents have been noted to significantly underreport their income for tax evasion reasons (Wagstaff & van Doorslaer, 2003). Hence, in literature, income as a denominator is generally not explored (Kimani, 2014).

Given these limitations, consumption or expenditure is preferred and used as the denominator of the budget share. When a household's total expenditure is used as the denominator, catastrophic expenditure is defined based on the budget share of health payments in total household expenditure (O'Donnell et al., 2008). The problem with this approach is that budget share may be low for poor households because a more substantial portion of household resources is taken up by expenditures on food and essential items, leaving a small fraction of resources to spend on health care. In other words, this approach excludes households that cannot afford to meet their catastrophic health payments in the first instance (Kimani, 2014).

An improvement to this methodology is the proposed method for this study. This study extends the literature and uses the household's "capacity to pay," also known as "non-discretionary expenditure," instead of household income or expenditure as the denominator of the budget share

(Xu et al., 2003). A household's "capacity to pay" is defined as the effective income left for the household after meeting subsistence needs (Buigut, Ettarh & Amenda, 2015). Subsistence expenditure is given as food expenditure and other non-food expenditures that are categorized as necessities and adjusted for equivalent household sizes (Pal, 2012). The argument is that non-food expenditure better differentiates between the rich and the poor than total expenditure (O'Donnell et al., 2008). This approach indicates that out-of-pocket prescription drug expenditure in Canada is involuntary and harms household's welfare due to the opportunity costs of payments made on prescription drugs (Akinkugbe, Chama-Chiliba & Tlotlego, 2012). The resulting budget share is thus given by out-of-pocket drug payments as a ratio of non-subsistence household expenditure.

For this study, household expenditure is given by all outlays towards all goods and services less outlay on vehicle and recreational vehicles (Caldbick et al., 2015; McLeod et al., 2011). Food expenditure by household is the value spent on all foodstuff both produced within or outside the household. Food expenditure does not include expenditure on alcohol, beverages or take-outs from restaurants or hotels (Xu et al., 2003).

3.4.2.2 Data Analysis

The study used Stata v15 software for all the analysis in this chapter. The 2016 data used was the annualized household level SHS and weighted accordingly with the survey weights to show the total population estimates. As earlier discussed in section 3.4.2.1, the household capacity to pay was used in the budget share equation. Following how the thresholds presented in the National Pharmaceutical Strategy report of 2006 were derived, this study used the updated thresholds of the existing provincial income-based drug plans (Newfoundland, Prince Edward Island, Manitoba, Ontario, Saskatchewan, and British Columbia). The 2006 report used as thresholds, the minimum,

average, and maximum values of the deductible caps of the then existing income-based public drug programs that determined catastrophic expenditure. The values of the current deductible caps can be found in table 2.1 of chapter two. Hence, this study presents the results of catastrophic expenditures using the lower limit, average and upper limit of the maximum income threshold percentages (3.4%, 6.73% and 12%) (Health Canada, 2006).

Also, for the first time in Canada, this study identified individuals who are “working poor”⁷ according to the country’s newly instituted official poverty line and presented the prevalence of Catastrophic Out-of-pocket Prescription drug expenditures (COOPDE) among them. As suggested by Arsenijevic, Pavlova and Groot (2013), the working poor are those whose income is between the absolute poverty line and the relative poverty line value. In Canada, the official absolute poverty line is approximately \$37,500 for a family of four (consisting of two children and two adults).

3.4.2.3 Determining Catastrophic Out-of-Pocket Prescription Drug Expenditure Using Capacity to Pay Approach

Mathematically, using Canadian data, the budget share was derived by following the steps below:

Step 1: Derivation of the out-of-pocket prescription drug expenditure of each household (OOPDE_h). Out-of-pocket prescription drug expenditures in this study are the actual amount paid by a household after receiving reimbursement from insurance plans. $OOPDE = \text{total drug payment from a household} - \text{insurance coverage}$. Transportation costs incurred when filling prescription drugs are also not included in this analysis because the data is not available in the survey. Additionally, the loss in productivity because of not filling prescription drugs was excluded

⁷ It is important to note here that, the definition of the “working poor” in this thesis is based on income categorization and not necessarily the same as typically defined in Canada. This definition is motivated by empirical literature of financial protection and may include both the working and non-working population (Arsenijevic, Pavlova & Groot 2013).

because it measures the effect of illness resulting from not filling prescription drugs rather than the financial catastrophe of filling prescription drugs (Xu et al., 2007).

Step 2: Derivation of the poverty line. The poverty line – the per capita (equivalent) subsistence expenditure – is the average of the equivalent food expenditures of the households whose food shares fall between the 45th and 55th percentiles of the food shares of all the households in the sample (Lara & Gomez, 2011; Xu et al., 2004). The poverty line figure will be used to derive the subsistence expenditure for all households in the next step. The procedure of finding the poverty line of the households in the sample consists of three steps.

First, calculate the food share of households ($FoodShare_h$) and rank the food shares in ascending order. A household's food share is the share of its food expenditure in total household expenditure ($FoodShare_h$) and is given by the expression:

$$FoodShare_h = \frac{Food\ expenditure\ (FoodExp_h)}{Total\ household\ expenditure\ (TExp_h)} \quad (3.1)$$

Second, find the equivalent food expenditure ($FoodExp_Eq_h$) of all households that adjusts for the equivalent household size.

$$FoodExp_Eq_h = \frac{Food\ expenditure\ (FoodExp_h)}{Equivalent\ household\ size\ (EqHHS_h)} \quad (3.2)$$

where equivalent household size ($EqHHS_h$) is captured in the expression:

$$EqHHS_h = [HHS_h]^{0.56} \quad (3.3)$$

Equivalent household size adjusts the household size by an equivalent scale. The value of the parameter β has been estimated from previous studies based on 59 countries' household survey data, and it equals 0.56 (Deaton & Zaidi, 2002; Xu, 2004). The value of β being 0.56 implies that an increase in the household's number by one increases the household's consumption by less than proportional value. The motivation behind this is that there is a need for a comparable basis for all

households in the study. For example, because of economies of scale (appropriate savings in foods because of one additional member's consumption), a household of six members do not necessarily require six times the level of food expenditure for one member. In other words, a simple division of household's expenditure by the number of individuals in the household does not yield overall comparable results. Finally, calculate the poverty line as the average of the equivalent food expenditures of those households whose food shares fall within the 45th to 55th percentile of *FoodShare*.

$$PovertyLine = Average (FoodExp_Eq_h) \quad (3.4)$$

if FoodShare_45thpercentile < FoodShare_h < FoodShare_55thpercentile

Step 3: Derivation of each household's subsistence expenditure (*SubExp_h*). Subsistence expenditure is equal to the product of the poverty line and the equivalent household size of each household (*EqHHS_h*), and is given by the expression:

$$SubExp_h = PovertyLine * EqHHS_h \quad (3.5)$$

Step 4: A household's capacity to pay (*Capacity_h*) is then equal to the following:

$$Capacity_h = \begin{cases} TExp_h - SubExp_h, & \text{if } SubExp_h \leq FoodExp_h \\ TExp_h - FoodExp_h, & \text{if } SubExp_h > FoodExp_h \end{cases} \quad (3.6)$$

This proposed study defines the "capacity to pay" of a household as the "non-subsistence expenditures," i.e. the total household expenditure net of the calculated subsistence expenditure. However, when a household's total expenditure is lower than the estimated subsistence expenditure, "capacity to pay" will be taken as the observed "non-food expenditure" (Kimani 2014; Lara & Gomez, 2011; Xu et al., 2004).

Step 5: Given the above steps, budget share is then given as

$$BudgetShare_h = \frac{Out\ of\ pocket\ prescription\ drugs\ expenditure\ (OOPDE_h)}{Household's\ capacity\ to\ pay\ (Capacity_h)} \quad (3.7)$$

Step 6: Determine whether a household has catastrophic out-of-pocket prescription drug expenditure. The event of catastrophic out-of-pocket prescription drug expenditures (COOPDE_h) occurs when the adjusted budget share is greater than 12 percent.

$$COOPDE_h = \begin{cases} 1, & BudgetShare_h \geq 12\% \\ 0, & BudgetShare_h < 12\% \end{cases} \quad (3.8)$$

This study also determined catastrophic events at the 3.4 percent and 6.73 percent thresholds and compare the results.

3.5 Results

3.5.1 Prevalence of Catastrophic Expenditures

The dollar amount of the OOPDE shown in table 3.6 in the Appendix indicates that as high as 63.21% of Canadian households had to pay greater than \$0 when they fill their prescription drugs. Across provinces, Prince Edward Island (74.7%), Quebec (74.4%) and Newfoundland (71.52%) had the highest percentage of non-zero OOPDE among their populations. Further, the working poor, seniors, and those whose education was below high school had the highest average dollar amount of out-of-pocket payment.

The prevalence of COOPDE at the thresholds 3.4%, 6.73% and 12% using the capacity to pay approach is presented in table 3.1 below. For Canada, at 3.4%, 6.73% and 12%, the prevalence of COOPDE are 14.61%, 6.12% and 1.88% respectively. That is using a 6.73% threshold, 6.12% of Canadian households incurred catastrophic payments when they fill their prescription drugs. The prevalence of COOPDE is highest among the working poor (27.22%, 12.07%, and 3.23%) among the income groups. Across provinces, the burden is highest in Quebec, Prince Edward Island,

Manitoba, and Saskatchewan compared to the other provinces. The results also show an inverse relationship between educational level and prevalence of COOPDE. Specifically, across all thresholds, individuals with education greater than or equal to university level experienced a relatively lower burden of COOPDE compared to other education levels (below high school, high school, between high school and university). The prevalence of COOPDE is very similar between different gender groups. Like education, individuals who are seniors (31.89%, 14.19%, 4.16%) are more likely to experience COOPDE compared to other age groups. A more detailed description is given in the table 3.1 below. A visual appraisal of the provincial distribution is also given in Figure 3.5 of the appendix.

Table 2.1: Distribution of catastrophic out-of-pocket prescription drug expenditures in Canada, 2016 at 3.4, 6.73 and 12%.

Variables	Budget share thresholds		
	3.4%	6.73%	12%
Canada	14.61	6.12	1.88
Age (years)			
< 35	5.76	2.07	0.77
35-50	5.80	1.54	0.51
50-65	13.64	6.03	1.88
≥65	31.89	14.19	4.16
Gender			
Male	14.10	6.49	2.22
Female	15.09	5.78	1.56
Per capita PL income			
>Ave	7.61	2.95	0.94
RPL-AVE	17.82	7.29	2.21
ABL-RPL	27.22	12.07	3.23
BAPL	11.97	5.77	2.31
Education			
Below high school	29.88	13.38	4.44
High school	15.22	6.91	1.64
Between	13.98	5.36	1.77
≥ University	7.53	2.87	0.94
Provinces			
NL	16.70	7.42	3.55

PEI	18.58	10.19	4.67
NS	15.95	6.87	2.28
NB	18.36	7.40	2.39
PQ	23.72	9.82	2.26
ONT	9.50	4.06	1.43
MB	17.28	8.96	3.59
SK	17.36	8.31	3.31
AB	9.67	3.92	1.75
BC	13.24	4.87	1.29
Employment income			
Paid/self/investment income	8.94	3.50	1.08
Government transfer/miscellaneous/all other sources	26.49	11.63	3.55
Marital status			
Separated/divorced/never married)	13.03	5.14	1.43
Married/common-law/widowed	15.39	6.61	2.09

*BAPL - Below absolute poverty line * ABL-RPL – Working poor * RPL-Ave – Between relatively poor and average per capita income * >Ave – Greater than average per capita income

3.5.2 Intensity of catastrophic Payments

Recall that budget share is given as the ratio of out-of-pocket prescription drug expenditures to household’s capacity to pay. And catastrophic out-of-pocket prescription drug expenditures is equal to 1 if the budget share is equal to or exceeds a threshold and 0 if otherwise. Let the “ith” household’s out-of-pocket prescription drug expenditures be T_i and the household’s capacity to pay be $CPTP_i$. Let the threshold be given as z .

Therefore, we can define an indicator say E , where $E = 1$ if $T_i/CPTP_i \geq z$ and $E = 0$ if $T_i/CPTP_i < z$. The resulting estimation of the catastrophic out-of-pocket prescription drug expenditures, also known as the prevalence and Headcount index (H), is presented in the previous section. That is,

$$H = \frac{1}{N} \sum_{i=1}^n E_i \quad (3.10)$$

Where N is the size of the survey sample, the headcount index, as the name connotes, is the count of the occurrence of catastrophic spending and does little to explain the intensity of catastrophe. Another index, the Overshoot index O_i , measures the intensity of COOPDE.

$$O = \frac{1}{N} \sum_{i=1}^n T_i / CPTP_i - z \quad (3.11)$$

The Overshoot index O_i is calculated as the difference between the actual budget share percentage that a household experience and the threshold of interest. For example, if a household's budget share is 25 percent and the threshold of interest is at 10 percent, the overshoot for that household is given by the difference between 25 and 10, which is equal to 15 percent. However, for those households whose budget share is lower than 10 percent, their overshoot is recorded as zero. In this case, "N" in equation 3.11 encompasses both those who incurred and those who did not incur catastrophic spending.

Another index, Mean Positive Overshoot (MPO), measures the overshoot among only those who incurred catastrophic spending. MPO is defined mathematically as

$$MPO = \frac{O}{H} \quad (3.12)$$

For example, assume we have four household observations where three of those households experience catastrophic spending at a 10 percent threshold. If their budget share is given as 10, 15, 25, 35 percent. Then the prevalence is 75 percent, overshoot is 11.25 percent while the MPO is 15 percent.

3.6 Measuring the Distribution Sensitivity of Catastrophic Out-of-Pocket Prescription drug expenditures

Aside from assessing the occurrence and prevalence of catastrophic payments, it is imperative also to assess the dynamics of the households that experience catastrophic payment. That is, a question such as do the poor tend to overshoot their budget share threshold compared to the rich is very

important to targeted policy formulation (O'Donnell et al., 2008). Against this backdrop, there is the need to develop weighted and distribution sensitive indices, also known in the literature as a concentration index. That is concentration indices for both overshoot (C_o) and prevalence index (C_E) such that for both indices, a positive value implies that wealthier households tend to exceed the budget share threshold while a negative value suggests that poorer households tend to exceed the budget share threshold. According to O'Donnell et al., (2008), the rank weighted headcount and overshoot are then given by the following expressions:

$$H^{rw} = H \cdot (1 - C_E) \quad (3.13)$$

$$O^{rw} = O \cdot (1 - C_o) \quad (3.14)$$

From the expressions above, if C_E takes on a negative value, the implication is that $H^{rw} > H$ and households with lower capacity to pay tend to exceed the budget share threshold. The opposite occurs when C_E takes on a positive value. A similar submission holds for the rank weighted overshoot expression.

3.6.1 Results of the Intensity and Distribution Sensitivity of COOPDE

The tables 3.2 and 3.3 below show both the prevalence, intensity, and distribution sensitivity of catastrophic out-of-pocket prescription drugs payment in Canada from the 2016 Survey of Household Spending. The methodology employed was Xu et al., (2003)'s capacity to pay approach. The table 3.2 shows that the prevalence of COOPDE falls from 14.61% to 1.88% and the overshoot falls from 0.64% to 0.13% as the threshold was raised from 3.4% to 12%. At the 3.4% threshold, the overshoot among those who already incurred COOPDE measured as the MPO, imply that households spent an average of 7.77% (3.4%+4.37%) and 19.14% (12%+7.14%) at the 12% threshold on prescription drugs.

Also, the weighted headcount index 19.99%, 9.02% and 2.91% is higher than the initial headcount index 14.61%, 6.12% and 1.88% at all the three thresholds. This phenomenon means that poorer households in Canada incur more catastrophic payments compared to wealthier households. The negative values of the concentration indices also confirm this (-0.37, -0.47 and -0.55 at the 3.4%, 6.73% and 12% thresholds). The same is true for overshoot estimates, as well. The poorer households are more burdened with COOPDE in Canada. As documented in O'Donnell et al., (2008), the phenomenon is explained by the inelastic nature of food expenditure. That is, food is a necessity, and when budget share considers non-food expenditure such as the capacity to pay approach used in this thesis, the difference between the rich and poor households is better distinguished.

Table 3.2: The intensity of COOPED at various thresholds.

	Budget share thresholds		
Out-of-pocket prescription drug expenditures as a share of capacity to pay	3.4%	6.73%	12%
Headcount	14.61%	6.12%	1.88%
Overshoot	0.64%	0.32%	0.13%
Mean Positive Overshoot (MPO)	4.37%	5.21%	7.14%

Table 3.3: Measuring the distribution sensitivity of catastrophic out-of-pocket prescription drug expenditures in Canada, 2016.

	Budget share thresholds		
Out-of-pocket prescription drug expenditures as a share of capacity to pay	3.4(%)	6.73(%)	12(%)
Concentration index, C_E	-0.37%	-0.47%	-0.55%
Rank-weighted headcount, H^{rw}	19.99%	9.02%	2.91%
Concentration index, C_o	-0.46%	-0.49%	-0.46%
Rank-weighted overshoot, O^{rw}	21.26%	9.14%	2.74%

3.7 Impoverishment Effects of Payment

Following the significant risks that financial catastrophe has for household's welfare, the potential for impoverishments from out-of-pocket payments must be measured as well since out-of-pocket payments can push some households into poverty or deepen the poverty for some households. This measurement is the crux of this section. As documented earlier, the federal government of Canada has institutionalized Canada's first official poverty line through the "Poverty Reduction Act" (Canada, 2018). The poverty line is defined as the required minimum income level needed to meet the necessities of life (O'Donnell et al., 2008; Kakwani, 2010). Specifically, Canada's official poverty line is a Market Basket Measure (MBM) that will be subject to continuous updates and improvements every five years (Corak, 2018; Homer, 2018). The official absolute poverty line is approximately \$37,500 for a family of four (consisting of two children and two adults), and \$18,750 for a family of one in Canada. Having a homogenous poverty line is essential for unmasking horizontal inequality in society (Kakwani, 2010). It is important to note that poverty is analyzed on per capita/individual basis; hence, this study adjusted both OOPDE and household income using the equivalent household size metric. Furthermore, as recommended by Corak (2018), this study maintained the poverty line for a household of one as half the amount of the poverty line for a household of four. Moreover, for households with a size larger than one, this study used the equivalent household size to determine the per capita equivalent figure. A relative poverty line determined as 60% of the median of total per capita household income (\$23,828) is also used to compare the results (Arsenijevic, Pavlova & Groot 2013). Analogous to catastrophic estimates presented earlier, the formula of poverty estimates is presented below.

Let X_i be the per capita income of an individual “ I ,” which indicates his or her total income before paying out-of-pocket for prescription drugs. W_i is the per capita OOPDE and PV be the poverty line. N is the sample size. An individual is poor if their pre-payment X_i is less than PV . That is $H_i^h = 1$ if $X_i < PV$ and $H_i = 0$ if otherwise. The percentage of the headcount of poverty in the population is then given as

$$H_{pv}^{pp} = \frac{1}{N} \sum_{i=1}^n H_i^h \quad (3.15)$$

The difference between the poverty line and X_i is defined as the poverty gap. It measures the depth of poverty (O’Donnell et al., 2008). Let G_i^g be the Pre-Payment individual poverty gap, which is equal to 1 if $PV - X_i > 0$ and 0 otherwise. Then the percentage of people who experience poverty gap in the population is given as

$$G_{pv}^{pp} = \frac{1}{N} \sum_{i=1}^n G_i^g \quad (3.16)$$

The pre-payment normalized poverty gap is equal to

$$NG_{pv}^{pp} = G_{pv}^{pp} / PV \quad (3.17)$$

While the pre-payment mean-positive poverty gap measures the intensity of poverty among the poor and it is equal to

$$MPG_{pv}^{pp} = G_{pv}^{pp} / H_{pv}^{pp} \quad (3.18)$$

Post payment poverty estimates can be easily obtained by replacing pre-payment income X_i with post payment income ($X_i - W_i$). The analogous post poverty indicators are then given as H_{pv}^{pst} , G_{pv}^{pst} , NG_{pv}^{pst} and MPG_{pv}^{pst} respectively.

Finally, the impoverishing effect of OOPDE is derived by estimating the difference between the post-payments and pre-payment indices and is derived below:

- a) Headcount: $H^{imp} = H_{pv}^{pst} - H_{pv}^{pp}$
- b) Poverty gap: $G^{imp} = G_{pv}^{pst} - G_{pv}^{pp}$
- c) Normalized poverty gap: $NG^{imp} = NG_{pv}^{pst} - NG_{pv}^{pp}$
- d) Mean positive poverty gap: $MPG^{imp} = MPG_{pv}^{pst} - MPG_{pv}^{pp}$

The results of the impoverishing effects of out-of-pocket prescription drugs payment using Canada's absolute and relative poverty lines are presented in table 3.4 below. A visual appraisal using a pen's parade is also presented below in figure 3.4. The Gross of health payment column shows the prepayment household per capita income (X_i), while the net of health payment column shows the post-payment per capita income ($X_i - W_i$). Against both the absolute and relative absolute poverty line, the poverty headcount and gap. Based on the evidence that post-payment income headcount is slightly higher than those of the prepayment income levels, out-of-pocket prescription drug payments in Canada impoverishes more individuals. Against the absolute poverty line level, the difference is 0.51%, which means 0.51% of Canadians become poor when they pay out-of-pocket for their prescription drugs. Also, the relative difference is 5.09% at the absolute poverty line; when we estimate against the relative poverty line level, the relative difference is 2.78%.

Further, recall that the poverty gap is the difference between household per capita income and the poverty line. The results of table 3.4 show that the poverty gap against the absolute poverty line and the relative poverty line is \$608.02 and \$1511, respectively, and the relative difference of the normalized poverty gap is given as 4.41% and 4.10% at the absolute and relative poverty line respectively. The intensity of poverty among the already poor is the normalized mean poverty gap. Following the negative sign at the absolute poverty line level, it implies that around 0.74% of

Canadians were brought into poverty and not that poverty of the already poor is deepened. At the relative poverty line estimates, the poverty of the already poor is deepened by 0.39%.

As shown in figure 3.3 below, using the absolute poverty line across provinces, poverty among the already poor is deepened slightly in Alberta, Prince Edward Island⁸, and in Ontario, when they make an OOPDE. In all other provinces, individuals are brought into poverty when they fill their prescription drugs. Manitoba and Nova Scotia had the largest population that fell into poverty due to out-of-pocket prescription drug payments, and British Columbia had the least population proportion falling below the poverty line due to non-reimbursed drugs payments. Figure 3.2 shows the visual appraisal pre and post-payment poverty headcount estimates across provinces in Canada. The highest prevalence of poverty occurred in Nova Scotia, Newfoundland, Quebec and Manitoba and the provinces with the least prevalence of poverty from out-of-pocket payments are Alberta and Ontario.

⁸ It is important to note that the sample proportion in the provinces of Prince Edward Island and Alberta is small with regards to Saskatchewan Research Data Center guidelines. So, the deepening of the poverty in the provinces of Prince Edward Island and Alberta might not be as significant as that occurring in Ontario.

Figure 3.2: Percentage of population impoverished by OOPDE, by province

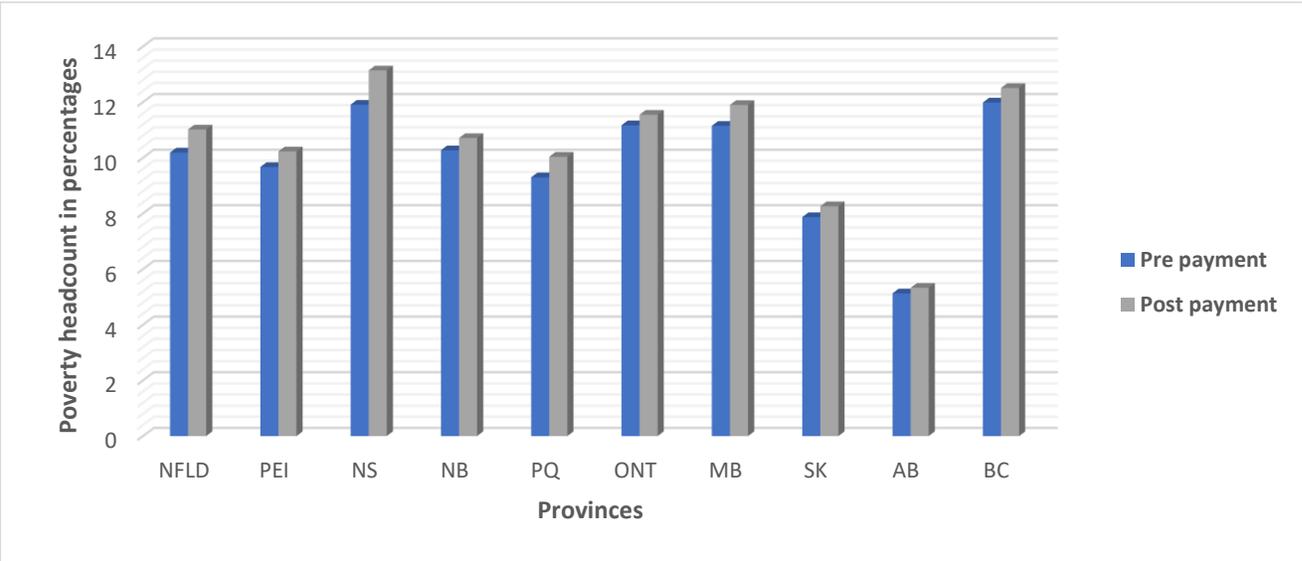
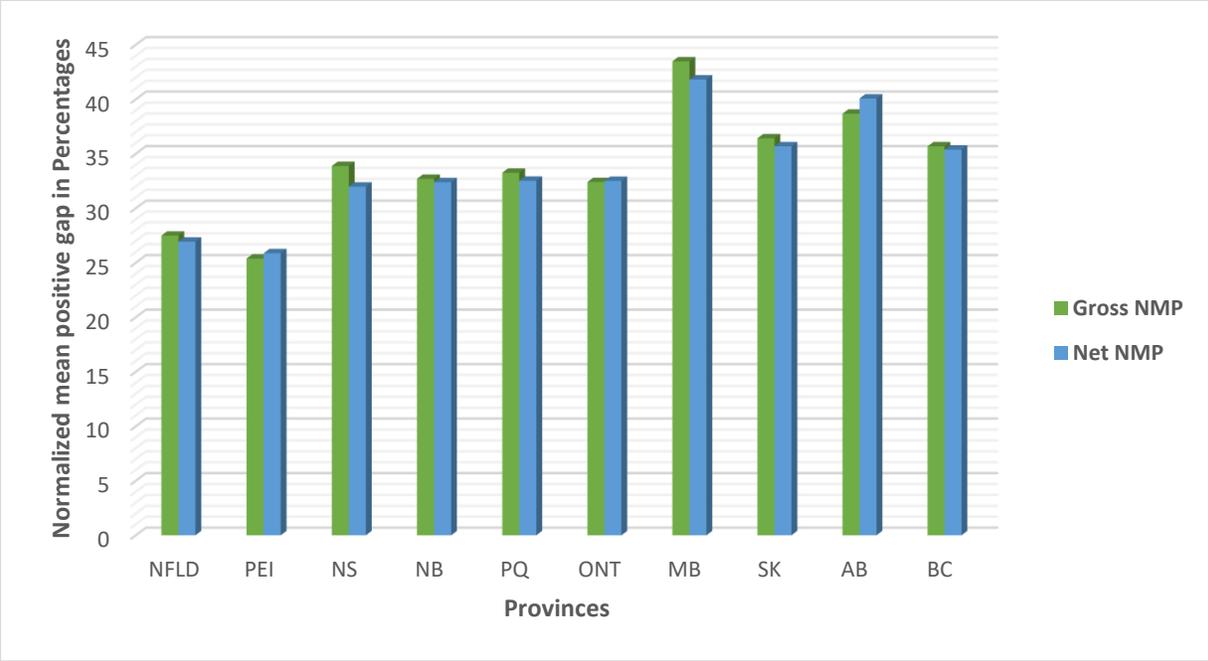


Figure 3.3: Impoverishing normalized mean positive gap impact estimates of OOPDE by province, Canada, 2016



The Pen’s Parade of poverty, in figure 3.4 below, describes changes in income as a result of expenditure on out-of-pocket prescription drugs for individuals in the lower half of the spectrum of income distribution. The graph of the upper half income groups is presented in the appendix.

The horizontal axis shows the ranked cumulative proportion of the population by per capita income gross of health payment. The vertical axis shows the changes in the per capita income before and after health payment. The changes in income is represented by the gap between the income before health payment (blue line) and the income after the health payment (red line). Figure 3.4 can be explained using the Median Voter Theory (MVT) (Mou, 2013). It is apparent from the graph below that only individuals in the lower half of the spectrum of income distribution experience poverty when they fill their prescription drugs. The MVT explains that since each vote's tax contribution to a social program is based on their income, the tax contribution of an individual with a below-average income is less than the average cost of the social program. While individuals whose income is more than average income will bear greater than average tax contribution. Hence, poorer individuals tend to support, and richer individual oppose the creation of social programs based on the simple cost-benefit framework. To get a particular social program financed, there is the need to appeal to the median voter, who is somewhat indifferent toward the creation of such programs. The Pen's Parade shows that the individuals with a median income (at the 50th percentile of the income distribution) experience no poverty when they fill their prescription drugs. Therefore, regardless of how attractive it is for a program like Pharmacare to be created in Canada for groups such as the working poor and those whose income is less than the absolute poverty line, it appears the needed median voter's support is not substantial.

Figure 3.4: Effect of OOPDE on the Pen's Parade of Households in Canada, 2016 (<50th percentile)

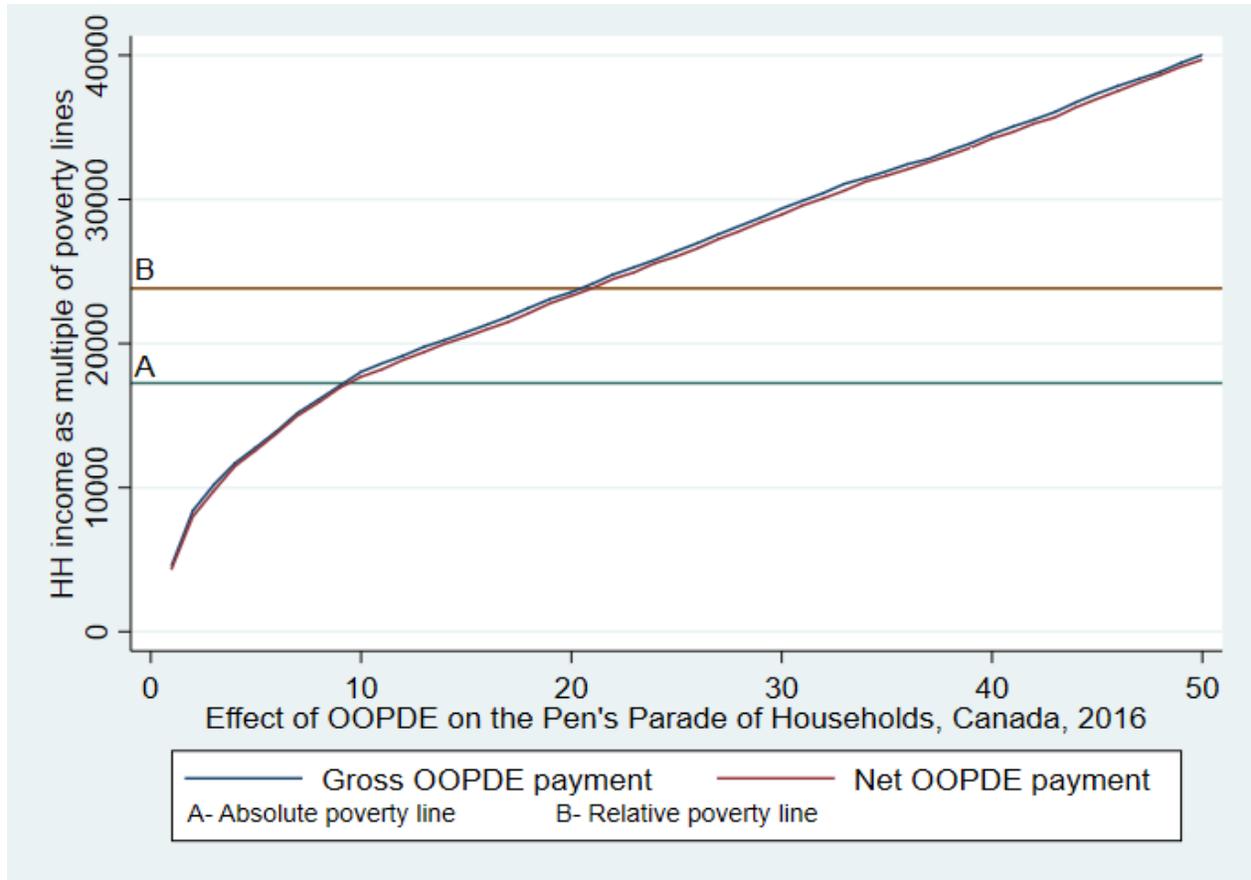


Table 3.4: Impoverishing impact of COOPDE in Canada against absolute and relative poverty line

Canada	Against absolute poverty line				Against relative poverty line			
	Income gross of health payments (a)	Income net of health payments (b)	Absolute difference (c)=(b)-(a)	Relative difference [(c)/(a)] *100	Income gross of health payments (a)	Income net of health payments (b)	Absolute difference (c)=(b)-(a)	Relative difference [(c)/(a)] *100
Poverty head count	10.02%	10.53%	0.51%	5.09%	20.54%	21.11%	0.57%	2.78%
Poverty gap	608.02	634.26	26.24	4.32%	1511	1572	61	4.04%
Normalized poverty gap	3.40%	3.55%	0.15%	4.41%	6.34%	6.60%	0.26%	4.10%
Normalized mean poverty gap	33.95%	33.70%	-0.25%	-0.74%	30.87%	31.26%	0.39%	1.26%

3.8 Discussion and Conclusion

This chapter analyzed the catastrophic and impoverishing effects of out-of-pocket prescription drug payments in Canada. The effects were examined using the 2016 Survey of Household Spending. The results showed that a significant percentage of Canadian households incurred financial catastrophe at all the three thresholds of catastrophic payment presented. As high as 14.61% of Canadian households spent more than 3.4% of their expenditure on prescription drugs. Hence, despite the provincial and federal efforts, there is not enough financial protection for households against financial catastrophe in Canada. The negative concentration indices also showed that poorer households compared to wealthier households are more likely to exceed the threshold of catastrophic payments in Canada. The intensity of catastrophic payments is also higher among poorer households compared to richer households.

The results also show that there is significant variation across provinces in catastrophic out-of-pocket prescription drug expenditures. Quebec had the highest percentage of population with catastrophic drug payment at both the 3.4% and 6.73% budget share thresholds, and Ontario had the least financial catastrophic burden across the three thresholds. A visual appraisal of this is given by the three diagrams below. The provincial drug plans have different eligibility and depth of drug coverage. However, an interesting fact is that Quebec used to have the least financial catastrophe among the provinces during the 2009 period, unlike what is obtainable in 2015 (Caldbeck et al., 2015). The next chapter explains these trends and more.

The final part of this chapter presented the impoverishing estimates of out-of-pocket prescription drug expenditures. The findings showed that only individuals in the lower half of the income distribution of the Canadian population experienced poverty due to out-of-pocket prescription drug expenditures. Individuals who become impoverished as a result of out-of-pocket

prescription drug expenditures is given as the difference between the gross of health payments (per capita household income) and net of health payments estimates (per capita household income less per capita household out-of-pocket prescription drug expenditures). Close to 73,000 Canadians fell below the Canadian absolute poverty line after they incurred out-of-pocket prescription drug payments. That is, without having to pay for prescription drugs out-of-pocket, about 73,000 individuals could be lifted from poverty.

An important factor that could have led to this empirical evidence is the significant cost-sharing mechanisms (premiums, deductibles, and coinsurance) in the existing patchwork system of prescription drug plans in Canada. Moreover, regarding cost-sharing mechanisms in Canada, there is the need for special attention to households who fall below the average income, are working poor, or the households below the absolute poverty line. Therefore, this chapter presented viable indicators for assessing the impact of the existing patchwork system of prescription drugs on Canadians in terms of financial catastrophe and impoverishment. In the next chapter, I will analyze the determinants of catastrophic payments in Canada using regressions.

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3.10 Appendix:

Descriptive statistics of the variables:

Table 3.5: Out-of-pocket prescription drug expenditures as a percentage of total household expenditure by province.

	NL	PEI	NS	NB	PQ	ONT	MB	SK	AB	BC
Mean (%)	1.66	1.89	1.47	1.53	1.90	1.03	1.72	1.62	1.07	1.20
Coefficient of variation	2.03	1.84	1.89	1.68	1.60	2.56	2.10	1.85	2.25	1.88

Table 3.6: Weighted distribution of out-of-pocket prescription drug expenditures in Canada, 2016 by dollar amount

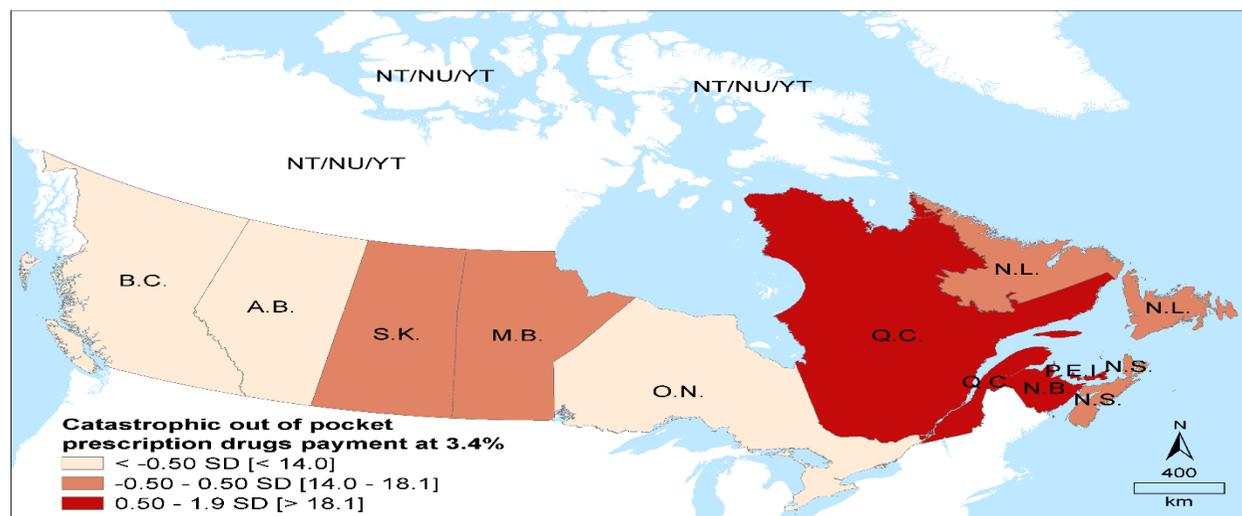
Variables	Percentage of individuals with non-zero dollar OOPDE	Percentage of individuals with zero-dollar OOPDE
Canada	63.21	36.79
Age (years)		
< 35	50.96	49.04
35-50	56.31	43.69
50-65	62.20	37.80
≥65	80.99	19.01
Gender		
Male	61.64	38.36
Female	64.68	35.32
Per capita PL income		
>Ave	60.73	39.27
RPL-AVE	68.55	31.45
ABL-RPL	68.73	31.27
BAPL	44.50	55.50
Education		
Below high school	70.12	29.88
High school	59.69	40.31
Between	64.06	35.94
≥ University	61.22	38.78
Provinces		
NL	71.52	28.48
PEI	74.70	25.30
NS	67.59	32.41

NB	71.26	28.74
PQ	74.40	25.60
ONT	55.84	44.16
MB	62.88	37.12
SK	64.54	35.46
AB	62.01	37.99
BC	59.93	40.07
Employment income		
Paid/self/investment income	59.55	40.45
Government transfer/miscellaneous/all other sources	70.89	29.11
Marital status		
Separated/divorced/never married)	54.35	45.65
Married/common-law/widowed	67.55	32.45

*BAPL- Below absolute poverty line * ABL-RPL – Working poor * RPL-Ave – Between relative poverty line and average per capita income *>Ave – Greater than average per capita income

Figure 3.5: Prevalence of OOPDE across provinces at different thresholds

(The colour beige implies low prevalence, brown implies medium prevalence, and red implies high prevalence)



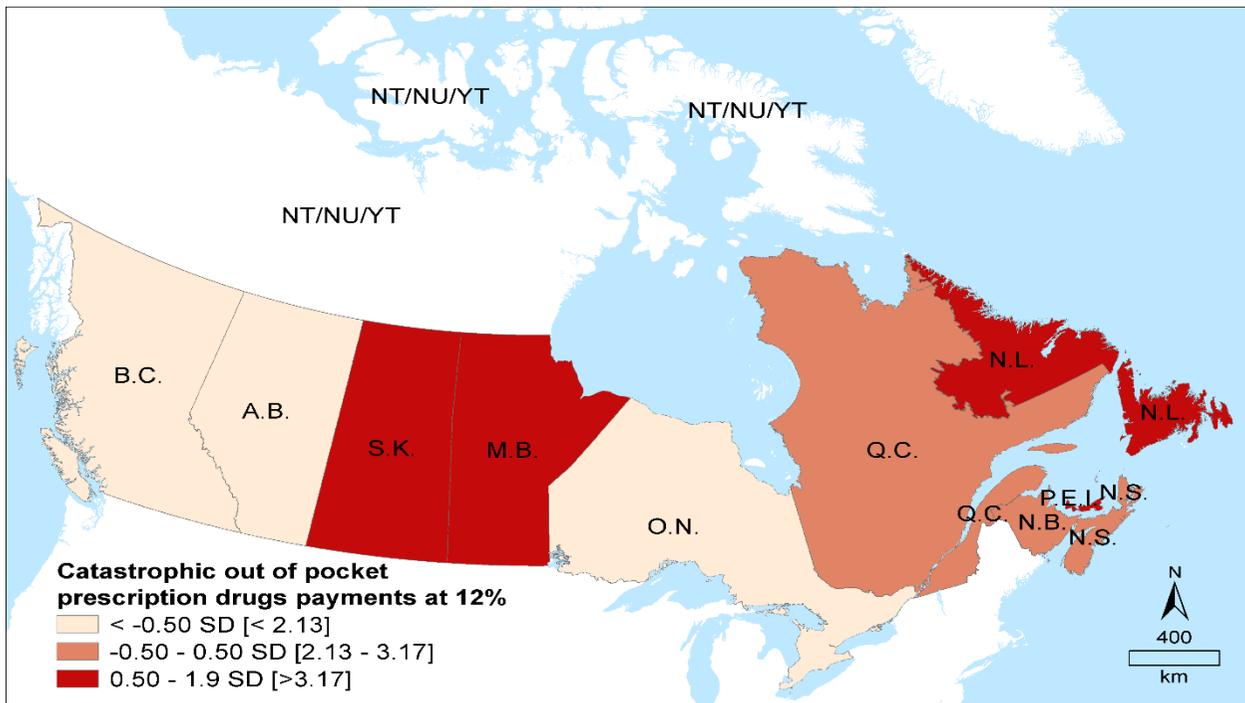
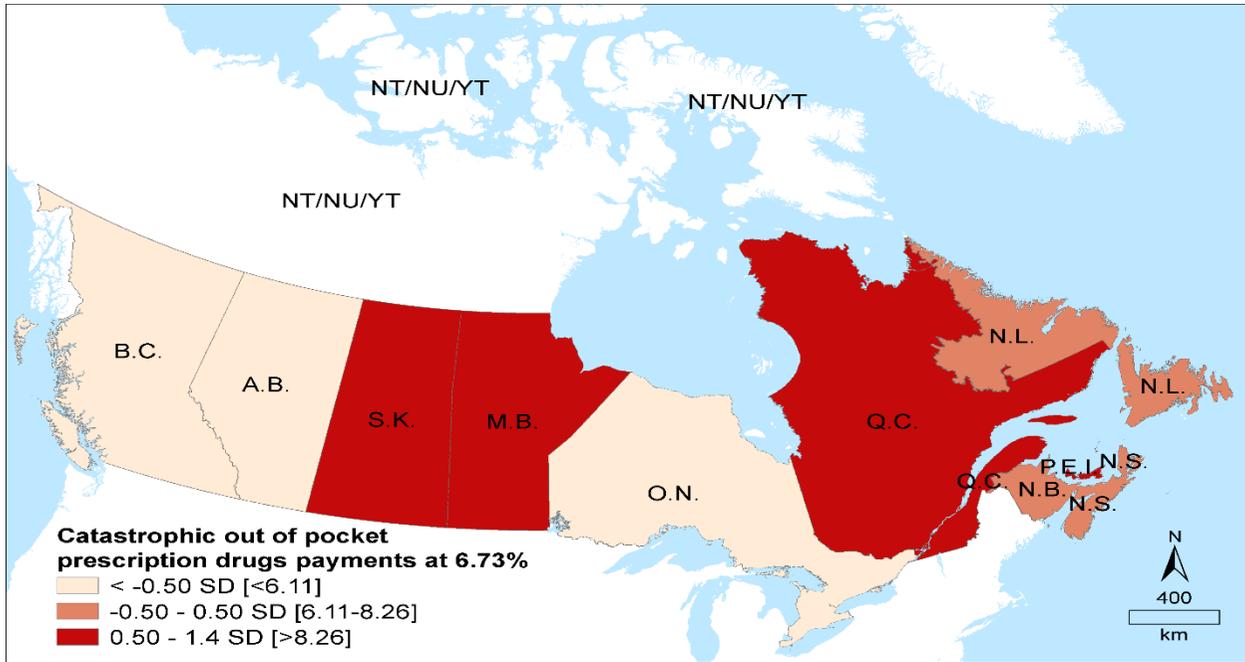
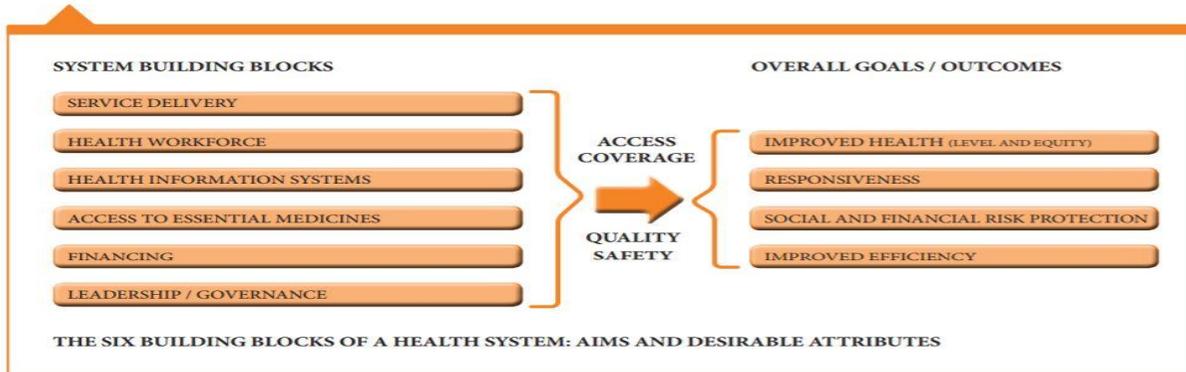
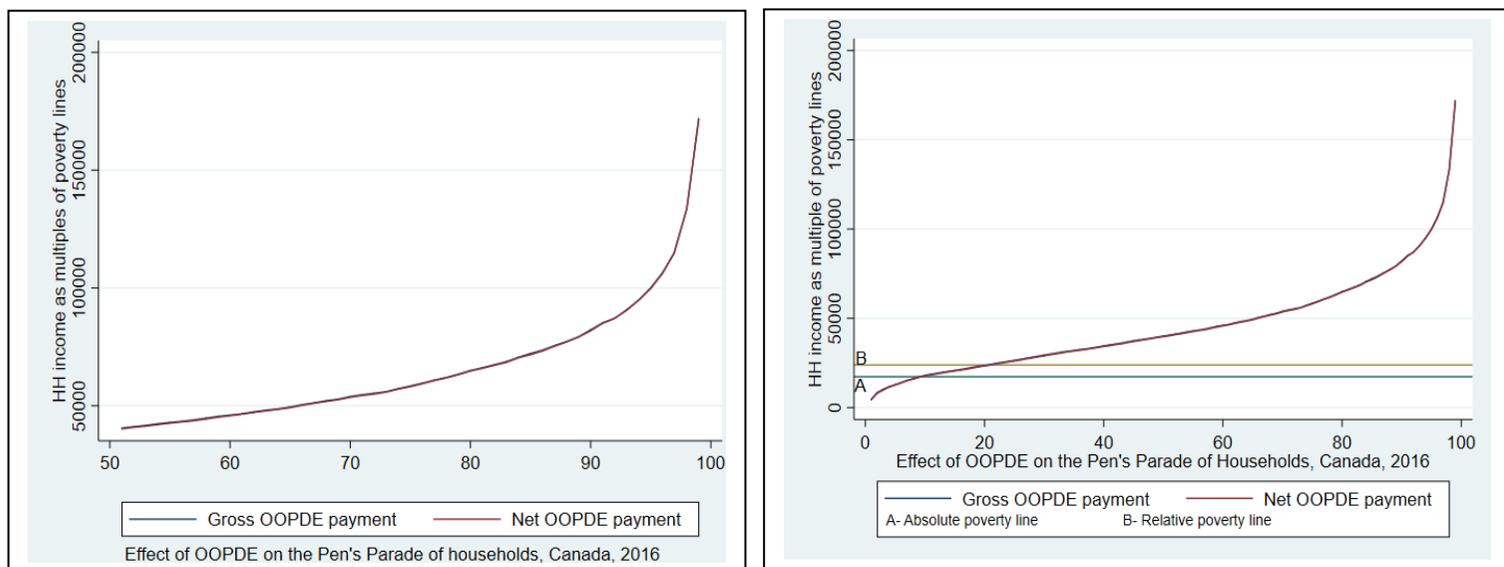


Figure 3.6: World Health Organization’s health systems framework showing the relationship between health building blocks and health outcomes.



Adapted from WHO (2010)

Figure 3.7: Pen's Parade – Effect of OOPDE on Households in Canada, 2016 (individuals $\geq 50^{\text{th}}$ percentile in income distribution (left), and Total population (right))



CHAPTER FOUR

FACTORS ASSOCIATED WITH CATASTROPHIC OUT-OF-POCKET PRESCRIPTION DRUG EXPENDITURES IN CANADA

4.1 Introduction

This chapter presents the regression analysis and descriptive statistics results of the factors associated with catastrophic out-of-pocket prescription drug expenditures in Canada. Furthermore, to assess the factors associated with catastrophic drug spending at various severity levels, this chapter also uses a Partial Proportional Odds (PPO) model. While a lot of literature has used logistic, Probit, Poisson and Tobit regression models to explain the determinants of catastrophic spending, the use of a PPO to assess the factors associated with catastrophic health spending at various severity levels is novel to the literature. Sections 4.2 and 4.3 give the background and literature review of the determinants of catastrophic health expenditure, sections 4.4 and 4.5 explain the methods and results, and section 4.6 concludes the chapter.

4.2 Background

The analysis in chapter three of this thesis demonstrated the substantial financial risks associated with the out-of-pocket prescription drug payments in Canada. Due to significant cost-sharing under the existing system, some Canadian households are unable to pay for their prescriptions (Law et al., 2012; Morgan & Boothe, 2015; Tang, Ghali & Manns, 2014). Cost-sharing mechanisms (e.g., deductibles and coinsurance/copayments) are provisions that allow for individuals and insurance companies to jointly pay some portion of the cost of the insured prescription drugs (Daw & Morgan 2010; Hurley, 2010). A deductible is a type of cost-sharing mechanism that specifies the maximum

amount that the insured must pay before the insurance company starts paying (either the full amount or shared) for the cost of the prescription drugs. Coinsurance is usually a percentage of the prescription drugs' prices that the insured must still pay after the deductible has been met. A copayment, however, is a fixed amount that the insured must pay per prescription. A premium is a monthly or yearly payment to maintain the insurance package (Daw & Morgan, 2012; Hurley, 2010). In the literature, financial risk pooling system, as well as some sociodemographic factors such as household size, gender and age, are associated with the catastrophic impact of out-of-pocket expenditures (Barros, Bastos & Damaso, 2011; Bennett & Dismuke, 2010; Water, Anderson & Mays, 2004). The above factors are also associated with the general efficiency and equity of a health care system (Goudge et al., 2009). As the need for financial protection in Canada's universal health coverage continues to grow, appropriate policy interventions are required to deal with the financial risks of some citizen groups. As a first step, this chapter analyses the determinants of the prevalence and intensity of catastrophic out-of-pocket prescription drug expenditures in Canada. The chapter uses bivariate, multi-variate logistic and PPO models to determine the association between sociodemographic factors and the prevalence of catastrophic out-of-pocket prescription drug expenditures in Canada.

4.3 Overview of the Literature

Several studies from Africa, Latin America, Asia, North America, and Europe have evaluated the determinants of financial protection in households. Some of the factors associated with vulnerability to catastrophic payments include household income, gender and age of household head, geographical location, educational level, employment status, health condition, the nature of in-patient and out-patient services, and health insurance (Barros, Bastos & Damaso, 2011; Berki, 1986; Gotsadze,

Zoidze & Rukhadze, 2009; Knaul, Wong & Arreola-Ornelas, 2012; Water, Anderson & Mays, 2004; Su, Kouyate & Flessa, 2006).

In their study on catastrophic health spending in Brazil, Barros, Bastos and Damaso (2011) used Poisson regression in determining households that were most vulnerable to incurring catastrophic payments. The study documented that households with elderly persons had a higher chance of incurring catastrophic payment. For all but the lowest income quintile, private health insurance had a rather positive association with catastrophic expenditure. The scholars noted that this result could have been from the incomprehensive nature of private health insurance packages in the country that leave out substantial aspects of health care such as home care, prescription drugs, among others. A piece of analogous evidence is documented in Thailand in Somkotra and Lagrada (2009), where the specific taste for private health care services among well-to-do households increase their prevalence of catastrophic spending.

Further, in Kenya, Kimani (2014) found that the government-owned National Hospital Insurance Fund mandated to provide health insurance to Kenyans above 18 years of age did little to protect Kenyans from catastrophic and impoverishment spending because of the limited range of service coverage it offered, unlike the counterpart private insurance. Therefore, there is confounding evidence in the literature regarding the existence of insurance and its impact on financial catastrophe and impoverishment. A similar submission can be made for Canada where a large proportion of the population has some form of insurance coverage, but as results from chapter three of this thesis shows, there exists a significant burden on some households' capacity to pay. Hence, tastes and preferences for insurance and comprehensiveness of the insurance package are important to the effectiveness of a health insurance scheme.

Using a logit model and the Burkina-Faso data, Su, Kouyate and Flessa (2006) showed the household income quartile was a critical factor that influenced catastrophic expenditure, and a similar

result was documented in Cruz et al., (2006) for Mexico and Buigut, Ettarh and Amendah, (2015) for Kenya. In Burkina-Faso, although poorer households had a low frequency of illness reports, they experienced significant catastrophic payments relative to higher-income households. Other factors identified were the prevalence of adult illness, the presence of chronic illnesses and health care utilization. The study submitted that the opportunity cost of health payments could sometimes be high enough to prevent households from seeking treatment all together except in extreme situations where death could occur.

Furthermore, in Latin America, Peticara (2008) showed that a significant burden from out-of-pocket payment expenditure was directly related to the nature of service (in-patient) and not directly on the household income capacity. And in studies such as Knaul et al., (2007), geographical location, presence of seniors as well as low income were directly correlated with catastrophic health care spending. Lara and Gomez (2011), using a Probit model found that lower-income households with no substantial financial protection from social security, and households with heads who are seniors had a higher chance of incurring catastrophic spending. This result is like those found in Merlis (2002) for the USA, Ngcamphalala (2016) for South Africa, Somkotra and Lagrada (2009) for Thailand, and Torres and Knaul (2003) for Mexico.

Using the 1997 Canadian data, Kapur and Basu (2005) built a database from Survey of Consumer Finances, National Population Health Survey, Statistics Canada Survey of Household Spending and the income data of the Canada Customs and Revenue Agency to determine the probability and extent to which Canadians have prescription drugs insurance coverage. The scholars simulated the specificity of the type of insurance coverage in the country – public coverage, private coverage and no coverage - and found that around 96% of Canadians have insurance coverage in some form. The scholars then used a Tobit model to analyze the burden of prescription drug payments across the province, age, household income, gender, area of residence and coverage status. The

results showed that females experienced a marginally higher burden compared to their male counterparts, and households with private drug plans had a lower burden compared to households with public plans or no insurance plan at all. Also, the Atlantic and Prairie provinces showed higher burdens of prescription drug payments when compared to Ontario.

Further, Caldbick et al., (2015) used a logistic regression model to determine the burden of catastrophic prescription drug payment in Canada across income, provinces, age and education. Like the earlier work by Kapur and Basu, the results showed significant variation across provinces. Also, an analysis across households showed that compared to households in the fourth income quartile, households in the first two quartiles had a higher probability of experiencing catastrophic prescription drug payments. Individuals aged 50 and above also had a higher probability of incurring catastrophic payments compared to individuals aged 35 and younger. Finally, those with educational levels below university education had a higher probability of experiencing a significant burden from prescription drug payments compared with those with university degrees and higher.

In general, the studies in the literature have focused on understanding the odds of the vulnerable population in incurring catastrophic spending at different thresholds. Because the response variable is dichotomous in this case, a simple logistic regression is appropriate for such analysis. As documented earlier, other studies such as Barros, Bastos and Damaso (2011), Sene and Cisse (2015), Nguyen, Rajkotia and Wang (2011) have employed Probit and Poisson regression as well. The review above has shown that factors such as the presence of chronic illness, nature of health care service, age, private insurance, income, education, among others, are associated with catastrophic health spending. However, due to the limited availability of data in the 2016 SHS, the independent variables used in this chapter are household heads' age, marital status, education, employment income type, as well as household per capita income and province of residence.

This study uses the conventional logistic model to analyze the odds of incurring catastrophic out-of-pocket payments in Canada at selected thresholds. Also, this study created a hierarchical category for the dependent variable to capture the severity of catastrophic spending among vulnerable population groups in Canada and a partial proportional odds model is used. While the use of PPO models has found relevance in education (Soon, 2010), transportation (Sasidharam & Menendez, 2014), etc., to the best of our knowledge, this approach is novel to catastrophic health spending literature. The methodology section explains this in detail.

4.4 Methods

As noted earlier and following other studies, logistics regression was applied to the household level data of the 2016 Canadian Survey of Household Spending to assess the determinants of the catastrophic out-of-pocket prescription drug expenditures. The response variable is the dichotomous variable that represents the occurrence of catastrophic spending, as given in equation 3.8 of this thesis. For the PPO Model, the intensity of catastrophic spending at the thresholds was categorized into three levels based on severity. The intensity is coded in descending order as follows: a very high burden = 3, a high burden = 2, a medium burden = 1, and a low burden = 0.

4.4.1 Bivariate and Multivariate Logistic Regression Analysis

$$\begin{aligned} \text{Recall } COOPDE_h &= 1 \text{ if } y^* \geq 6.73\% \\ COOPDE_h &= 0 \text{ if otherwise} \end{aligned}$$

The results for 3.4% and 12% were presented in chapter three of this thesis. Given the dichotomous nature of the response variable, the simple regression model is given as follows:

$$y^* = \alpha + \sum \beta_i X_i + \varepsilon \quad (4.1)$$

Where y^* is the response variable representing the occurrence of catastrophic prescription drug spending at a threshold. β_i is the coefficient of the independent variable, α is the intercept and ε is

the error term. X_i is independent variables based on the literature on the financial burden of prescription drug payment in Canada (Caldbeck et al., 2015; Kapur & Basu, 2005; McLeod et al., 2011). The independent variables used in this thesis are household heads' age, marital status, education, employment income type, household per capita income and province of residence. Gender was not statistically significant at the bivariate level of the analysis and was not included in the model. Additionally, because household size had been accounted for in the capacity-to-pay approach that resulted in the response variable, household size was omitted as an independent variable.

The probability of a Canadian household facing catastrophic out-of-pocket prescription drug payments is then given by the logit distribution function:

$$\Pr (\text{COOPDE}_h = 1|X) = F(\beta X') = \frac{e^{\beta X'}}{(1 + e^{-\beta X'})} \quad (4.2)$$

The odds ratio associated with the probability is then derived for bivariate (here X_i takes on only one of the independent variables) and multivariate (here X_i takes on all independent variables) regressions respectively as follows:

$$\ln \frac{P(x)}{1-P(x)} = \alpha + \sum \beta_i X_i \quad (4.3)$$

$P(x)$ is the probability of incurring catastrophic out-of-pocket prescription drug payments. β_i gives the parameters associated with the independent variables X_i , and α is the model's constant. Only the independent variables that were significant in bivariate regressions were included in the multivariate regression.

Table 4.1 summarizes the variables used in the multivariate regression analysis of the factors associated with catastrophic out-of-pocket prescription drug expenditures in Canada.

Table 4.1: Variables description

Categories of variables	Definition	Categories	Anticipated effect
Per capita household income	Household income is the value in Canadian dollars that each member of a household contributes to its sustenance (e.g. food, rent and utilities). This is then adjusted by equivalent household size	0 = >Ave 1 = RPL-AVE 2 = ABL-RPL 3 = BAPL	Negative
Head of household's main employment income source	This implies the major source of income of the head of household in the year under review.	0 = Paid/self/investment 1=Governmenttransfer/Misc/others	Negative
Marital status (IV)	This is the marital status the head of household reports in the survey.	0=Separated/divorced/never married 1 = Married/common-law/widowed	Uncertain
Head of household's education (IV)	This is the highest level of education the head of household reports in the survey.	0 = University and greater 1 = Between 2 = Below high school and high school	Negative
Head of household's age (IV)	This is the reported age the head of household reports in the survey.	0 = ≤ 40 years 1 = 40-64years 2 = ≥ 65 years	Positive
Province of residence (IV)	This is the province of residence as confirmed by the household for the year under review.	0 = Ontario 1 = British Columbia 2 = Prairie 3 = Atlantic 4 = Quebec	Uncertain
Catastrophic out-of-pocket prescription drug expenditures	This measures whether a household incurs catastrophic expenditures at the given threshold	0 = if household does not experience catastrophic payment 1 = 0 if household experiences catastrophic payment	----

4.4.2 Logistic Regression Results

The multivariate logistic regression results at the 6.73% threshold are presented in Tables 4.2 and 4.3. For the multivariate model, pairwise correlations using the Spearman correlation coefficient among independent variables were less than 0.6, indicating the absence of multicollinearity (Akoglu, 2018). Statistics Canada sample weights were applied to the estimations. Concerning the survey of household spending's weights and methodology, please refer to the website provided in the reference section (Statistics Canada, 2016). Additionally, the Balanced Repeated Replications (BRR), which account for sampling variability and uses the survey bootstrap weights were employed to estimate the confidence interval as well as the standard error of COOPDE. At all three threshold percentages of COOPDE, gender was statistically insignificant. The insignificance of gender might mean that coverage in our existing system does not discriminate based on sex. The post-estimation goodness of fit test [linktest (_hatsq) and Stata v15 estatgof] for the model showed that the model fits the data.

An important finding from this research is that the probability of incurring catastrophic out-of-pocket prescription drug payments in Canada varies significantly with age. In Canada, seniors are approximately six times more likely to incur catastrophic spending at the 6.73% threshold compared to individuals aged 40 years and younger. The value is 2.4 times for individuals between the ages of 40 and 64 years compared to their counterparts who are aged 40 years and younger. A viable explanation for these findings is the Grossman-Wagstaff theory of demand for health, which indicates that health demands increase with age (Grossman, 2000; Ngcamphala, 2016). Another important finding from the empirical evidence is that the household head's level of education affects the probability of incurring catastrophic spending. Compared to households headed by individuals with a university degree or higher, those headed by individuals with an educational level below high school are 1.86 times more vulnerable.

The results also showed cross-provincial variation in the determinants of catastrophic out-of-pocket prescription drug expenditures (COOPDE), especially for the working poor, the effect of per capita income on COOPDE significantly depended on the province of residence. The working poor in the Prairie provinces had the highest probability of incurring COOPDE (5.11 times) compared with their counterparts in Ontario. The same phenomenon is true for the working poor in Quebec (4.19 times) and the Atlantic provinces (3.63 times) compared with their counterparts in Ontario.

Furthermore, Figure 4.1 below shows the predicted probabilities of COOPDE at 6.73% threshold across provincial and income categories. The predicted probabilities were calculated using the margins of the estimation of the model. The visual appraisal shows that the working poor (ABL-RPL) of Quebec, Prairie and Atlantic provinces have a higher predicted probabilities of incurring financial catastrophe due to out-of-pocket prescription drug payments.

Table 4.2: Multivariate analysis of the association between sociodemographic factors and the prevalence of COOPDE in Canada at the 6.73% threshold

Variable	Odds Ratio (OR) of COOPDE (95% CI)
Age group, years (Ref: ≤ 40)	1.0
40-64 years	2.40 (1.46-3.94)
>65 years	5.95 (3.33-10.62)
Provinces (Ref: Ontario)	1.0
British Columbia	1.07 (0.49-2.35)
Prairie^a	0.77 (0.42-1.42)
Atlantic^b	1.02 (0.54-1.90)
Quebec	1.41 (0.65-3.07)
Marital status (Ref: Separated/divorced/never married)	1.0
Married/common-law/widowed	1.26 (0.94-1.69)
Employment income (Ref: Paid/self/investment income)	1.0
Government transfer/miscellaneous/all other sources	1.25 (0.82-1.89)
Education (Ref: University and greater)	1.0
Between high school and university	1.47 (0.99-2.16)
Below high school and high school	1.86 (1.25-2.75)
Per capita income (>Ave)	1.0
RPL-Ave	1.41 (0.71-2.80)
ABL-RPL	0.78 (0.24-2.55)
BAPL	1.81 (0.61-5.41)

Table 4.3: Multivariate analysis of the interaction between per capita income and province and the prevalence of COOPDE in Canada at the 6.73% threshold

Combination of variables		Odds Ratio (OR) of COOPDE (95% CI)
Per capita income and provinces		
RPL-Ave (vs >Ave)	British Columbia (vs Ont.)	0.95 (0.34-2.70)
RPL-Ave (vs >Ave)	Prairie (vs Ont.)	2.22 (0.96-5.11)
RPL-Ave (vs >Ave)	Atlantic (vs Ont.)	1.50 (0.68-3.29)
RPL-Ave (vs >Ave)	Quebec (vs Ont.)	1.50 (0.59-3.79)
ABL-RPL (vs >Ave)	British Columbia (vs Ont.)	2.21 (0.52-9.34)
ABL-RPL (vs >Ave)	Prairie (vs Ont.)	5.11 (1.51-17.28)
ABL-RPL (vs >Ave)	Atlantic (vs Ont.)	3.63 (1.09-11.98)
ABL-RPL (vs >Ave)	Quebec (vs Ont.)	4.19 (1.09-16.02)
BAPL (vs >Ave)	British Columbia (vs Ont.)	0.82 (0.19-3.61)
BAPL (vs >Ave)	Prairie (vs Ont.)	3.08 (0.69-13.84)
BAPL (vs >Ave)	Atlantic (vs Ont.)	1.42 (0.42-4.88)
BAPL (vs >Ave)	Quebec (vs Ont.)	1.14 (0.27-4.81)
	_cons	0.01 (0.00-0.01)
	_hatsq	0.65
	F(9,979)	0.19
	Prob>F	0.99

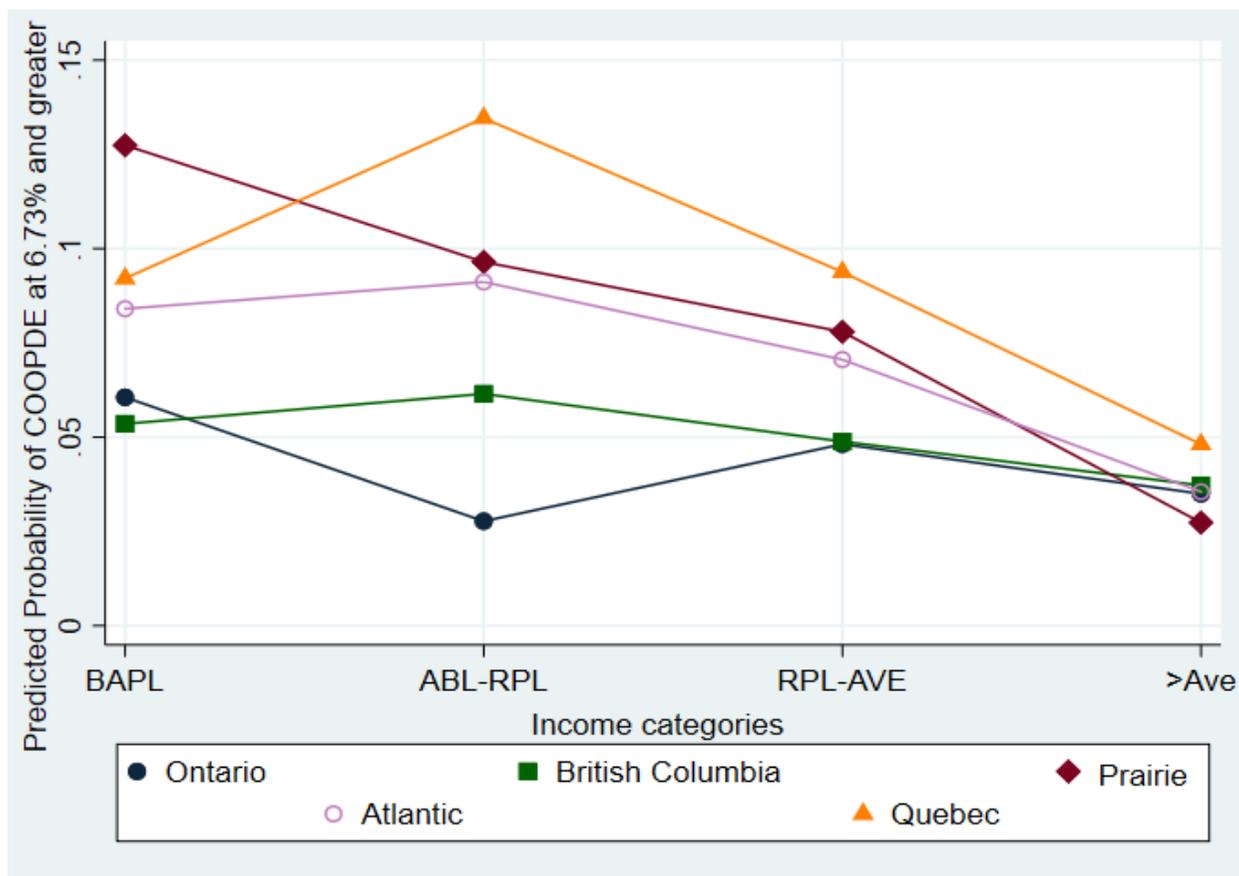
Abbreviations: OR - odds ratio; vs - versus; CI - confidence interval; Ref - reference group

^a Manitoba, Saskatchewan, Alberta

^b Prince Edward Island, Nova Scotia, New Brunswick, Newfoundland, and Labrador

Note: Statistically significant values are bolded

Figure 4.1: Graph showing the interaction between income and province categories.



4.5 Analysis of the severities of COOPDE using a Partial Proportional Odds Model (PPO)

This section analyses the severities of catastrophic out-of-pocket prescription drug expenditures in Canada across smaller cut off points. As a robustness check to the previous threshold above, we used the fixed threshold of 5% provided by the National Pharmaceutical Strategy in their 2006 report (Health Canada, 2006). This threshold was modelled using a Partial Proportional Odds (PPO) model. For this section, we used British Columbia as a reference group because the estimates are comparable to those of Ontario.

Following Sasidharam and Menendez (2014), Williams (2006) and Williams (2016), a PPO model for this study can then be specified as follows. Let Y_i denote the observed level of catastrophic

payments for prescription drugs in Canada (COOPDEh). Equation 4.4 shows the intensity and severity of catastrophic payments for prescription drugs at the threshold levels defined below:

$$Y_i^* = \alpha + \sum \beta X_i + \varepsilon \quad (4.4)$$

$$Y = \begin{cases} 0, \text{ low burden, if } Y^* < 0.05 \\ 1, \text{ medium burden, if } Y^* \geq 0.05 < 0.10 \\ 2, \text{ high burden, if } Y^* \geq 0.10 < 0.15 \\ 3, \text{ very high burden, if } Y^* \geq 0.15 \end{cases}$$

Let M represent the count of the severity levels of catastrophic payments. In this case, M is 4. Then the probability of incurring catastrophic payments at a catastrophic severity level (say j) is given as

$$P(Y_i > j) = P_{ij} = e^{\alpha_j + X_i \beta_j} / 1 + e^{\alpha_j + X_i \beta_j}; J = 1, 2, \dots, M-1 \quad (4.5)$$

Where β represents a uniform value for all severity levels given that the proportional odds assumption is met; here, meeting the proportional odds assumption means that all the independent variables including household heads' age, education, major source of income, as well as household income and province of residence all have equal effect on the prevalence of catastrophic spending from the low to very high burden level. Because of this equal effect, an ordered logistic regression would seem to be the appropriate analysis to employ. However, in this study, variables including the Quebec province dummy variable and major sources of income from government transfers, miscellaneous, and others did not meet the proportional odds assumptions, for these reasons, I use the PPO model. The results of the PPO model imply that the coefficients of the two variables that did not meet the assumption can vary across the model. The Gologit2 Stata program, which tests the proportional odds assumption as well as estimates the odds ratios, was used to fit the model in this thesis (Sasidharam & Menendez, 2014; Williams, 2006).

4.5.1 The Partial Proportional Odds Model Results

This section presents the results of the PPO model in table 4.4 below. Pairwise Spearman correlations among independent variables were less than 0.6, indicating the absence of multicollinearity (Akoglu, 2018). The statistic to measure the predictive power of the PPO model is given as the Percentage Correctly Predicted (PCP). In this study, the PCP was 89.27%, which implies that our model correctly predicts about 89% of the observed outcome. The PPO model is thus robust.

In the PPO model, there are four COOPDE severity categories; hence, the results of the PPO model are presented in three panels. The response variables for the first panel of the PPO model – PPO(0) is coded as 0 vs 1, 2, and 3; PPO(1) is coded as 0, 1 vs 2 and 3; and PPO(2) is coded as 0, 1, 2 vs 3. The proportional odds assumption implies that all explanatory variables have the same effect on COOPDE across the severity levels. The results are presented in Table 4.4 using an odds ratio and at a 95% confidence interval. An odds ratio greater than 1 means an increased likelihood of experiencing COOPDE, and the reverse is also true. For example, the odds ratio in the first panel suggests the probability of incurring COOPDE as a low burden as opposed to the other three categories.

Furthermore, as specified in Sasidharam and Menendez (2014), the variable categories that do not meet the proportional odds assumption are also interpreted using marginal effects. A positive marginal effect value indicates that the probability of incurring COOPDE is higher when an independent variable increases by one unit and the reverse is also true.

When interpreting PPO models, the reference group is both the present category and a lower category where obtainable (Soon, 2010). Hence, an odds ratio greater than 1 means that an increase in the independent variable increases the likelihood of an individual incurring COOPDE at a *higher* category than the one they currently are at. An odds ratio less than 1 implies that an increase in the

independent variable increases the likelihood of an individual incurring COOPDE in a *lower* category than their current one (Soon, 2010; Williams, 2006).

In summary, the interpretation of each panel is as follows: individuals have a higher probability of incurring COOPDE at higher severity burden levels compared to their current category (or lower). For example, an odds ratio value of 5.74 means that seniors in Canada have a higher likelihood of incurring COOPDE at medium, high, and very high burden thresholds than at low burden thresholds. Across all panels, individuals between the ages of 40 and 65 years are 2.50 times more likely to experience COOPDE at higher burden thresholds than those at lower thresholds. Furthermore, as obtained in the multivariate logistic regression, significant interaction was found here between income and province as well, and these results are interpreted in the same manner: in the Prairie provinces, individuals who earn between the relative poverty line and average income levels are 2.27 times more likely to incur catastrophic spending at higher thresholds. The working poor also have a higher probability of incurring COOPDE at higher severity levels (2.84 times) in the Prairies. The same is true for residents of Quebec (3.10 times) and the Atlantic provinces (2.76 times). Again, the severity of catastrophic spending is higher in Quebec and among the working poor. In summary, the results show that for most of the variable categorizations, individuals have a higher probability of incurring COOPDE at higher severity levels compared to lower categories.

Similarly, from the positive values of their marginal effects, individuals in Quebec and individuals whose major source of employment income is government transfers have a higher probability of incurring COOPDE at all severity levels.

Table 4.4: Partial proportional odds model for severities in catastrophic out-of-pocket prescription drugs payment in Canada.

Variable	Odds Ratio (OR) of COOPDE (95% CI)
<i>Low burden (0)</i>	
Age group, years (Ref: ≤ 40)	1.0
40-64 years	2.50 (1.67-3.74)
>65 years	5.74 (3.60-9.17)
Provinces (Ref: British Columbia)	
Ontario	0.59 (0.31-1.12)
Prairie ^a	0.71 (0.41-1.22)
Atlantic ^b	0.78 (0.45-1.35)
Quebec	1.21 (0.63-2.35)
Employment income (Ref: Paid/self/investment income)	
Government transfer/miscellaneous/all other sources	1.37 (0.99-1.91)
Education (Ref: University and greater)	
Between	1.65 (1.20-2.26)
Below high school and high school	1.87 (1.37-2.55)
Per capita income (>Ave)	
RPL-Ave	1.12 (0.63-2.00)
ABL-RPL	1.12 (0.52-2.39)
BAPL	1.09 (0.45-2.61)
Gamma_2	
Quebec	0.73 (0.56-0.95)
Government transfer/miscellaneous/all other sources	0.95 (0.72-1.25)
Gamma_3	
Quebec	0.44 (0.25-0.76)
Government transfer/miscellaneous/all other sources	0.63 (0.39-1.00)
<i>Medium burden (1)</i>	
Quebec	0.87 (0.43-1.75)
Government transfer/miscellaneous/all other sources	1.29 (0.83-2.00)
<i>High burden (2)</i>	
Quebec	0.52 (0.23-2.1.21)
Government transfer/miscellaneous/all other sources	0.86 (0.47-1.56)

Combination of variables	Odds Ratio (OR) of COOPDE (95% CI)
Per capita income and provinces	
RPL-Ave (vs >Ave)	Ontario (vs BC.) 0.70 (0.74-3.90)
RPL-Ave (vs >Ave)	Prairie (vs BC.) 2.27 (1.16-4.47)
RPL-Ave (vs >Ave)	Atlantic (vs BC.) 1.90 (0.97-3.71)
RPL-Ave (vs >Ave)	Quebec (vs BC.) 1.74 (0.81-3.72)
ABL-RPL (vs >Ave)	Ontario (vs BC.) 1.02 (0.18-5.78)
ABL-RPL (vs >Ave)	Prairie (vs BC.) 2.84 (1.18-6.82)
ABL-RPL (vs >Ave)	Atlantic (vs BC.) 2.76 (1.21-6.32)
ABL-RPL (vs >Ave)	Quebec (vs BC.) 3.10 (1.29-7.83)
BAPL (vs >Ave)	Ontario (vs BC.) 1.99 (0.57-7.00)
BAPL (vs >Ave)	Prairie (vs BC.) 2.89 (0.81-10.28)
BAPL (vs >Ave)	Atlantic (vs BC.) 1.85 (0.65-5.31)
BAPL (vs >Ave)	Quebec (vs BC.) 1.41 (0.45-4.44)
	_cons 0.01 (0.01-0.03)
	_hatsq (0) 0.39
	_hatsq (1) 0.52
	_hatsq (2) 0.86

Abbreviations: OR - odds ratio; vs - versus; CI - confidence interval; Ref - reference group

^a Manitoba, Saskatchewan, Alberta

^b Prince Edward Island, Nova Scotia, New Brunswick, Newfoundland, and Labrador

Note: Statistically significant values are boldened

Figure 4.2 below show the interaction in the PPO model between provinces and income. To make the argument clearer, we graph the interaction showing the income categories against provinces here. The graph shows a clear progression in financial catastrophe for the working poor (green line) especially for the province of Quebec, followed by Atlantic provinces and the Prairies. In other words, at the higher thresholds (greater than 5%), residents of these three provinces who are working poor have a higher predicted probability of incurring financial catastrophe when they make out-of-pocket prescription drugs payments.

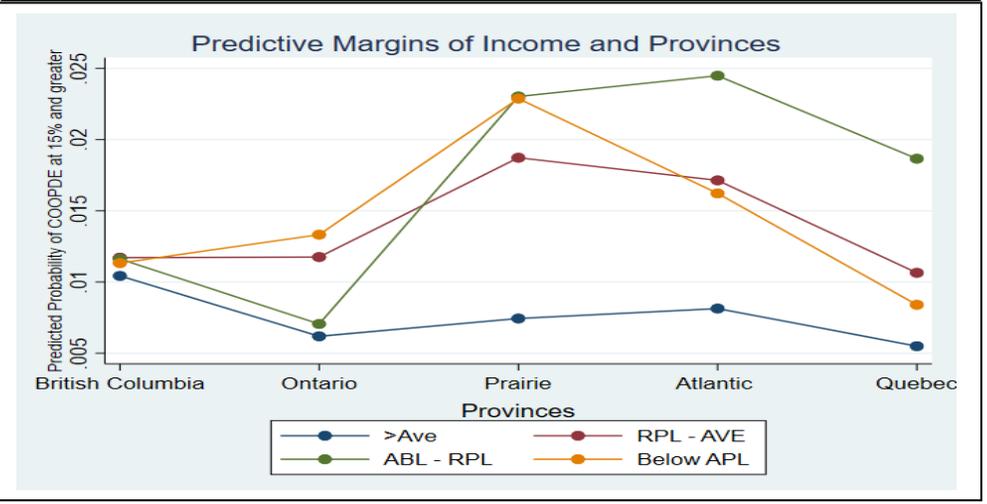
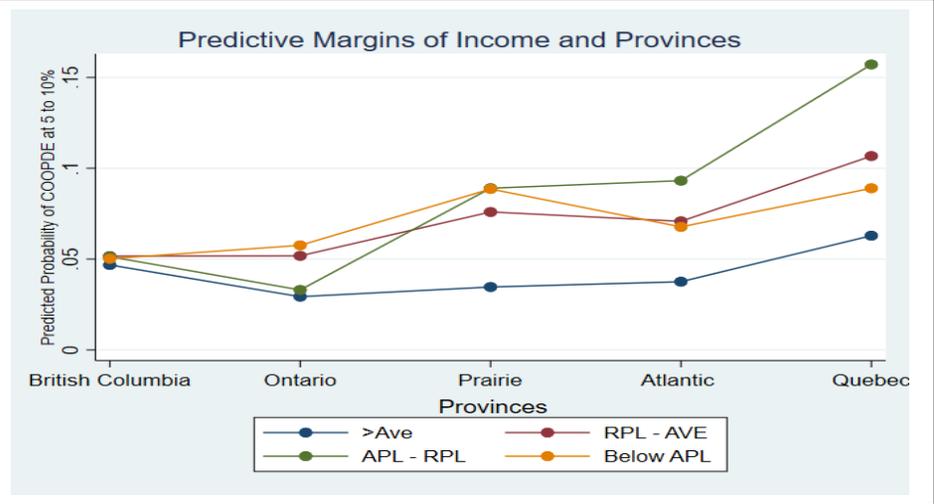
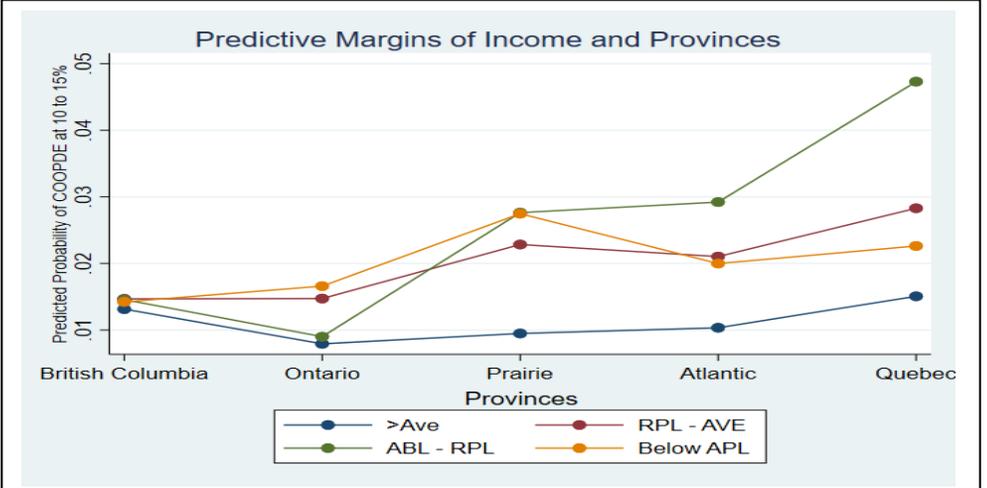
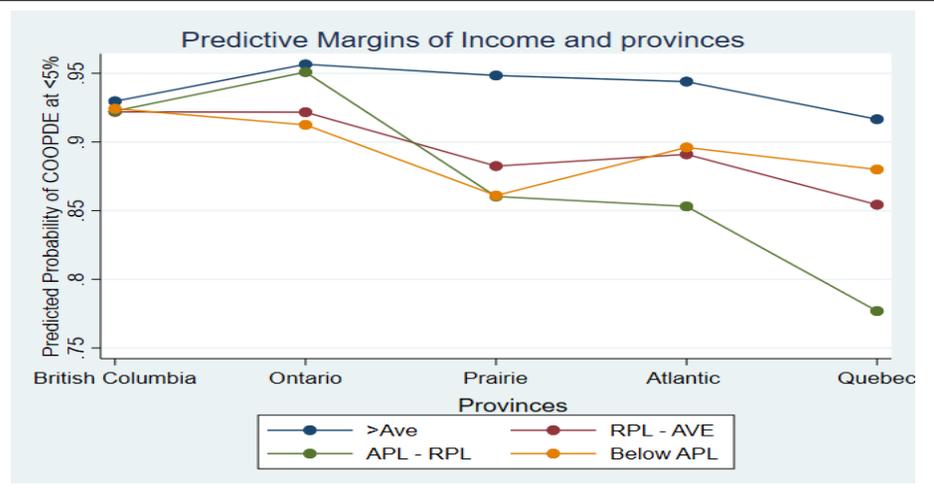


Figure 4.2: Graph of the interaction in the PPO Model

4.6 Discussion and Conclusion

The results above have shown that the absence of a universal insurance program for prescription drugs like Medicare has led to significant variation in prescription drug coverage across provinces in Canada. Other scholars have reached similar conclusions (e.g., Caldbick et al., 2015; McLeod et al., 2011; Sanmartin et al., 2014; Sutherland & Dinh, 2017). The diverse private insurance programs have done little to protect Canadians across different age groups, educational levels, and income levels from catastrophic spending. This situation could have arisen because, in the existing patchwork system diverse eligibility criteria exist for enrollment and coverage (Anis, Guh & Wang, 2001; Campbell et al., 2017; Daw & Morgan, 2012; Demers et al., 2008; Kapur & Basu, 2005). Specifically, some of the programs depend heavily on premiums and cost-sharing mechanisms (Daw & Morgan, 2012).

While Quebec has a mandatory prescription drug insurance policy for all its residents, the results of this study have shown that, compared to other provinces and across all income groups, the residents of Quebec are doing poorly in terms of being protected against COOPDE. Interestingly, in Caldbick et al. (2015), Quebec had better indicators than other provinces for protection from COOPDE, but the dynamics of the insurance program have since changed. Residents of Quebec are now subject to increased premiums, deductibles, and coinsurance payments (34.9%), a combination well documented in the literature to create substantial barriers to health care access (Campbell et al., 2017). Similar to Quebec, the Prairie provinces have little protection from COOPDE. Alberta's program involves premiums, copayments (30%) but a maximum out-of-pocket payment limit, Saskatchewan's program requires a 35% copayment after the deductible has been reached but no

maximum out-of-pocket limit. In Manitoba, there is no premium payment but significant deductibles to be paid. The same situation is true for the Atlantic Provinces.

According to the UHC cube in Chapter Two, Quebec has a full length (the entire population is covered), good breadth (outpatient prescription drugs are covered), but a very shallow depth (significant cost-sharing). Hence, the presence of insurance does not necessarily result in the absence of catastrophic spending. Similar conclusions were reached in Brazil (Barros, Bastos & Damaso, 2011) and Thailand (Somkotra & Lagrada, 2009). The consequences of the UHC cube in Canada indicate that the working poor is more likely to face financial ruin than those with higher per capita income levels. This result is supported in the literature (e.g., Kwesiga, Zikusooka & Ataguba, 2015; Onwujekwe, Hanson & Uzochukwu, 2012; Su, Kouyate & Flessa, 2006). The burden is likely higher for the working poor because those with higher incomes have access to resources and favourable insurance packages to protect them against financial risks (Ngcamphala, 2016). The empirical evidence suggests that a federal financial protection scheme, particularly for the working poor, would benefit numerous individuals. The simulation of such a program forms the basis of the next chapter of this thesis. Meanwhile, one solid conclusion is apparent: the working poor and seniors in Canada need a prepayment insurance scheme that reduces/eliminates the cost-sharing payments they are exposed to, and a maximum out-of-pocket payment should be specified for these vulnerable groups.

4.7 References

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CHAPTER FIVE

THE IMPACT OF INSURANCE ON CATASTROPHIC OUT-OF-POCKET PRESCRIPTION DRUG EXPENDITURES IN CANADA

5.1 Introduction

This chapter reviews the expansion of Universal Health Coverage (UHC) in Canada using a historical analysis. The chapter also simulates the impact of targeted and universal insurance across income levels, provinces, and age groups. The chapter concludes with relevant policy directions.

5.2 Background:

A recurring discourse in this thesis is that the existing patchwork system for prescription drug payments is inefficient and inequitable. In several Canadian provinces, households are burdened by out-of-pocket payments, resulting in impoverishment, or deepening of existing poverty (see chapter three). In summary, the existing system creates a barrier in terms of equity of access (where all individuals can fill their prescription drugs based on need and not on their ability to pay).

A collective financial risk pooling mechanism and cross-subsidization like Medicare for primary care could protect Canadian households from catastrophic out-of-pocket prescription drug expenditures (COOPDE). The analysis in the previous two chapters has documented the key indicators (prevalence, intensity and determinants) needed to develop appropriate policy responses and an effective insurance program. This chapter simulates the impact of a collective financial risk pooling mechanism (targeted and universal insurance) on the distribution of COOPDE. With the increasing debate among politicians, physicians, academia and the general population around Pharmacare, this chapter presents relevant policy analysis.

According to the Government of Canada (2019), Pharmacare in Canada would involve a continuation of the existing patchwork system, with a more significant role for the federal government in ensuring both universality and equity. That is, under this proposal, the federal government would substantially fund the expansion of the existing system to ensure that a program similar to and guided by the principles of Medicare is created for prescription drugs. In this program, a national formulary of drugs would be covered, there would be no deductibles, out-of-pocket payments would not exceed \$5 per prescription, copayments would be \$2 for essential medicines, and there would be an annual maximum of \$100 per household (Government of Canada, 2019). In this chapter, I explore the effects of implementing a prepayment mechanism such as this version of Pharmacare. But first, I review relevant literature to explore why Pharmacare is not yet part of Medicare.

5.3 The Barriers to the Inclusion of Pharmacare in Medicare

As noted earlier, the enactment of the Canada Health Act (CHA) in 1984 eliminated the use of extra-billing and user fees for hospital services, physician services, and prescription drugs administered in a hospital setting. The literature documents that when the legislation was passed, the role of technology in the pharmaceutical industry was discounted and that the potential for a change in the demographics (ageing population) and income of the Canadian population was also not a top priority (Morgan & Boothe, 2016). Using a historical and contemporary perspective, this section explains the factors that led to the exclusion of outpatient prescription drugs in the CHA.

5.3.1 The Role of Vested Interest Groups

Morgan and Boothe (2016) documented that in the early 1980s, the introduction of Pharmacare was framed by the media and policymakers using a cost-benefit analysis framework. This framework was used to suggest that Pharmacare would substantially lower the benefits in the

existing universal hospital and physician care program and noting that the overall costs of expansion were neither feasible nor sustainable. These two claims influenced voters' view of a universal and publicly funded prescription drug program. That is, the introduction of Pharmacare was framed as a significant redistribution of income to the poor from the rich. However, more recently, the Canadian electorate has been influenced by the growing prescription drug needs of an ageing population, increased cost-sharing in the existing patchwork of prescription drugs, and examples of successful Pharmacare systems diffusion in similarly advanced countries (Morgan et al., 2015). Morgan argues that these factors have shifted Canadians' views, and, as a result, they have started to become more enthusiastic about the idea of a national Pharmacare program.

In shifting Canadians' views and facilitating policy change on prescription drugs in Canada, vested interest groups have played an important and well-documented role. For over 20 years, interest groups such as the Canadian Federation of Nurses Union (CFNU), Life and Health Insurance Association have continually advocated for a national pharmaceutical program. Notwithstanding this advocacy, little change has occurred (Gagnon, 2014). In 1997, an advisory panel chaired by Prime Minister Jean Chretien and called the National Forum on Health categorized pharmaceuticals as "medically necessary" and, hence, recommended the adoption of a universal public drug program (Morgan et al., 2015). Five years later, the commission on the Future of Health Care in Canada, chaired by Saskatchewan's premier Roy Romanow, recommended that the federal and provincial governments collaborate to include medically necessary prescription drugs within the Canadian health care system. In his report, Romanow (2002) wrote that universal catastrophic drug coverage was the first step in including prescription drugs under the Canada Health Act. He suggested that a national agency be established to negotiate prices, monitor drug safety, and determine coverage decisions for the universal drug plan

(Romanow, 2002). In 2004, at the council of the Federation meeting, the provincial premiers and the federal government committed to creating the National Pharmaceuticals Strategy (NPS) (Morgan et al., 2015). However, the commitments never materialized: there was no political will, provincial budgets were stretched because the federal government had reduced federal health care allocations, and private insurance and pharmaceutical companies campaigned against any variation of national Pharmacare program (Gagnon, 2014; Hurley & Guindon, 2008; Law, Kratzer & Dhalla, 2014; Morgan & Boothe, 2016).

Further, the role of pharmaceutical companies cannot be underestimated in explaining why Pharmacare is not yet part of Medicare (Fierlbeck, 2011). Fierlbeck identified these companies' increasing power and capacity as an essential factor behind Medicare's inflexibility and its resulting inability to include prescription drugs. She noted that these companies have both the political power to evade the government's regulatory authority and strong ties with the medical community, enabling them to build support for their prescription drugs among physicians, primarily through training and educational programs. Since these pharmaceutical companies profit from the existing patchwork program, they are understandably resistant to change (Morgan & Boothe, 2016).

5.3.2 Historical Perspective

In the early 1900s, the epidemic spread of diseases such as small-pox, diphtheria, typhoid fever necessitated doctors to be residents in the rural municipalities of Saskatchewan, where Medicare was later birthed (Schnur & Hollenberg, 1966). The continuous pooling of funds through a progressive tax system ensured that the level of care provided by the resident doctors (municipal doctor scheme) was sustainable. In addition to the pooled resources for doctors, residents also pooled resources towards the building of hospital facilities (municipal hospital scheme) (Houston

& Massie, 2013). Together, the schemes became the Municipal Medical and Hospital Services Act (also known as the Matt Anderson Act) (Taylor, 1987). Neighbouring provinces such as Manitoba and Alberta had also made considerable progress in health care during the first 20 years of the 20th century (Houston & Massie, 2013).

However, following the global economic recession of the 1930s and 1940s and the aftermath of the second war, access to basic medical care became the focus of the then fragile municipal health systems. Canadians experienced widespread unemployment, poverty, and a depressed economy. It was apparent that the federal government had to play an increased role, especially financially, to help the provinces sustain municipal health systems. Mackenzie King, the then prime minister, proposed to the cabinet that the federal government concentrate on unemployment insurance, health insurance, and social security for older people via a public pension (Taylor, 1987). The prime minister was particularly influenced by Winston Churchill's ideas on unemployment, social security, and health. In Saskatchewan, Premier Tommy Douglas had commissioned medical historian Dr. Henry Sigerist to assess the health care needs of the province. The Sigerist commission submitted a report on October 4, 1944, that recommended strengthening the financial risk pooling mechanism, building health infrastructures, and increasing the capacity of health care practitioners.

However, notably absent in federal and provincial policy directions was the potential for technological advancement, especially in terms of the need for prescription drugs. According to Daw and Morgan (2012), policymakers were waiting for an increase in both the use and price of prescription drugs before implementing a national Pharmacare program. Nevertheless, several individual provinces developed drug subsidy systems for their social assistance recipients and vulnerable population such as seniors. At the time, prescription drugs were relatively inexpensive

because more generic drugs were available than patented drug brands. However, the situation changed in the 1970s – pharmaceutical innovation led to new patented drugs, and, both the use and price of drugs increased. Many Canadians could no longer afford the prescription drugs they needed.

Following the Hall Commission's 1960 report to Prime Minister Pearson, the need for a universal health insurance program that extended beyond Medicare became apparent (Taylor, 1987). However, because of the government change at the time and the concerns about cost, the commission's recommendations to include prescription drugs under Medicare were not fully implemented. In summary, in the 20-30 years following the war, the political program was centred on improving the depressed economy, to the extent that only medically necessary doctor visits and hospitalization were prioritized. The Canada Health Act of 1984 also only includes drug coverage for drugs administered in hospitals.

5.3.3 The Institutional Perspective

Institutions can also be used to explain why Pharmacare has not been included in Medicare. Parsons (2007) defines institutions as the formal and informal rules, procedures, embedded norms, conventions, practices, or regulations in society. These institutions are indispensable in the formulation, design, adaptation, acceptance, and implementation of new policies. Additionally, according to North (1990), institutions are the rules of the game and the embedded norms that constrain human interactions in society. They may be created (e.g., the constitution) or may evolve (e.g., common law). Institutions have a self-reinforcing and locking in mechanism, which results in policy legacies, and when combined with the history, culture, time, and values of a particular people, form a trajectory for policies (policy inertia). This process is called path dependence (Pierson, 2000) because policies are affected by past legacies and feedback from pre-existing

policies (Wier & Skocpol, 1985). Specifically, path dependency implies that the predominant factor shaping policy at a given time (t) is the policy at previous time (t-1) (Rose, 1991). Moreover, according to Campbell (2004), path dependency implies that policies are adaptations at the margin of previous policies, which consequently constrain the bounds of the policy even if alternative policies are more efficient and effective.

According to Miaoni (1997), the power of the middle class, party discipline as well as the decentralization of Canadian federalism enabled provincial jurisdiction over health. These factors consequently led to the inflexibility of Medicare to include prescription drugs over the years (Morgan & Boothe, 2016). That is, with less veto points in policy making, little policy change has occurred in Canada especially since the ideas of politicians have remained largely unfavourably toward Pharmacare.

In her work on the political economy of 13 OECD countries, Mou (2013), wrote that in addition to path dependence, policy drifting explains the continued survival of Canada's patchwork system of prescription drugs. Policy drifting describes an institutional change that arises from inaction and no reform of existing policies (Beland, Roco & Waddan, 2016; Beland & Waddan, 2012; Hacker, 2004; Thelen, 2004). According to Mou (2013), prescription drug programs in Canada have primarily remained the same over the years, with just minor changes at the margins, taking the form of changes in eligibility and cost-sharing requirements and listing and delisting of prescription drugs and services from the formulary. Thus, although evidence suggests that public sector insurance for prescription drugs would have substantial beneficial effects, private insurance still dominates the industry (Mou, 2013).

In summary, the literature identifies three broad factors that can be used to explain the absence of Pharmacare in the basket of Medicare. First, in history, the then existing health system

was negatively affected by the global economic recession of the 1930s and 1940s coupled with the occurrence of the second world war. Hence, the priority of the then government was to ameliorate the consequences of the widespread unemployment and provide pension program for the population. Little priority was given to the need to include prescription drugs, which was at the time also inexpensive. Second, while vested interest groups unanimously bound by the desire to deliver a universal prescription drugs program have actively sought opportunities to push for the materialization of Pharmacare, the push for the materialization of Pharmacare has been stalled by a lack of political will, the presence of a strong private insurance system and pharmaceutical companies, which are motivated by the profits the existing system provides them. Lastly, the literature identifies that, the decentralization of the Canadian federalism, provincial jurisdictional power and party discipline have fuelled a path dependent policy trajectory that has excluded a universal prescription drugs program in Canada.

5.4 Methodology

The most definitive work on the role of insurance in catastrophic health payments was done by Saksena, Xu and Carrin (2006). The scholars defined total potential prevalence from out-of-pocket health payments and then measured the effect of insurance on the prevalence of catastrophic payments. Total potential prevalence is the combination of both observed prevalence (the observed prevalence among those who reported the need for health care and used health care), and potential prevalence (the prevalence among those who reported the need for health care but could not use it because of prohibitive costs).

This study simulates the effect of an insurance program (targeted and universal) on the prevalence of catastrophic out-of-pocket prescription drugs payments in Canada. The method of

the current study was similar in many ways to Saksena, Xu and Carrin's (2006) research. However, because the Survey of Household Spending (SHS) did not collect data on the self-reported need for prescription drugs and other health status variables, only observed prevalence is used here. Thus, this study analyzed the effect of insurance (targeted and universal) on the observed prevalence of COOPDE. Compared to a universal insurance program, which covers every income category, targeted insurance is an insurance program for the working poor and those in lower-income categories. As in Saksena, Xu and Carrin (2006), we assumed that the insurance programs cover a percentage of the out-of-pocket payments for prescription, without caps. We take the revenue-neutral principle in the simulations. That is, we assume the cost of the new drug insurance is paid by an additional tax on only higher-income groups. We use the required tax revenue to calculate the tax rate of an additional tax that is imposed on only the individuals in the upper two income categories (RPL-AVE and >AVE). The decrease in income for these higher-income individuals means a reduction in these households' capacity to pay.

5.5 Results

The pre-insurance and post-insurance results are presented in this section. Three scenarios are simulated, and the results are presented across income distribution, age, and provinces. The analysis at the three thresholds 3.4%, 6.73%, and 12% are given below. The scenarios simulated are as follows 1) an insurance program that covers 100% of out-of-pocket prescription drug payments for households in the working poor and absolutely poor categories only; 2) an insurance program that covers 50% of out-of-pocket prescription drug payments for the whole population; and 3) an insurance program that covers 100% of out-of-pocket prescription drug payments for the whole population.

Figure 5.1 below shows the distinct prevalence of catastrophic spending across income categories in scenario 2) – when 50% of out-of-pocket prescription drug payments for the whole population is covered by an additional insurance. After the introduction of a prepayment insurance program, there was a significant decrease in the observed prevalence of catastrophic out-of-pocket prescription drug spending. In Figure 5.1 for the working poor (ABL-RPL), the prevalence at the 3.4% threshold fell from 22.72% to 11.96% and from 3.23% to 0.33% at the 12% threshold. A significant reduction in prevalence is observed for the relative poverty line to average income category (RPL-AVE), with the difference at the 3.4% threshold being the highest, and the difference at the 12% threshold the lowest. These findings suggest that a drug insurance program would significantly lower the prevalence of financial catastrophe for lower-income households.

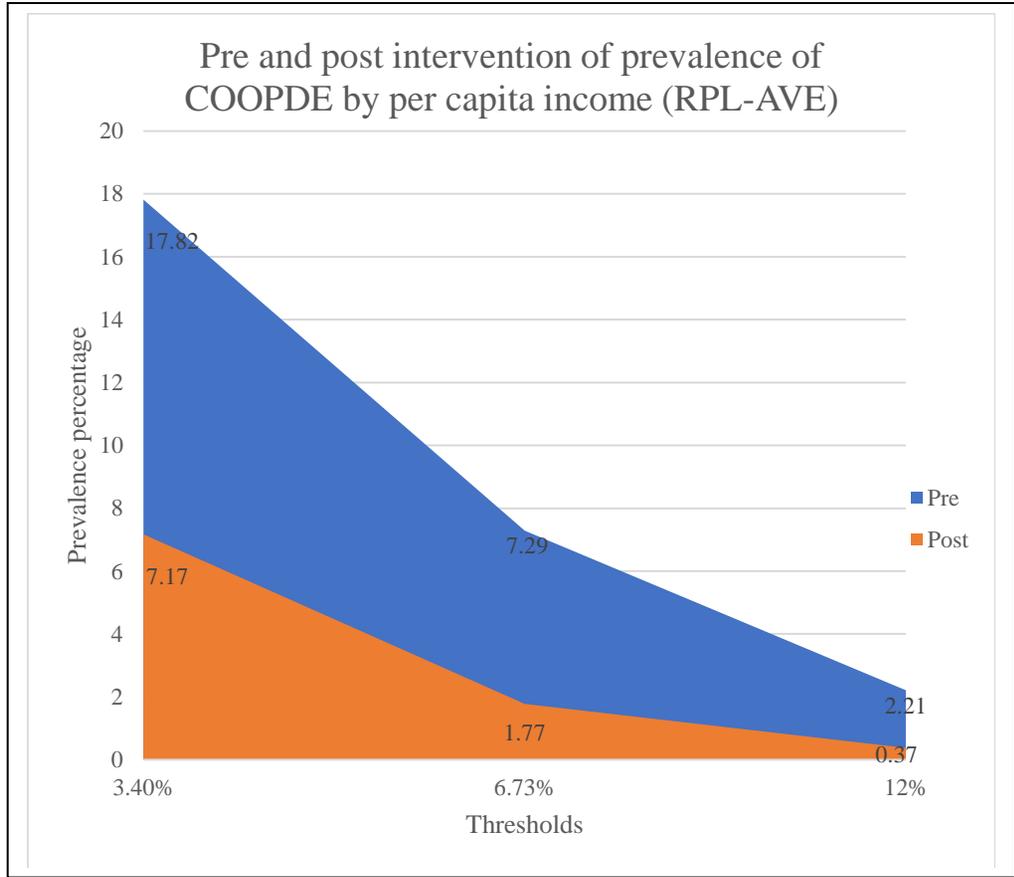
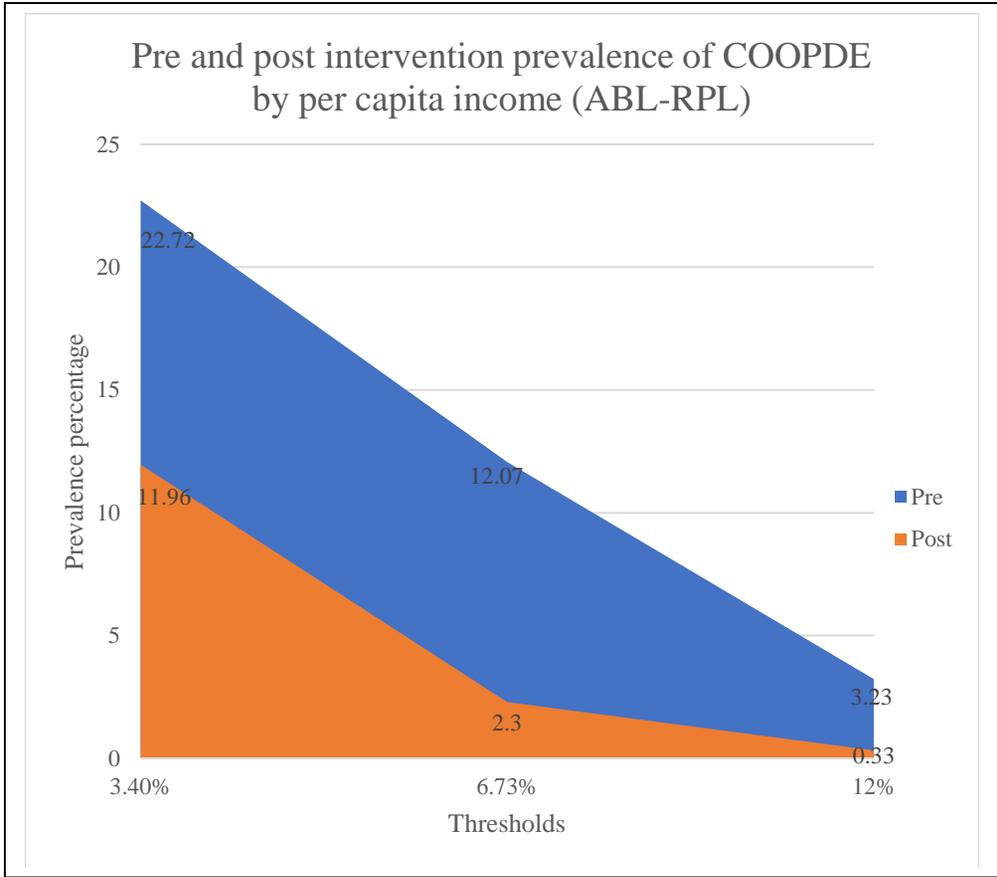


Figure 5.1: Impact of drug insurance (50% of out-of-pocket payments) on ABL-RPL and RPL-AVE income categories

The tax rate associated with the implementation of this proposed insurance program in scenario 2) is 0.34% on the households who are not in the working poor or absolutely poor categories. This tax contribution translates to a yearly tax contribution of around \$255 for households with a gross income of \$75,000 and an annual tax contribution of about \$102 for those with a gross income of approximately \$30,000. The overall observed prevalence of catastrophic spending in Canada fell by 58.5% at the 3.4% threshold, 75.5% at the 6.73% threshold and 81.4% at the 12% threshold.

For age categories in Figure 5.3, the drug insurance program significantly reduces the prevalence of financial catastrophe among seniors by as much as 17.8% at the 3.4% threshold. It implies that older individuals would benefit more from the insurance program than younger individuals. For provincial distribution, Figure 5.2 shows the pre-intervention (left) and post-intervention (right) prevalence across provinces. The figure shows that the insurance program would reduce the financial risk the residents face in every province, particularly for Quebec and Saskatchewan.

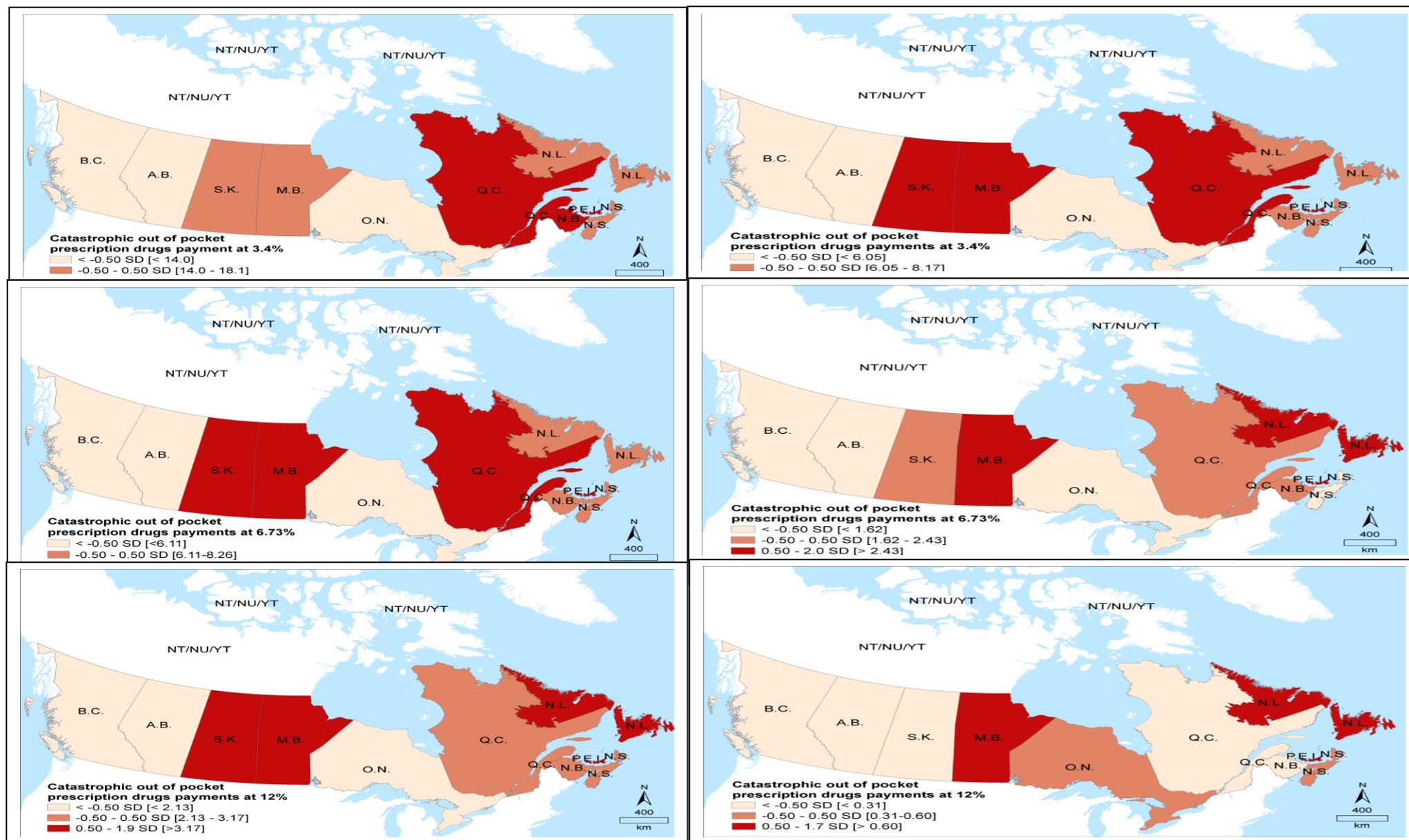


Figure 5.2: The pre-intervention (left) and post-intervention (right) impact of universal insurance (50% off out-of-pocket payments) across province

The above analysis has documented the impact of a prepayment health-financing scheme on the distribution of financial catastrophe across the whole Canadian population. Indeed, such a program has merit in substantially reducing the prevalence of catastrophic expenditure for the most vulnerable individuals in the country including seniors, the working poor, and Quebec residents. The insurance program is critical, mainly because its impact is highest for those at the highest risk of incurring financial catastrophe when they buy prescription drugs. Interestingly, the cost of this universal program would be reasonably affordable, as it represents a low financial burden for the income categories being taxed. Although even with new insurance, the prevalence figures are still highest among the most vulnerable, a reduction in the cost-sharing payments to which these vulnerable people are exposed ensures that out-of-pocket payments for these people are limited (Saksena, Xu & Carrin, 2006).

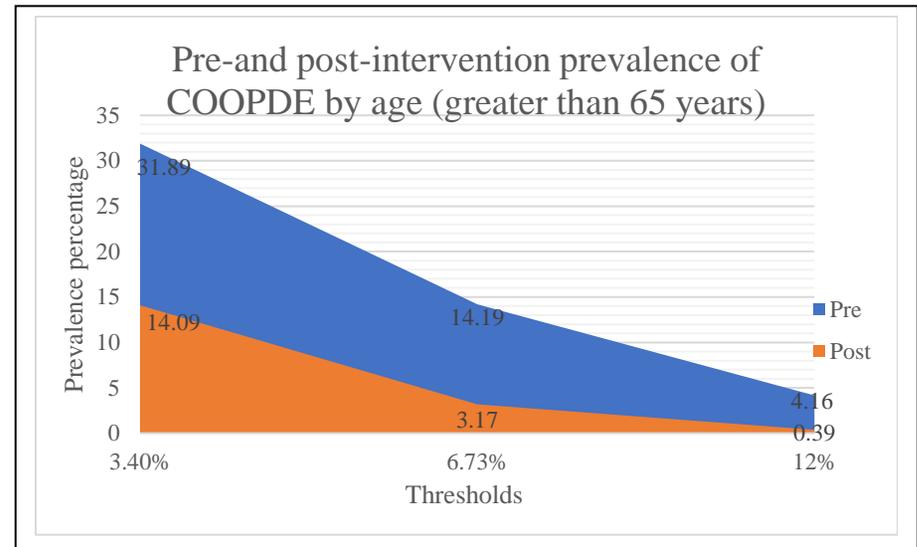
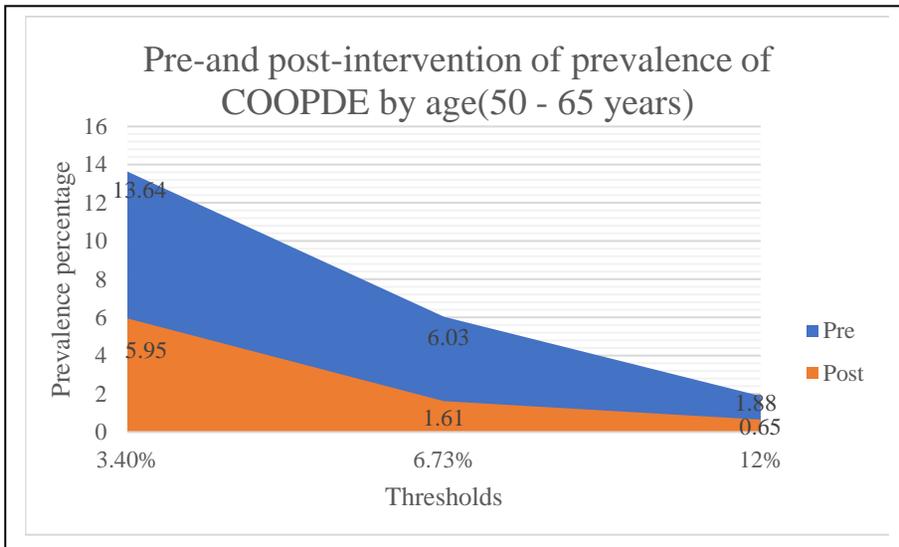
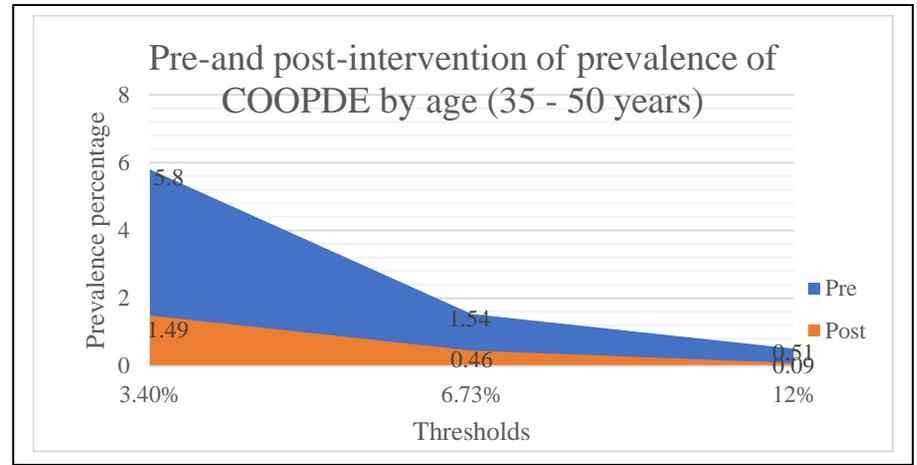
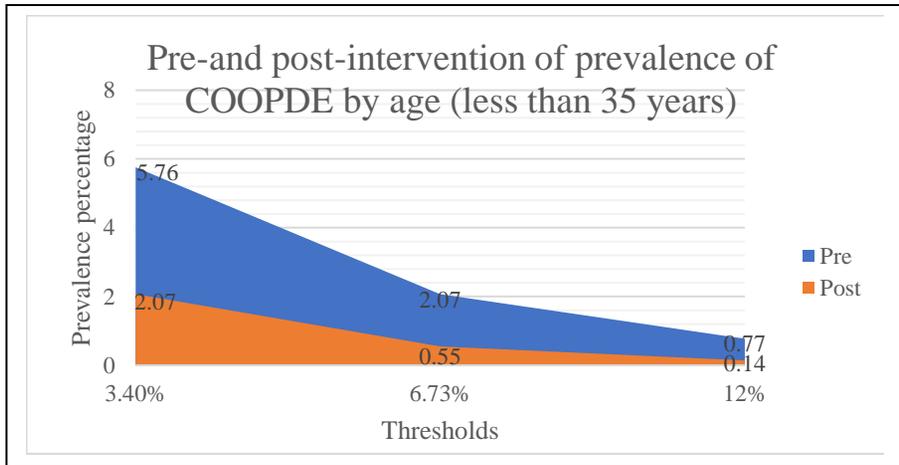
Against this backdrop, this study also simulated targeted insurance for only individuals whose earning fall below the relative poverty line, i.e. scenario 1). The results indicate that the affordability of such a targeted program is even higher than that of the insurance program earlier presented. With a tax rate of 0.03%, the tax burden of the program's financiers is very minimal, but the benefit is significant for its beneficiaries. Across provinces, the percentage reduction in the prevalence of financial catastrophe is highest in Quebec (59%), followed by PEI (46.52%). In the Prairies, Saskatchewan had a prevalence reduction of 30%, and Alberta 34%.

An insurance program that covers 100% of out-of-pocket payments without caps for all population, i.e. scenario 3), would result in a tax increase of 0.69% percent for individuals who are with higher income. For example, a household with a pre-tax income of \$75,000 would pay a little over \$500 per year towards the program. Overall, then, the argument that Pharmacare would

be cost-prohibitive does not hold up in light of this figures. The results of this chapter have shown that the first step toward Pharmacare is neither cost-intensive nor unsustainable.

To ensure the robustness of the results, I simulated two other scenarios of partial insurance programs for the population, which cover 25% and 75% of the out-of-pocket payments. The results are presented in the appendix of this chapter for thresholds 3.4% and 6.73%. The findings based on these scenarios are consistent with those presented above.

Figure 5.3: Impact of universal insurance (50% of out-of-pocket payments) across age categories in Canada



5.6 Conclusion

This study argues that a universal and comprehensive insurance for prescription drugs as opposed to a patch-work system may improve access and overall equity of the health care system. Other scholars have also concluded that a universal Pharmacare program for Canada is efficient and will improve equity in the long run (Adam & Smith, 2017; Canadian Health Coalition, 2007; Gagnon & Hébert, 2010; Morgan, Daw & Law, 2013; Morgan et al., 2015). A recent study by Hajizadeh & Edmonds (2020) also documented that out-of-pocket prescription drugs spending is a clear antithesis of the financial protection that universal health coverage seeks to achieve and it is imperative for Canada as a country to institute a universal Pharmacare program.

One of this thesis's key conclusion is that instituting universal coverage for drugs is not cost-prohibitive (Roberts, Hsiao & Reich, 2015). The literature also provides supporting evidence. On the supply side, economies of scale from bulk purchasing of drugs would reduce the cost to consumers. As well, the creation of a drug list like the WHO's essential medicines (formulary) is necessary for consideration. With the strong administrative capacity and distribution channels of provincial drug programs, government has a higher chance of success in prescription drugs purchase, pricing and distribution with minimal waste and unhealthy competition motivated by profit from private companies (Laurell, 2010; Ramesh, Wu & Howlett, 2015; Robinson & White, 2001; Sengupta, 2013). A public system could also absorb the shocks from marginal costs and expand the benefits to the vulnerable population (Sengupta, 2013). Therefore, the large out-of-pocket prescription drug payments in Canada do not indicate that private insurance companies should play a more significant role; instead, they draw attention to the consequences of relying on private insurance (Sachs, 2012; Sengupta, 2013). Hence, the solution to the policy challenge of catastrophic out-of-pocket prescription drugs spending is to develop a more comprehensive public system.

Although, based on the results of the empirical analysis of this thesis, indeed there is the need for a comprehensive and universal program that prevents the occurrence of financial catastrophe in the first place, there exists significant barrier to the implementation of such a program in Canada. The median voter is somewhat indifferent, and all those who experience significant burden are in the lower income distribution (Mou, 2013; Sanmartin et al., 2014). The needed support from individuals as well as policy makers might not be substantial now. In summary, although, the evidence-based conclusion will be an increased call for universal Pharmacare, perhaps a program targeted at those individuals presently falling through the cracks might be more feasible in the short-run.

According to the World Health Organization (2010, p. 9), “Countries must raise sufficient funds, reduce the reliance on direct payments to finance services, and improve efficiency and equity.” Against this background, this chapter presented a valuable route to the pre-paid pooling of resources. We used a progressive tax system that involved taxing those who can afford to pay. It has been established that consumption tax is counter intuitive as it burdens the already poor and has little influence on the already rich; hence, the progressive nature of this income tax scheme is directly linked to progress towards UHC (Reeves et al., 2015).

In conclusion, using the UHC cube, one important question arises what should be Canada’s next step in terms of coverage expansion of services, population groups, payments, and at what cost? As several authors have already argued, one crucial role of UHC in health policy is to protect against catastrophic out-of-pocket health payments for the vulnerable (Abihiro & De Allegri, 2015; Palmer et al., 2004). This thesis confirms that in the long run for the Canadian health care system, a universal Pharmacare program may provide financial protection and eliminate impoverishment as well as improve equity. In a short-term however, coverage expansion for essential prescription

drugs could be oriented towards lower-income households and financed by the higher-income population.

5.7 References

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5.8 Appendix

Table 5.1: Simulation analysis of partial insurance at 3.4% and 6.73%

	3.4%		6.73%	
	25% off	75% off	25% off	75% off
Age				
(years)				
< 35	4.92	3.56	1.94	1.08
35-50	5.15	4.17	1.05	0.94
50-65	13.02	10.82	5.29	4.47
≥65	29.30	21.85	11.96	9.29
Per capita				
PL income				
>Ave	7.61	7.61	2.95	2.95
RPL-AVE	17.82	17.82	7.29	7.29
ABL-RPL	20.06	2.19	6.60	0.25
BAPL	9.46	1.92	3.40	0.49
Provinces				
NL	15.35	11.61	6.75	4.81
PEI	17.27	12.34	8.22	5.78
NS	14.68	10.72	6.28	4.53
NB	17.25	13.77	6.22	4.45
PQ	21.79	15.54	7.90	5.91
ONT	8.35	7.05	3.56	3.10
MB	16.58	14.55	8.34	6.66
SK	16.38	13.19	7.33	5.98
AB	9.55	8.41	3.69	2.70
BC	12.01	9.51	3.96	3.27

CHAPTER SIX

CONCLUSION

6.1 Introduction

This chapter summarizes the results of this study. Policy implications as well as contributions to knowledge are also presented. Finally, this chapter concludes with the study's limitations and areas of further research.

6.2 Summary

This research used the 2016 Statistics Canada Survey of Household Spending to investigate the distribution of and factors associated with catastrophic out-of-pocket prescription drug expenditures (COOPDE) in Canada. Finally, a simulation analysis of the effect of insurance on the distribution of catastrophic out-of-pocket prescription drug payments is also presented. For this study, we used the capacity to pay approach to calculate the catastrophic effects. A logistic and partial proportional odds model are employed in the study of the factors associated with catastrophic out-of-pocket prescription drug spending. The results of this study have substantially increased the understanding of financial risk protection in prescription drug payments in Canada.

The study revealed two important findings. First, Canadian residents who are seniors, as well as individuals who are working poor, are disproportionately burdened with catastrophic payments when they fill their prescription drugs. Second, in the existing public-private mix of insurance system for prescription drugs, financial protection across provinces vary in terms of the breadth

(types of drugs covered), length (individuals covered) and depth (cost-sharing mechanism) of the UHC cube.

In designing appropriate policy responses to any policy challenge, the first step for policymakers is the understanding of the dynamics of the policy challenge. In the case of financial catastrophe and impoverishment in Canada, this implies having information on the prevalence and intensity across various subpopulation groups. Importantly, the factors that put Canadians at high risk of experiencing financial catastrophe and impoverishment when they fill their prescription drugs. In other words, understanding the characteristics of a Canadian resident who suffers financial catastrophe is necessary to design targeted social policies to combat such impacts. The results of this are captured in chapter four of this thesis.

While achieving universal health coverage that eliminates user fees and promote cross-subsidization of financial risk is no easy task, chapter four of this thesis shows that the existence of OOPDE as a health financing scheme has a negative effect on the most vulnerable (individuals who are older, have lower educational levels, and working poor) of the Canadian population. In Canada, it is also clear from the results that equity of access that stems from the WHO's definition of universal health coverage involving people's ability to access their needed prescription drugs based on need and not ability to pay is not feasible without an alternative funding scheme (WHO, 2010).

It is expected that when households purchase insurance plans, it is to protect against COOPDE. However, as seen in the findings of the Partial Proportional Odds Model, the predicted probability of incurring COOPDE is highest in Quebec across all income categories (especially among the working poor) despite the presence of mandatory insurance. Hence, the presence of health insurance does not necessarily imply equity in access. In this regard, an alternative funding

scheme, preferably tax based that allows for cross-subsidization aimed at reducing/eliminating out-of-pocket prescription drug payments is by the empirical evidence presented above, the next step towards Pharmacare in Canada. Doing this means that there will be equity in access and financial protection for the most disadvantaged in Canada.

6.3 Policy Implications

The finding from this study has shown that the financial risk that Canadians face when they fill their prescription drugs is a significant threat to their welfare in general. This limited financial protection in Canada is a valid health policy concern. One key message from the thesis is that the reliance on out-of-pocket payment financing in Canada for prescription drugs is regressive and should be reduced and ultimately eliminated. Like all progressive health care systems, Canada should strive to achieve universal health coverage to attain financial risk protection against catastrophic and impoverishing out-of-pocket prescription drug payments.

The results of chapter five of this thesis have presented policy options. Of importance is targeted insurance for the working poor as a first step. The simulation shows a 40.63% reduction in the prevalence of COOPDE (at the 6.73% threshold) in the province of Quebec. Across the Atlantic provinces, this targeted insurance will reduce the prevalence of COOPDE by an average of 41.26%, and the value is 30.72% reduction for the Prairie provinces. Insurance that covers 100% of out-of-pocket payments for all the population will result in a tax rate of 0.69% percent for individuals who are of relatively higher income. E.g. a household with a gross income of \$75,000 will pay a little over \$500 per year towards the program.

In both scenarios, there is the need for an expansion of the patchwork insurance system towards a more comprehensive universal insurance package. For the historical first time, this study

was able to provide impoverishment estimates from out-of-pocket prescription drug expenditures. Following from the absolute poverty line estimates in Canada, about 73,000 individuals in Canada are brought into poverty when they fill their prescription drugs. The significant implication of this is that individuals whose income is close to absolute poverty line should be protected against regressive cost-sharing payments via a targeted or universal insurance program. Further, the findings of this study showed that seniors are most likely to incur catastrophic out-of-pocket prescription drugs. Therefore, there is also the need to institute a targeted program that reduces the financial risk seniors face from prescription drug payments.

On the supply side, due to health insurance information asymmetry, patients are incentivized to use unnecessary high-technology health care alternatives as well as more costly prescription drugs, which ultimately increases out-of-pocket payments and financial risks. The government should create a much-needed national formulary of essential medicines and negotiate with pharmaceutical companies to find a way of reducing costs for those essential drugs for Canadian residents. This solution has merit in reducing overall health care expenditure as well as financial risks (Lindelow & Wagstaff, 2005; Sengupta 2013).

6.4 Study Limitations

There are some limitations to this study. The first limitation is the cross-sectional survey data used in this research. As with cross-sectional data, there is a possibility of recall bias where respondents might not be able to accurately recall pertinent retrospective expenses. Self-reported data bias may have led respondents to exaggerate or understate their private information due, for example, to their mood. There might also be a selection bias. Although the survey is designed to be a representation of the whole population, some locations might have been underrepresented in the sample, while other locations might have been overrepresented.

Further, the Survey of Household Spending did not collect some important information such as health status information, insurance data, travel costs and health care need data. This information could have been useful in analyzing the impact of out-of-pocket payments on, for example, cost-related adherence. Also, valuable patterns regarding the relationship between health care need, insurance status and catastrophic out-of-pocket payments could have been assessed. Furthermore, because we used the household level data of the Survey of Household Spending, we projected household head characteristics to the other members of the family for analysis purposes. This projection might not necessarily hold in all cases, although it is an acceptable practice in the literature. Finally, the simulation analysis assumed no extra administration cost of running the new insurance programs. There might be administrative costs that limit the affordability of such programs.

6.5 Future Research Directions

A study of the impact of out-of-pocket prescription drug spending on financial catastrophe and impoverishment in Canada is noteworthy. However, while this study's methodology is very viable in highlighting the extent of vertical inequality from prescription drugs payment in Canada, it is very important to note that some households might not have filled their prescription drugs at all because of prohibitive costs. Therefore, we only analyzed the observed prevalence in this thesis. Future research should model the impact on individuals who would have otherwise filled their prescription drugs, but due to costs, they could not. This future research direction is referred to as potential prevalence. In this regard, there is a need for data on health care needs and health status in general. The real prevalence (potential and observed prevalence) will show the actual distribution and intensity of the policy problem. Further, future research can model the impact of a Pharmacare program that is like Medicare and not the existing patchwork system as done here.

Further studies can construct a special panel data set that combines the Survey of Household Spending, the Canadian Community Health Survey (provides rich information on cost-related non-adherence and coping strategies that households use to deal with filling their prescription drugs) and the Canadian Rx Atlas (provides rich data on the use of and expenditure on prescription drugs across provinces, drug plans and therapeutic categories). This robust data set can be used to assess the change process and trends in catastrophic spending on prescription drugs over time for households and provinces. The important link between catastrophic out-of-pocket prescription spending, household coping mechanisms and cost-related non-adherence can then be established. Hence, persistent and/or occasional catastrophic patterns discovered from the link can be used to inform the effective policy design to solve the policy issue.

Finally, future research can use a methodological triangulation that involves a qualitative approach to answering the research questions analysed quantitatively in this thesis. It will be important to assess how the results of the qualitative analysis converges or diverges from those in this thesis. The triangulation approach also has merit in presenting an in-depth, enriched and increase understanding/perspective to the policy issue of catastrophic out-of-pocket prescription drugs spending in Canada.

6.6 References

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