



An Econometric Study of the Determinants of Canada's Non-reimbursable Medical Care Costs

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Abstract:

Introduction: Several studies have assessed the linkages between household factors and non-reimbursable medical costs over the years. However, there still exists a substantial gap in information on non-reimbursable medical costs in Canada that requires addressing. For instance, more information is needed about the extent and variation of the non-reimbursable medical costs across Canada. Even less is known about the prevalence of these costs among different population segments. We use the survey of household spending data to predict non-reimbursable medical costs across Canada's 10 provinces.

Methods: In order to estimate the predictors of non-reimbursable medical costs in Canada, descriptive assessments and weighted cross-sectional regression analyses were conducted. Regression estimates on the Canadian survey of household spending data were performed to estimate the econometric predictors of non-reimbursable medical costs.

Results: Findings showed significant variation in non-reimbursable medical costs across the country's 10 provincial regions. More importantly, they show that the share of earnings spent on non-reimbursable medical services is negatively associated with household earnings itself (estimated, coefficient of $\ln(\text{Earnings}) = -0.73, -0.73, -0.85, \forall p < 5\%$ for 2004, 2009, 2015, respectively), while at the same time increasing with agedness (estimated, coefficient of Canadians aged > 65 years = 0.58 & $0.82, \forall p < 5\%$ versus Canadians aged < 19 years, for 2004, 2009, respectively), feminine gender (estimated, coefficient of feminine gender = $0.28, 0.22, \forall p < 5\%$ versus masculine gender for 2004, 2009, respectively), married status, living in large-sized families, and ill-health.

Conclusion: In Canada, non-reimbursable medical costs differ substantially by province and across socioeconomic, demographic, and health dimensions.

Keywords: Non-reimbursable medical costs, Canadian provinces, Socioeconomic status, Health status, Demographic factors, Gender, Age.

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1. INTRODUCTION

For any nation, non-reimbursable medical costs are problematic in a number of ways [1-21]. For instance, a problem relating to non-reimbursable medical costs, as per the World Health Organization, was medical care accessibility challenges for persons who need medical care [1]. Interestingly, sometimes, medical care accessibility can be limited for persons of low socioeconomic status when medical care service providers decide to engage in adverse selection while taking advantage of the medical care information asymmetry existing in some markets [1]. The unaffordability of the medical services and products from high non-reimbursable medical costs can place a heavy burden on government assisted medical services provision. According to WHO [1], a typical problem with non-reimbursable medical spending was the determination of equitable distribution of government-provided medical assistance to eligible recipients, and that higher non-reimbursable medical costs often lead to households having to forego spending on other vital resources of wellbeing such as housing, food, and keeping the house warm in winters. Studies have also associated non-reimbursable medical costs with poverty among patients and households [2, 19, 22-30]. For instance, a study [2] found that extreme non-reimbursable medical costs can often drive individuals into poverty, especially when these medical costs become catastrophic, with few persons in the household earning an income and/or subscribed to health insurance. According to another source [3], non-reimbursable medical costs sometimes lead to non-adherence to treatments (such as missing a medication and/or “not filling a prescription” and “missing doses”) among Canadians. Skipping medication doses due to financial constraints often leads to unintended consequences. Studies have also associated non-reimbursable medical costs with barriers in accessing medical services [31-41]. Similarly, a study [4] found that non-reimbursable medical costs yielded medical access challenges and inequities among citizens of Australia when they studied 5 countries. It also found that extended medical insurance coverages in some of the countries studied shielded patients from challenges stemming from non-reimbursable expenses associated with medical care [4, p309-p322].

Additionally, a study [5] also found that in the US, for example, non-reimbursable medical costs cause a problem of medical access barriers and reduce medical services efficiency. Despite the abovementioned problems associated with non-reimbursable medical costs, limited information still exists on the determinants of these medical costs across Canada's 10 provincial regions. Below, we discuss and review information on previous articles relating to the determinants of non-reimbursable medical costs.

1.1. Determinants of Non-reimbursable Medical Spending

1.1.1. Socioeconomic Predictors

Past studies have shown that several factors, such as job status, literacy level, and earnings, influence non-reimbursable medical costs. For instance, past studies associated income and non-reimbursable medical costs [42-58]. Findings by some researchers [42, 54, 55, 57, 58]

showed that per-capita earnings were negatively associated with non-reimbursable medical costs. For instance, a study [42] found disproportionately higher non-reimbursable medical costs among households of poor socioeconomic status (*e.g.*, a household with low average income). Specifically, their findings revealed high catastrophic non-reimbursable medical costs among poor households, households headed by females, and households with an older person in Canada. Similarly, a study [46] also found that per capita earnings and non-reimbursable medical costs were negatively associated. Additionally, a group of researchers [47] found that low-earning Canadian households would suffer significantly if the provincial governments adopted the 2003 medical care insurance plan, where medications would be availed at a 25% cost-sharing rate on a \$12,000 medicinal package. Additionally, the same researchers [47] found that medical care models practised in certain Canadian provinces were better than that of other provinces – attributing their findings to taxation and medical care financing [47, p13]. The above research [47] could mean that employed Canadians with extended employer-provided medical care coverages often spend less in median non-reimbursable medical costs compared to Canadians without employer-sponsored care coverages. The article [47] had limitations in its adherence to a single component of non-reimbursable medical costs (prescription medication costs). It did not also factor in the regulatory heterogeneity in Canada's 10 provinces. In the United States, for instance, a study [44] associated low-income bracket families with increased non-reimbursable medical costs. Additionally, researchers also found that low-earning oncology individuals in an Eastern Canadian province incurred higher than average non-reimbursable medical care costs while seeking treatment in Ontario when compared with their higher-earning counterparts [52]. Contrary to the findings discussed above, a study [56] showed that non-reimbursable medical costs increased with incomes in the United States of America. The research [56] stressed that low-income families were constrained by their earnings and thus, on average, spent less than their higher-income earning counterparts despite insurance protection. Despite the numerous attempts by past researchers to study the earning-non-reimbursable medical cost linkage above, the studies may have been limited to a number of factors (*e.g.*, focusing on just one type of non-reimbursable medical cost, like dental care, prescription care, and medical care, insurance-based costs [45, 48, 49], recall bias, a small sample size [51], and persons affected by medical conditions [52]). Similarly, the studies may have also been limited in that the Canadian provincial variations in non-reimbursable medical costs stemming from earnings were not assessed.

A few studies have linked years of schooling (or education) to non-reimbursable medical costs [48, 59, 60]. For instance, research [48] mentioned that education level affects an individual's capability and intent to purchase medical care insurance. Specifically, their finding showed that Canadian individuals with at least a secondary school credential were more likely to afford medical care insurance as compared to their counterparts without (57.5 percent *versus* 53.5 percent, respectively). Similarly, another study [59] found that possessing more than a secondary school

education substantially hiked the odds of both men and women affording medical care from their financial resources (OR=1.7, p -value<1%; OR=1.9, p -value<1%; respectively) compared to just possessing a secondary school education. Additionally, a researcher [60] found a positive correlation between education and non-reimbursable medical costs. The above studies [48, 59, 60] were limited, however by a focus on individual cases of non-reimbursable medical costs as opposed to overall total non-reimbursable medical costs. Additionally, details of education levels were also excluded in the above studies - further contributing to their limitations.

Additionally, previous studies [46, 48, 49, 60, 61] have shown some connection between non-reimbursable medical costs and job status. For instance, a study [60] has demonstrated that non-reimbursable medical costs declined as Albertans gained full-time employment in Canada. Similarly, a study by a team of researchers [48] showed that employer-sponsored extended health insurance coverage lowers the non-reimbursable medical cost met by an eligible Canadian. Past research [61] indicated that employment state and payments for medical care in non-reimbursable medical care costs were associated, whereby persons without jobs were generally more likely to incur higher non-reimbursable medical care costs compared to those with jobs when medical conditions are accounted for. Besides job type, the control over employment was also reported to affect non-reimbursable medical costs. For example, a study concluded that having little say over one's job stability was associated with cardiovascular conditions, hence leading to increased non-reimbursable medical spending [46]. The above studies, too, were limited to their concentration on a single portion of non-reimbursable medical costs, a location, or a pre-existing condition.

1.1.2. Demographic Factors

Demographic attributes such as years since birth, gender, and marriage, as well as the size of the family and Canadian provincial region, may influence non-reimbursable medical costs. Past studies [46-49, 53, 59, 60, 62-67] showed that age influenced non-reimbursable medical costs. Old age was particularly associated with increased non-reimbursable medical costs [46-49, 53, 59, 60, 63, 64]. One study [60] associated being older than 65 years with reduced odds of paying for medical care from own resources (mean odds ratio, MOR=0.43, p -value<5%) - which is contrary to the majority of the findings by previous authors. The above association became insignificant when the above authors' conclusions were adjusted for sex (men-MOR=0.38, p -value>5%; women-MOR=0.63, p -value>5%). One could argue that the above studies were also limited by the specific circumstances around which the studies were conducted. Similarly, a study by a team of researchers [62] revealed lower non-reimbursable medical costs among older food-allergic Canadians when compared with food-allergic children. Their finding revealed higher indirect costs associated with medical care. In terms of sex as a demographic factor, a study by [63-68] found that non-reimbursable medical expenses were somewhat more pronounced for women compared to men. Specifically, the research by [63] found that women incurred 40 percent more non-reim-

bursable costs when compared to men (median women non-reimbursable medical costs \$89,741 *versus* only \$64,091 incurred by men over their lifetime in Manitoba, Canada). The limitation of the above research rested on its non-empirical nature, focussing on only Manitoba as a province in Canada and unlikely to have undergone an empirical model diagnostic test. In terms of marital status, an article [48], for instance, revealed that Canadians who are in a marriage carried higher odds of incurring non-reimbursable medical costs compared to Canadians who were not in a marriage arrangement (68.00 percent *versus* 56.90 percent). The above study [48] also only considered medical care insurance-related premiums, leaving out other non-reimbursable medical cost components. Contrary to the above researchers' [48] finding, a group of researchers [60] reported that being without a partner, in contrast to having a companion, yielded an insubstantial effect on non-reimbursable medical costs (MOR=0.85, p -value>5%). Including only a few subjects in the research while focussing on only insurable medical costs as a medical care expense contributed to the limitation of the above study.

In reviewed past research, there was an absence of studies covering relationships between family sizes and non-reimbursable medical costs. For example, one study excluded children and seniors when researching family sizes and non-reimbursable medical costs [47]. Similarly, the above pattern, including total exclusion of family sizes was observed in a number of studies looking at non-reimbursable medical costs [60, 69, 70]. In terms of provincial variations, very few articles examined regional and provincial heterogeneity in non-reimbursable medical costs in the country. Relationships between Canadian provincial regions and non-reimbursable medical costs [47-49, 71, 72] have been understudied. If research was undertaken, the focus was limited to consideration of a single non-reimbursable medical cost type, non-reimbursable medical care costs including medicinal drugs [48, 49], a high-level summary study with limited sample size, failure of research to demonstrate provincial regional variation in non-reimbursable medical costs [47], and a substantial level of involvement of other factors such as pre-existing medical conditions, provincial policies (*e.g.*, a model that led to under-involvement in regional provincial medical care coverages), and age [64] were simultaneously observed in the studies.

1.1.3. Medical Determinants

Past research revealed that increased non-reimbursable medical costs were mostly incurred by persons with pre-existing medical conditions in Canada and elsewhere [54, 59, 62, 73-77]. For instance, a group of researchers [62] found that Canadians of all ages experiencing severe food allergy reactions incurred higher non-reimbursable medical costs compared to those with mild or no food allergy. They specifically found that food-allergic children with fair or poor general health status incurred disproportionately higher non-reimbursable medical costs compared with their adult food-allergic and child counterparts in good general health. Similarly, past researchers [59] found that osteoarthritis (OA), a health condition, raised non-reimbursable medical costs for US persons suffering from the condition in the amount of \$1,379 for each sufferer. Similarly, other

research showed substantially increased per-patient non-reimbursable medical care costs and disease severity in the country [78, 79]. A similar finding was also observed in two other articles [74, 75]. Also, in Eastern Canada, a team of researchers [77] observed a similar finding among sufferers of cancer in Ontario. However, a number of studies, such as those mentioned above, have looked at relations between medical status and non-reimbursable medical expenses; such research excluded the effects of functional and mental medical status on non-reimbursable medical expenses, thereby prompting further research.

This research, therefore, provides several contributions. First, it considers all Canadian provinces in assessing the determinants of non-reimbursable medical expenses in the country. Specifically, this study uses the 10 Canadian provinces as separate categories of independent variables whose effects on the ratio of medical non-reimbursable expenditures to earnings are tested. Secondly, the study also includes households as an independent factor in predicting non-reimbursable medical costs in Canada. Similarly, the study also considers an element of time variation in non-reimbursable medical costs by employing three separate regressions (*e.g.*, 2004, 2009, and 2015 cross-sectional regressions) in its assessment. Unlike in the previously conducted studies, this paper also fills the gap in the existing research by including every non-reimbursable medical expense type (*e.g.*, optometric or eye care-related costs, dental care costs, insurable medical costs, as well as prescription drug costs) in the study. This research also considers the inclusion of all Canadian populations as represented by weighted/bootstrapped cross-sectional regressions (unlike as seen in previous research articles). This research uses a very large sample size ($n=112,940$ Canadians), thereby reducing the problems associated with the use of relatively smaller sample sizes used in previous research articles.

2. DATA AND METHODS

2.1. Data

The data required for this study was accessed through the University of Northern British Columbia's Canadian Research Data Centre Network (CRDCN) branch with permission from Statistics Canada beginning in the Fall of 2018. Survey of household spending (SHS) data spanning the periods 2004 to 2015 were used for the purpose of this research. SHS datasets between 1998 to 2003 were excluded from this study because estimates of their bootstrap weights were missing. Between 2004 and 2015, a total of 112,940 Canadian households were studied as part of this research from their responses collected via the SHS. The sample of the households reporting in the 2004-2015 SHS dataset who reported negative earnings were truncated and removed from our study analyses. The three Canadian territories of Nunavut, Yukon Territories, and Northwest Territories were excluded from this research as their total SHS share of observations did not meet the CRDCN data release vetting requirement ($n < 5$; sample observations in a given cell were less than 5).

2.2. Methods

Univariate assessments such as bootstrapped averages were performed for the purpose of this research. Similarly, bootstrapped regression analyses were also conducted to assess the determinants of non-reimbursable medical costs by provincial regions in Canada. The total non-reimbursable medical care costs were determined by summing up all the various components of non-reimbursable medical costs, such as medical, dental-related care, and eye-related care costs, amongst others.

2.2.1. Descriptive Analysis

Univariate assessments, such as the bootstrapped average value of non-reimbursable medical costs and ratios, were analysed. Findings from the descriptive assessments informed the choice of variables to be evaluated further in the cross-sectional regression analysis, which will be discussed below.

2.2.2. Regression-related Analysis

Bootstrapped regression models were conducted for the SHS datasets for the 3 years, 2004, 2009, and 2015, to determine the factors affecting the non-reimbursable medical care costs in Canada. First, a cross-sectional assessment of regressions was run for the male and female genders separately. Secondly, regressions incorporating years since birth were conducted to estimate the effects of age on non-reimbursable medical costs, while both male and female genders were combined. Categorical data were recoded and assigned dummy values in the process of conducting regressions. These variables included but were not limited to perceived medical status, gender, Canadian provincial region, and schooling. Assessment of pairwise-correlations for the independent factors and non-reimbursable medical costs preliminarily helped determine which factors to include in the bootstrapped regressions, specifically those independent factors exhibiting significant relationships with non-reimbursable medical costs. Log-adjusted regressions between the independent factors and non-reimbursable medical costs were conducted for the years 2004, 2009, and 2015. Model 1 below provides the assessment for non-reimbursable medical cost determinants, which was run 3 times for 2004, 2009, and 2015 SHS cycle datasets, while years since birth were considered a continuous variable, and gender was considered separately (Eq. 1).

$$\begin{aligned} \ln(N) = & \alpha_0 + \alpha_1 \ln(y_1) + \alpha_2 \ln(y_2) \\ & + \alpha_3 \ln(y_3) + \alpha_4 y_4 + \alpha_5 y_5 + \alpha_6 y_6 \\ & + \alpha_7 y_7 + \alpha_8 y_8 + \alpha_9 y_9 + E \end{aligned} \quad (1)$$

Model 2 below provides an assessment of determinants of non-reimbursable medical costs when the number of years since birth was categorized into 3 categories: < 19 years, 20-34 years, 35-64 years, and > 65 years, for 2004, 2009, 2014 SHS data cycles, taking into account combined sexes (Eq. 2).

$$\begin{aligned} \ln(N) = & \alpha_0 + \alpha_1 \ln(y_1) + \alpha_2 \ln(y_2) \\ & + \alpha_3 y_3 + \alpha_4 y_4 + \alpha_5 y_5 + \alpha_6 y_6 \\ & + \alpha_7 y_7 + \alpha_8 y_8 + \alpha_9 y_9 + \alpha_{10} y_{10} + E \end{aligned} \quad (2)$$

Where N is the non-reimbursable medical costs to earnings ratio, y_1 and y_2 , are earnings and the size of the family, which were both continuous variables. y_3 through y_{10} are recoded variables for dummy variable grouped attributes such as years since birth, years of schooling, job status, marriage status, Canadian provincial region, self-perceived functional medical state, and self-perceived mental and general medical state. E is the randomized term of error. Years since birth or "age" (y_3) was grouped (for the second model, Model 2), comprising < 19 years of age, 20-34 years of age, 35-64 years of age, and > 65 years.

Diagnostic model tests were run, and all the bootstrapped regression models showed no evidence of heteroscedastic error terms (heteroscedastic test, p -value > 5%). The cross-sectional nature of this research did not warrant the regression model diagnostic test of autocorrelation (supplementary material).

3. RESULTS AND DISCUSSION

3.1. Descriptive Findings

Results from descriptive data analyses revealed a growing trend (2004 to 2015) in Canada's median per-person non-reimbursable medical costs (Fig. 1). An aggressive rise in the non-reimbursable medical costs was observed during the recession (between 2009 to 2010), and a mild decline in

2011, 2012, and 2014. Non-reimbursable medical costs began to rise again after 2014 (Fig. 1).

Fig. (2) below compares the average non-reimbursable medical costs in 2004, 2009, and 2015 across the ten (10) provinces in Canada. It shows that non-reimbursable medical costs were highest in the province of Alberta (*e.g.*, mean non-reimbursable medical costs, year: \$2,279.82, the year 2015), Quebec (*e.g.*, mean non-reimbursable medical costs, year: \$2,285.08, the year 2015), and New Brunswick (*e.g.*, mean non-reimbursable medical costs, year: \$1,855.87, the year 2015). Conversely, non-reimbursable medical costs were lowest for Ontario, British Columbia, and Manitoba (see Fig. 2 below) between 2004 and 2015. Over the years, changes in non-reimbursable medical costs revealed positive growth in per capita non-reimbursable medical costs across all provinces except for an isolated case of an 8.9 percent drop in non-reimbursable medical costs in New Brunswick through the years.

Non-reimbursable medical costs vary among different age groups. Between 2004 and 2015, Canadians in the 35 to 64 age bracket paid the biggest costs in non-reimbursable medical care expenses (Fig. 3), compared with Canadians in other age brackets. The mean non-reimbursable medical cost rose from \$1,616 in 2004 to \$1,869.60 in 2009 and \$2,188.25 in 2015. Conversely, Canadians in the Below 19 years age bracket incurred the lowest average per capita non-reimbursable medical cost during 2005-2015 (mean non-reimbursable medical costs were \$608, \$603.94, and \$847.33 for 2004, 2009, and 2015, respectively). Canadians older than 65 years of age incurred higher average per capita non-reimbursable medical costs compared to Canadians younger than 35 years of age.

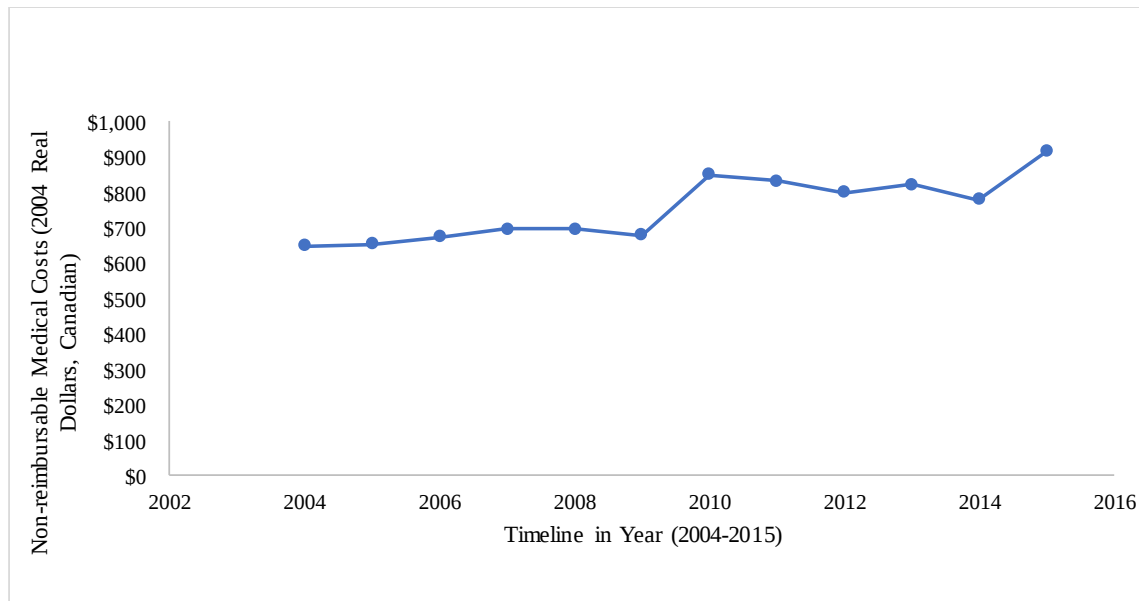


Fig. (1). Bootstrapped Canadian average non-reimbursable medical cost per-capita (real 2004 dollars, Canadian).

Notes: Fig. (1) is adapted from the 2020 work of Ogwal [79].

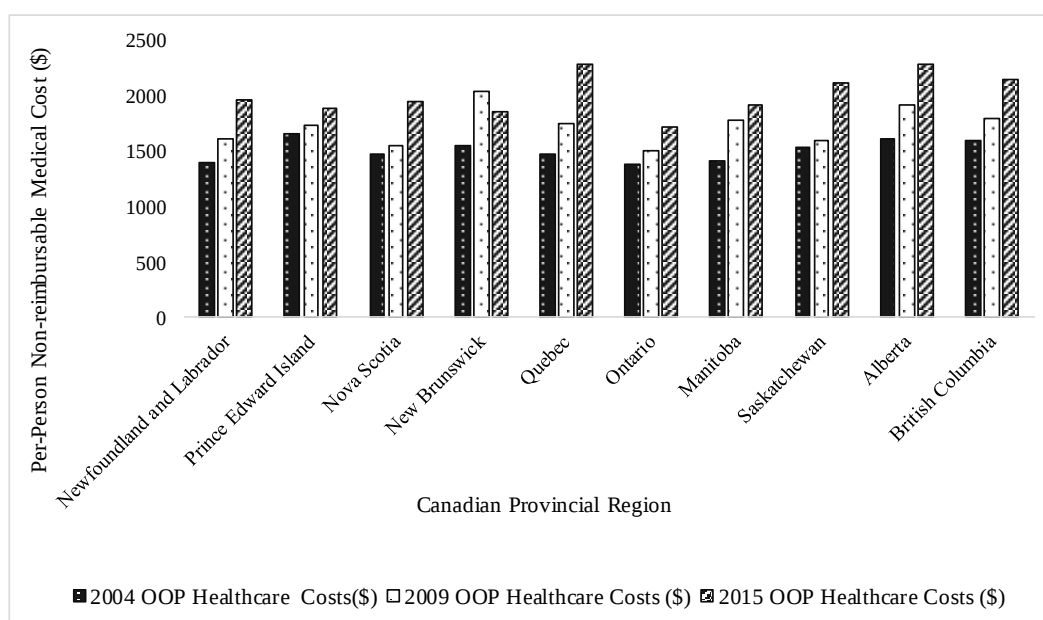


Fig. (2). 2009 through 2015 Canadian non-reimbursable medical costs per Canadian provincial region.

Notes: Fig. (2) is adapted from the 2020 work of Ogwal [79].

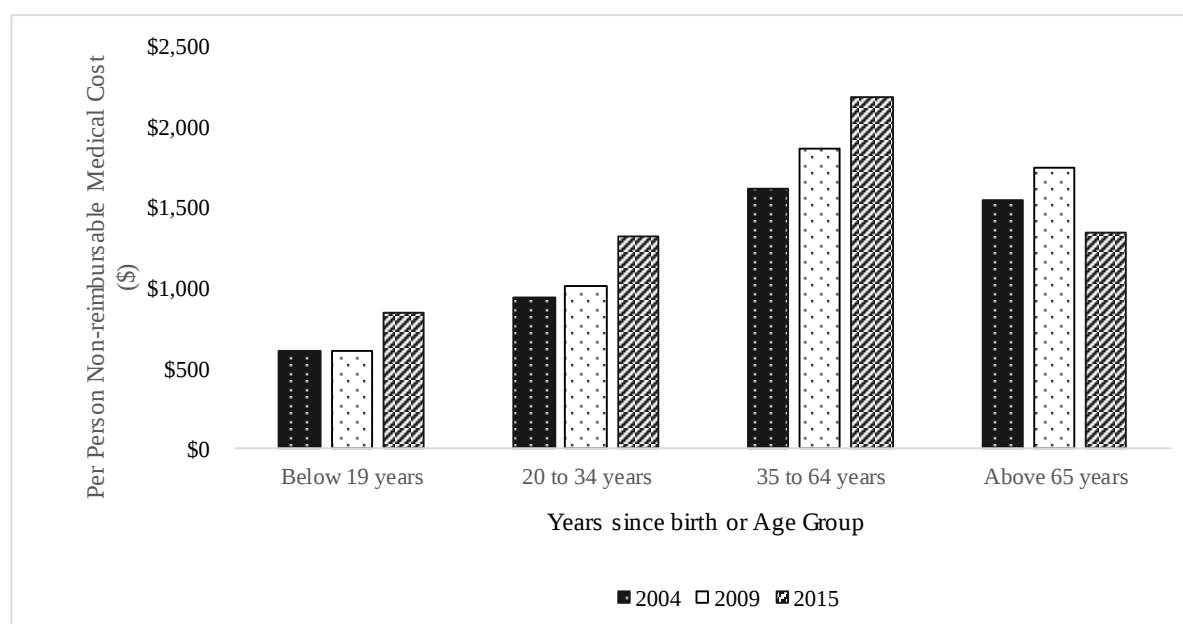


Fig. (3). Non-reimbursable medical costs per age group in Canada between 2004 and 2015.

Notes: Fig. (3) is adapted from the 2020 work of Ogwal [79].

3.2. Regression Results

As will later be seen in Tables 1 and 2, the cross-sectional regression models of the log-adjusted share of non-reimbursable medical costs to earnings on socioeconomic, demographic, and health factors yielded interesting findings (Tables 1 and 2 below). In summary, socioeconomics, demographics, and health factors have played substantial roles in predicting the variations of median per-person non-reim-

bursable medical costs in the country (2004-2015). Results from Tables 1 and 2 below were similar. The discussion section focused on the findings in Table 2 (as it captured age group effects on the non-reimbursable medical costs). Tables 1 and 2 results findings are similar, except for the fact that there were observed individual differences in the covariates on non-reimbursable medical expenses stemming from the difference in the male and female genders.

Table 1. Gender-categorized regression estimates of non-reimbursable medical costs in Canada for years 2004, 2009 and 2015.

Predicated Item	In(NRMC/Earnings)	2004 SHS		2009 SHS		2015 SHS	
-	-	Men	Women	Men	Women	Men	Women
-	Independent Covariates/Predictors	(R ² =0.292)	(R ² =0.40)	(R ² =0.295)	(R ² =0.383)	(R ² =0.426)	(R ² =0.39)
	-	(α , μ)	(α , μ)	(α , μ)	(α , μ)	(α , μ)	(α , μ)
Socioeconomic variables	In(Earnings)	-0.63(0.04)**	-0.83(0.034)**	-0.70(0.05)**	-0.77(0.04)**	-0.86(0.05)**	-0.84(0.06)**
	Schooling/Education Years						
	Zero education ^b						
	Secondary-level education	1.13(0.53)**	0.28(0.58)	0.08(0.09)	-0.46(0.52)	-0.13(0.52)	-0.13(0.33)
	Vocational-level certificate (Trade)	1.24(0.52)**	0.25(0.60)	0.24(0.4)	0.40(0.40)	-0.22(0.51)	-0.41(0.25)
	Apprenticeship-license certificate	0.93(0.56)*	0.38(0.61)	0.27(0.09)**	0.59(0.09)**	-0.24(0.53)	-0.21(0.28)
	CEGEP, nursing school diploma, or Community college	1.28(0.52)**	0.55(0.58)	0.31(0.13)**	0.66(0.14)**	-0.25(0.52)	-0.30(0.26)
	Below a university bachelor's certificate or diploma	1.40(0.53)**	0.51(0.59)	0.28(0.10)**	0.62(0.11)**	0.05(0.52)	-0.07(0.29)
	Bachelor's degree (B.A., B.Sc., B.Ed.) education	1.35(0.52)**	0.60(0.58)	0.34(0.11)**	0.64(0.12)**	0.15(0.64)	-0.55(0.59)
	Above a bachelor's university degree, certificate, or diploma	1.48(0.53)**	0.63(0.29)	-0.16(0.41)	0.84(0.29)**	-0.49(0.51)	-0.60(0.24)**
	Job Status						
	Full-time employment ^b						
	Part-time employment	-0.11(0.07)	0.044(0.06)	0.06(0.08)	0.050(0.07)	-	-
	No employment	0.04(0.09)	-0.07(0.08)	-0.044(0.11)	0.02(0.09)	-	-

Note: In – Natural logarithm; (α , μ) indicates α -regression coefficient, μ -error term respectively; NRMC indicates non-reimbursable medical costs; **– 5% significance level; *–10% significance level; ^b –category of reference factor; Job state data absent for the 2015 survey of household spending dataset.

Contents of table adapted from Ogwal's 2020 MA thesis "Out of pocket expenditures on healthcare across Canadian provinces" [79].

Predicated Item	In(NRMC/Earnings)	2004 SHS		2009 SHS		2015 SHS	
Men	Women	Men	Women	Men	Women	Men	Women
-	Independent Covariates/Predictors	(R ² =0.292)	(R ² =0.40)	(R ² =0.295)	(R ² =0.383)	(R ² =0.426)	(R ² =0.39)
	-	(α , μ)	(α , μ)	(α , μ)	(α , μ)	(α , μ)	(α , μ)
Demographic factors	In(Age)	0.80(0.11)**	1.01(0.10)**	0.99(0.12)**	1.10(0.11)**	0.76(0.15)**	0.75(0.21)**
	Marital status						
	Married-status person ^b						
	A person in common-law status	0.08(0.08)	0.04(0.08)	0.05(0.08)	0.09(0.10)	0.06(0.12)	-0.062(0.11)
	Single-state person (Never married)	-0.57(0.10)**	-0.39(0.09)**	-0.37(0.12)**	-0.54(0.010)**	-0.38(0.16)*	-0.34(0.14)**
	Others (separated, divorced, or widowed)	-0.56(0.09)**	-0.47(0.07)**	-0.41(0.10)**	-0.61(0.07)**	-	-
	Remainder of marital statuses for 2015					Male	Female
	A person who is widowed	-	-	-	-	-0.4(0.20)*	-0.3(0.14)**
	A person who is separated	-	-	-	-	-0.44(0.28)	-0.28(0.19)
	A person who is divorced	-	-	-	-	-0.64(0.26)**	-0.4(0.16)**
	In(Household size)	0.40(0.06)**	0.39(0.06)**	0.50(0.08)**	0.40(0.07)**	0.26(0.13)*	0.35(0.13)**
	Province of residence						
	NL(Newfoundland and Labrador) ^b						
	PE(Prince Edward Island)	0.279(0.10)**	0.20(0.09)**	0.15(0.10)	0.15(0.09)	0.23(0.24)	0.002(0.13)
	NS(Nova Scotia)	0.11(0.08)	0.07(0.07)	0.15(0.09)*	-0.005(0.08)	0.15(0.10)	0.05(0.11)
	NB(New Brunswick)	0.12(0.08)	0.18(0.07)**	0.25(0.08)**	0.30(0.08)**	0.01(0.09)	0.17(0.10)*
Demographic factors	QC(Quebec)	0.09(0.08)	0.15(0.07)**	0.21(0.08)**	0.15(0.09)*	0.28(0.09)**	0.32(0.09)
	ON(Ontario)	-0.35(0.09)**	-0.20(0.08)**	-0.28(0.09)**	-0.30(0.08)**	-0.30(0.11)**	-0.29(0.13)**
	MB(Manitoba)	-0.005(0.08)	0.0005(0.08)	0.14(0.10)	0.30(0.09)**	0.14(0.10)	0.10(0.10)
	SK(Saskatchewan)	0.11(0.08)	0.17(0.07)**	0.06(0.08)	0.18(0.08)**	0.09(0.11)	0.24(0.11)
	AB(Alberta)	-0.042(0.09)	0.13(0.07)*	0.06(0.10)	0.15(0.09)	0.05(0.11)	0.16(0.13)
	BC(British Columbia)	0.02(0.08)	0.12(0.07)	0.006(0.09)	0.017(0.09)	-0.04(0.11)	0.11(0.11)

Note: In – Natural logarithm; (α , μ) indicates α -regression coefficient, μ -error term respectively; NRMC indicates non-reimbursable medical costs; **– 5% significance level; *–10% significance level; ^b –category of reference factor; Job state data absent for the 2015 survey of household spending dataset.

Contents of the table adapted from the 2020 work of Ogwal's MA thesis [79]. Provincial coding such as NL, PE, NS, ... were adapted from: https://www12.statcan.gc.ca/census-recensement/2021/ref/dict/tab/index-eng.cfm?ID=t1_8.

(Table 1) contd....

Predicated Item	In[NRMC/Earnings]	2004 SHS		2009 SHS		2015 SHS	
-	-	Men	Women	Men	Women	Men	Women
-	-	(α , μ)	(α , μ)	(α , μ)	(α , μ)	(α , μ)	(α , μ)
-	Independent Covariates/Predictors	($R^2=0.292$)	($R^2=0.40$)	($R^2=0.295$)	($R^2=0.383$)	($R^2=0.426$)	($R^2=0.39$)
Physio-functional Health Factors	Perceived functional health						
	Yes-sometimes (Functional disability) ^b						
	Yes-often (Functional disability)	0.19(0.12)*	-0.002(0.11)	-0.21(0.14)	-0.06(0.10)	-	-
	No-(Functional disability)	-0.016(0.10)	-0.25(0.10)**	-0.11(0.11)	-0.16(0.09)**	-	-
	Perceived Physio-mental health						
	Yes-sometimes ^b						
	Yes-often (Activity limitation, mental or physical limitation)	0.17(0.12)	0.15(0.11)	0.10(0.14)	0.08(0.13)	-	-
	No-(Activity limitation, mental or physical limitation)	-0.10(0.10)	0.12(0.10)	-0.25(0.11)**	-0.15(0.09)*	-	-
	Constant ^o	-1.54(0.74)**	0.73(0.75)	-0.28(0.69)	0.11(0.55)	3.15(0.92)*	2.96(1.18)**

Note: In - Natural logarithm; (α , μ) indicates α -regression coefficient, μ -error term respectively; NRMC indicates non-reimbursable medical costs; ** - 5% significance level; * - 10% significance level; ^b - category of reference factor; Job state data absent for the 2015 survey of household spending dataset.

Contents of the table adapted from the 2020 work of Ogwal's MA thesis [79].

3.2.1. Non-reimbursable Medical Costs and Socioeconomic Attributes

The relationship between earnings and the share of non-reimbursable medical costs to household earnings was decremental in nature (Tables 1 & 2). Although the general direction of the relationship remained negative, variations in earnings effect on the share of non-reimbursable medical costs to per capita earnings fluctuated between males and females during the select study periods (Table 1). Results showed that for a 10 percent rise in per-person earnings, the share of non-reimbursable medical costs to earnings fell by 7.2 percent (p -value<5%) in the year 2004, 7.4 percent (p -value<5%) in the year 2009, and 8.4 percent (p -value<5%) in the year 2015 (Table 2). Effects of schooling fluctuated between 2004 and 2009, despite an overall positive effect being registered. This finding was particularly evident in the year 2004, with the rising effect of schooling continuously increasing as per-capita share of earnings to non-reimbursable medical costs increased. Additionally, the share of non-reimbursable medical costs to earnings, for instance, rose by more than 134 percent (p -value<5%), for secondary education diploma holders, 169 percent (p -value<5%), for undergraduate degree holders, and 194 percent (p -value<5%) for Canadians with more than an undergraduate degree, successively. Similarly, years of schooling yielded a resembling trend as seen above in 2009 as relates to its effects on the share of non-reimbursable medical costs to earnings, despite this effect being less substantial. The effects of schooling on the share of non-reimbursable medical costs to earnings were negligible in 2015. The effect of job status on non-reimbursable medical costs in Canada between 2004 and 2015 was not statistically significant (Table 2).

3.2.2. Demographic Factors

Old age had a substantial effect on the share of non-reimbursable medical costs to earnings in Canada. Canadians older than 65 years saw a median rise of 78.6 percent (p -value<5%) and 127 percent (p -value<5%) in their non-reimbursable medical spending from 2004 to 2009, respectively. In 2015, the effect of old age on the share of non-

reimbursable medical costs to earnings was financially inconsequential. The resulting ratio of non-reimbursable medical costs to earnings was disproportionately higher among older women within the same age range as men between 2004 and 2009, except for the year 2015, when model estimations were gender-adjusted. Between 2004 and 2009, gender played a significant role in per capita non-reimbursable medical spending in Canada (Table 2). For the years 2004 and 2009, being a woman rose the per capita non-reimbursable medical costs share to earnings by 32.2 percent (p -value<5%) and 24.6 percent (p -value<5%) when compared to being a man, in Canada, respectively (Table 2). The above finding was, however, negligible for the year 2015 (p -value>5%). Canadians who were single, separated from their partners, divorced from their partners, or widowed by their partners reported smaller shares of non-reimbursable medical care costs to their earnings in the year 2004, compared with Canadians who were married. In single-person Canadian households, a 95.4 percent (p -value<5%) decrease in the share of non-reimbursable medical care costs to earnings was reported. This number was 73.3 percent (p -value<5%) amongst Canadians who were separated, divorced, or widowed, in contrast to Canadians in marriage-state households. Similarly, 82.2 percent (p -value<5%) and 75.1 percent (p -value<5%) decrements were reported for the year 2009, respectively, amongst Canadians in similar marital states. Comparing to Canadians who are married, divorced, widowed, and separated from a partner was associated with reductions in the share of non-reimbursable medical costs to earnings for the year 2015, in the following amounts, respectively: 39.1 percent (p -value<5%), 46.2 percent (p -value<5%) and 58.4 percent (p -value<5%), in the year 2015. Findings showed that Canadians with larger family sizes incurred higher shares of non-reimbursable medical costs compared to those with smaller-sized households (Table 2). Ceteris paribus, a 10 percent rise in family size raised the share of non-reimbursable medical costs to earnings by 39.1 percent (p -value<5%), 44.8percent (p -value<5%), and 25.9 percent (p -value<5%) in years 2004, 2009, and 2015, accordingly. Comparing the results of other provinces to the Canadian province of Newfoundland and Labrador, the shares of non-

reimbursable medical costs to earnings varied by province. For instance, the share of non-reimbursable medical costs to earnings was more by 25.9 percent (p -value<5%), 18.5 percent (p -value<5%), 17.4 percent (p -value<5%), and 16.2 percent (p -value<5%) in the Canadian provinces of PE, NB, QC, and SK, successively, comparing to NL. Contrastingly, Canadians residing in ON saw decreased shares of non-reimbursable medical costs to earnings in the amount of 31 percent (p -value<5%) compared to Canadians residing in NL. Similarly, the same findings were seen for the year 2009. Compared to NL, Canadians residing in the provinces of QC, MB, and SK, saw higher shares of non-reimbursable medical costs to their earnings during the year 2015. Contrastingly and repeatedly, the Canadian province of ON consecutively saw lower shares of non-reimbursable medical costs when compared to NL (Table 2).

3.2.3. Health Factors

Compared to Canadians with moderate forms of physio-functional and physio-mental health conditions, Canadians reporting the absence of any medical conditions reported incurring reduced shares of non-reimbursable medical costs by up to 18.5 percent (p -value<5%) in the year 2009 (Table 2). During the year 2004, health influence on non-reimbursable medical spending amongst Canadians was not statistically significant (Table 2). Compared to Canadians with severe occurrence of medical conditions, residents without any health condition reported a 24.6 percent (p -value<5%) reduction in the share of non-reimbursable medical costs to their earnings in the year 2009.

4. DISCUSSION

Canada has a rising trend in per capita non-reimbursable

medical costs [80]. The growing trend of non-reimbursable medical costs was unevenly distributed between men and women in Canada, with women reporting higher shares of these costs. The Canadian province of ON reported the smallest per-person non-reimbursable medical expenses between 2004 and 2015 when compared to all other provincial regions in Canada. Contrastingly, the provinces of AB and QC reported the highest per-person non-reimbursable medical costs in Canada from 2004 to 2015. Our findings consequently signal that the economic and financial collapse of the years 2007 through 2009 might have added fuel to the fire increase in the median household non-reimbursable medical expenses in the Canadian provinces, respecting the years 2007 through 2015. Per capita earnings had a negative effect on the non-reimbursable medical care expenses in the country between the years 2004 and 2015. Particularly, low-earning Canadians, on average, paid more in non-reimbursable medical expenses, compared to high-earning Canadians. Generally, Canadians saw higher average medical spending from their own financial resources as they pursued more schooling. Canadians aged 65 years and older generally reported incurring higher non-reimbursable medical care costs compared to their counterparts below the age of 65 years. Bigger family sizes propelled Canadian's median per-household non-reimbursable medical costs upwards, disproportionately, compared to the case reported in smaller-sized Canadian families. Canadians who reported being widowed, separated, divorced, or single and never married reported incurring lower non-reimbursable medical costs across all of Canada's 10 provinces. Conclusively, Canadians with medical conditions reported paying higher per-person non-reimbursable medical costs compared to Canadians reporting good perceived health statuses. Our

Table 2. Age-categorized regression estimates of non-reimbursable medical costs in Canada for years 2004, 2009 and 2015.

Predicated Item	In(NRMC/Earnings)	2004 SHS	2009 SHS	2015 SHS
-	-	Men and Women	Men and Women	Men and Women
-	-	(α , μ)	(α , μ)	(α , μ)
	Independent Covariates/Predictors	(R²=0.3668)	(R²=0.3360)	(R²=0.4043)
Socioeconomic factors	In(Earnings)	-0.73(0.03)**	-0.73(0.03)**	-0.85(0.04)**
	Schooling/Education Years			
	Zero education ^b			
	Secondary-level education	0.72(0.33)**	0.28(0.07)**	-0.46(0.36)
	Vocational-level certificate (Trade)	0.78(0.33)**	0.33(0.21)**	-0.36(0.37)
	Apprenticeship-license certificate	0.58(0.38)	0.39(0.07)*	-0.23(0.37)
	CEGEP, nursing school diploma, or Community college	0.94(0.33)**	0.46(0.10)**	-0.31(0.36)
	Below is the university bachelor's certificate or diploma	0.97(0.33)**	0.41(0.08)**	-0.03(0.37)
	Bachelor's degree (B.A., B.Sc., B.Ed.) education	0.99(0.33)**	0.46(0.08)**	-0.05(0.55)
	Above a bachelor's university degree, certificate, or diploma	1.08(0.34)**	0.22(0.31)	-0.54(0.35)
	Job Status			
	Full-time employment ^b			
	Part-time employment	-0.04(0.04)	0.05(0.05)	-
	No employment	0.03(0.07)	0.02(0.08)	-

Note: In - Natural logarithm; (α , μ) indicates α -regression coefficient, μ -error term respectively; NRMC indicates non-reimbursable medical costs; ** - 5% significance level; * - 10% significance level; ^b - category of reference factor; Job state data absent for the 2015 survey of household spending dataset. Contents of the table adapted from the 2020 work of Ogwal's MA thesis [79].

(Table 2) contd.....

Predicated Item	In(NRMC /Earnings)	2004 SHS	2009 SHS	2015 SHS
-	-	Men and Women	Men and Women	Men and Women
-	-	(α , μ)	(α , μ)	(α , μ)
-	Independent Covariates/Predictors	($R^2=0.3668$)	($R^2=0.3360$)	($R^2=0.4043$)
Demographic-associated variables	Age group			
	<19 years ^b	-	-	-
	20 - 34 years	-0.14(0.31)	0.003(0.32)	-0.33(0.54)
	35 - 64 years	0.22(0.31)	0.44(0.32)	0.12(0.53)
	> 65years	0.58(0.32)*	0.82(0.33)**	0.32(0.54)
	Gender	-	-	-
	Men ^b	-	-	-
	Women	0.28(0.04)**	0.22(0.04)**	0.04(0.06)
	Marital status			
	Married-status person		-	-
	A person in common-law status	-0.06(0.06)	-0.02(0.06)	-0.04(0.08)
	Single-state person (Never married)	-0.67(0.06)**	-0.6(0.08)**	-0.5(0.15)**
	Others (separated, divorced, or widowed)	-0.55(0.05)**	-0.56(0.06)**	-
	The remainder of marital statuses for the year 2015			
	A person who is widowed	-	-	-0.33(0.12)**
	A person who is separated	-	-	-0.38(0.15)**
	A person who is divorced	-	-	-0.46(0.11)**
	In[Household size]	0.33(0.04)**	0.37(0.05)**	0.23(0.09)**
	Province of residence			
	NL(Newfoundland and Labrador) ^b			
	PE(Prince Edward Island)	0.23(0.07)**	0.17(0.07)**	0.08(0.12)
	NS(Nova Scotia)	0.09(0.06)	0.08(0.06)	0.11(0.07)
	NB(New Brunswick)	0.17(0.06)**	0.28(0.06)**	0.10(0.07)
	QC(Quebec)	0.16(0.06)**	0.21(0.07)**	0.32(0.06)**
	ON(Ontario)	-0.27(0.06)**	-0.28(0.06)**	-0.27(0.08)**
	MB(Manitoba)	0.02(0.06)	0.22(0.06)**	0.12(0.1)*
	SK(Saskatchewan)	0.15(0.06)**	0.11(0.1)*	0.18(0.08)**
	AB(Alberta)	0.05(0.06)	0.10(0.07)	0.099(0.08)
	BC(British Columbia)	0.08(0.06)	0.01(0.07)	0.05(0.08)

Note: In - Natural logarithm; (α , μ) indicates α -regression coefficient, μ -error term respectively; NRMC indicates non-reimbursable medical costs; ** - 5% significance level; * - 10% significance level; ^b - category of reference factor; Job state data absent for the 2015 survey of household spending dataset.

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Predicated Item	In(NRMC /Earnings)	2004 SHS	2009 SHS	2015 SHS
-	-	Men and Women	Men and Women	Men and Women
-	-	(α , μ)	(α , μ)	(α , μ)
-	Independent Covariates/Predictors	($R^2=0.3668$)	($R^2=0.3360$)	($R^2=0.4043$)
Physio-functional Health Factors	Perceived functional health			
	Yes-sometimes (Functional disability) ^b			
	Yes-often (Functional disability)	0.09(0.08)	-0.12(0.09)	-
	No-(Functional disability)	-0.15(0.07)	-0.17(0.07)**	-
	Perceived physio-mental health			
	Yes-sometimes ^b			
	Yes-often (Activity limitation, mental or physical limitation)	0.17(0.09)**	0.002(0.10)	-
	No-(Activity limitation, mental or physical limitation)	-0.005(0.07)	-0.22(0.07)**	-
	Constant^a	2.85(0.50)**	3.47(0.45)**	5.93(0.71)**

Note: In - Natural logarithm; (α , μ) indicates α -regression coefficient, μ -error term respectively; NRMC indicates non-reimbursable medical costs; ** - 5% significance level; * - 10% significance level; ^b - category of reference factor; Job state data absent for the 2015 survey of household spending dataset.

Contents of the table adapted from the 2020 work of Ogwal's MA thesis [79].

research contributes valuable scientific knowledge and data to regulators at all levels of government, academia, medical institutions, and not-for-profit organizations. This research provides useful information that Canadian regulators can use to derive and implement policies that reduce the burden of per capita household non-reimbursable medical spending in the country. The regulators could adopt such policies that aim at offering medical subsidies to vulnerable Canadians, such as Canadians in financially struggling large families, the elderly, women, and children. Similarly, our findings also signal that healthcare policy makers in provinces where Canadians are facing disproportionately higher non-reimbursable medical costs (*e.g.*, Quebec and Alberta) could review their medical expenditure policies in such a way that their provincial medical care cost policies become more aligned with their low-cost counterparts (such as Ontario and British Columbia). Such policy implications and measures could include pro-rated medical care subsidies and government-regulated medical care cost controls (*e.g.*, price ceiling policy in certain healthcare markets) for certain rare but needed medical products or care procedures where there may be a tendency of the healthcare market to become monopolized. Additionally, healthcare policy makers could also adopt favourable universal pharmacare insurance policies to protect the elderly, the vulnerable, as well as women and children, in Canadian Provinces where non-reimbursable medical care costs are rising disproportionately. Another policy implication of this research is that the Canadian medical care regulators could employ non-reimbursable medical cost reduction strategies using a systematic approach that covers the following four main aspects of the medical care system: medical services financing, medical care guardianship, development of more medical care products and services, as well as availing and encouraging more equitable medical care access policies [81-85]. The inclusion of a more comprehensive set of data, including data on medical technological advancement, structural distribution, and regulatory distribution of the Canadian medical services providers, as well as extra-Canadian regulatory influences on the Canadian healthcare markets, is recommended for a more robust and comprehensive study of determinants of non-reimbursable medical costs in Canada. Similarly, being able to include political as well as fiscal variables, such as those identified in the study, might have made the findings of this research more comprehensive.

CONCLUSION

Using three sets of cross-sectional data for the years 2004, 2009, and 2015, we examined the associations of a number of socio-economic, demographic, and health-related factors with the share of earnings spent on non-reimbursable medical costs for patients across Canadian Provinces. Our findings indicate that non-reimbursable costs are negatively associated with earnings or income, implying a regressive cost burden on lower-income people. On the other hand, non-reimbursable costs are found to be increasing with age (particularly those > 65), family size, level of education (for 2004 and 2009 estimates), and ill-health measured both as perceived functional and mental health. The results also indicated that married couples and

women had greater non-reimbursable expenses. We found no statistically significant association between non-reimbursable costs and employment status. Such results, as important as they are, should be taken cautiously as they are based on cross-sections of different individuals at different times. We believe panel data of cohort populations, when available, would provide a richer information base for drawing more conclusive results.

AUTHORS' CONTRIBUTION

J.S.: Contributed to the concept design, literature review, reviewing, and editing of the paper; W.C.: D Reviewing, contribution to literature, and editing; E.O.: Writing the Paper.

LIST OF ABBREVIATIONS

CRDCN = Canadian Research Data Centre Network
SHS = Survey of Household Spending
UNBC = University of Northern British Columbia

ETHICS APPROVAL AND CONSENT TO PARTICIPATE

Not Applicable.

HUMAN AND ANIMAL RIGHTS

Not applicable.

CONSENT FOR PUBLICATION

Not applicable.

AVAILABILITY OF DATA AND MATERIALS

All the data and supporting information are provided within the article.

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CONFLICT OF INTEREST

The authors have no conflicts of interest to disclose.

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Of Household Spending data) from Statistics Canada, through the UNBC CRDCN.

SUPPLEMENTARY MATERIAL

Supplementary material is available on the publisher's website along with the published article.

REFERENCES

- [1] Out-of-pocket payments for primary health care unaffordable for millions in Europe, new WHO report shows. 2023. Available from: <https://www.who.int/azerbaijan/news/item/12-12-2023-out-of-pocket-payments-for-primary-health-care-unaffordable-for-millions-in-europe-new-who-report-shows>
- [2] Buigut S, Ettarh R, Amendah DD. Catastrophic health expenditure and its determinants in Kenya slum communities. *Int J Equity Health* 2015; 14: 46. <http://dx.doi.org/10.1186/s12939-015-0168-9>
- [3] Lee A, Morgan S. Cost-related nonadherence to prescribed medicines among older Canadians in 2014: A cross-sectional analysis of a telephone survey. *CMAJ Open* 2017; 5(1): E40-4. <http://dx.doi.org/10.9778/cmajo.20160126>
- [4] Schoen C, Doty MM. Inequities in access to medical care in five countries: Findings from the 2001 Commonwealth Fund International health policy survey. *Health Policy* 2004; 67(3): 309-22. <http://dx.doi.org/10.1016/j.healthpol.2003.09.006>
- [5] Schoen C, Osborn R, Doty MM, Bishop M, Peugh J, Murukutla N. Toward higher-performance health systems: Adults' health care experiences in seven countries, 2007. *Health Aff* 2007; 26(6): w717-34. <http://dx.doi.org/10.1377/hlthaff.26.6.w717>
- [6] Fong JH. Out-of-pocket health spending among Medicare beneficiaries: Which chronic diseases are most costly? *PLoS One* 2019; 14(9): e0222539. <http://dx.doi.org/10.1371/journal.pone.0222539>
- [7] Hwang W, Weller W, Ireys H, Anderson G. Out-of-pocket medical spending for care of chronic conditions. *Health Aff* 2001; 20(6): 267-78. <http://dx.doi.org/10.1377/hlthaff.20.6.267>
- [8] You X, Kobayashi Y. Determinants of out-of-pocket health expenditure in China: Analysis using China health and nutrition survey data. *Appl Health Econ Health Policy* 2011; 9(1): 39-49. <http://dx.doi.org/10.2165/11530730-000000000-00000> PMID: 21174481
- [9] Baird KE. The incidence of high medical expenses by health status in seven developed countries. *Health Policy* 2016; 120(1): 26-34. <http://dx.doi.org/10.1016/j.healthpol.2015.10.004> PMID: 26694137
- [10] El-Haouly A, Lacasse A, El-Rami H, Liandier F, Dragomir A. Out-of-pocket costs and perceived financial burden associated with prostate cancer treatment in a Quebec remote area: A cross-sectional study. *Curr Oncol* 2020; 28(1): 26-39. <http://dx.doi.org/10.3390/currenol28010005> PMID: 33704114
- [11] Dieleman J, Campbell M, Chapin A, et al. Evolution and patterns of global health financing 1995-2014: Development assistance for health, and government, prepaid private, and out-of-pocket health spending in 184 countries. *Lancet* 2017; 389(10083): 1981-2004. [http://dx.doi.org/10.1016/S0140-6736\(17\)30874-7](http://dx.doi.org/10.1016/S0140-6736(17)30874-7) PMID: 28433256
- [12] Rahman T, Gasbarro D, Alam K. Financial risk protection from out-of-pocket health spending in low- and middle-income countries: A scoping review of the literature. *Health Res Policy Syst* 2022; 20(1): 83. <http://dx.doi.org/10.1186/s12961-022-00886-3> PMID: 35906591
- [13] Spithoven AHGM. Why U.S. health care expenditure and ranking on health care indicators are so different from Canada's. *Int J Health Care Finance Econ* 2009; 9(1): 1-24. <http://dx.doi.org/10.1007/s10754-008-9044-0> PMID: 18592374
- [14] Cunningham PJ. The growing financial burden of health care: National and state trends, 2001-2006. *Health Aff* 2010; 29(5): 1037-44. <http://dx.doi.org/10.1377/hlthaff.2009.0493> PMID: 20338908
- [15] Bodenheimer T. High and rising health care costs. Part 1: Seeking an explanation. *Ann Intern Med* 2005; 142(10): 847-54. <http://dx.doi.org/10.7326/0003-4819-142-10-200505170-00010> PMID: 15897535
- [16] Grigorakis N, Floros C, Tsangari H, Tsoukatos E. Macroeconomic and financing determinants of out of pocket payments in health care: Evidence from selected OECD countries. *J Policy Model* 2018; 40(6): 1290-312. <http://dx.doi.org/10.1016/j.jpolmod.2018.02.006>
- [17] Lenzen S, Bakx P, Bom J, van Doorslaer E. Health care use and out-of-pocket spending by persons with dementia differ between Europe and the United States. *Med Care* 2021; 59(6): 543-9. <http://dx.doi.org/10.1097/MLR.0000000000001539> PMID: 33827110
- [18] McIntyre D, Thiede M, Dahlgren G, Whitehead M. What are the economic consequences for households of illness and of paying for health care in low- and middle-income country contexts? *Soc Sci Med* 2006; 62(4): 858-65. <http://dx.doi.org/10.1016/j.socscimed.2005.07.001> PMID: 16099574
- [19] Rajan S, Rathod SD, Luitel NP, Murphy A, Roberts T, Jordans MJD. Healthcare utilization and out-of-pocket expenditures associated with depression in adults: A cross-sectional analysis in Nepal. *BMC Health Serv Res* 2020; 20(1): 250. <http://dx.doi.org/10.1186/s12913-020-05094-9> PMID: 32213188
- [20] Moody E, Ganann R, Martin-Misener R, et al. Out-of-pocket expenses related to aging in place for frail older people: A scoping review. *JBI Evidence Synthesis* 2022; 20(2): 537-605. <http://dx.doi.org/10.11124/JBIES-20-00413> PMID: 34738979
- [21] Wagstaff A, Eozenou P, Smits M. Out-of-pocket expenditures on health: A global stocktake. *World Bank Res Obs* 2020; 35(2): 123-57. <http://dx.doi.org/10.1093/wbro/lkz009>
- [22] Vick BC, Jones K, Mitra S. Poverty and psychiatric diagnosis in the US: Evidence from the medical expenditure panel survey. *J Ment Health Policy Econ* 2012; 15(2): 83-96. PMID: 22813941
- [23] Patton-Lopez MM. Out-of-pocket health care expenditures and household food insecurity among families with children. Doctoral Thesis 2012.
- [24] Rashad AS, Sharaf MF. Catastrophic and impoverishing effects of out-of-pocket health expenditure: New evidence from Egypt. *Am J Econ* 2015; 5(5): 526-33.
- [25] Fofack AD, Sarpong S. The impact of out-of-pocket health expenditure on maternal health: Empirical evidence from central and Latin American countries. *Journal of Health Science and Medical Research* 2019; 37(3): 237-45. <http://dx.doi.org/10.31584/jhsmr.201957>
- [26] O'Donnell O. Health and health system effects on poverty: A narrative review of global evidence. *Health Policy* 2024; 142(105018): 105018. <http://dx.doi.org/10.1016/j.healthpol.2024.105018> PMID: 38382426
- [27] Garg CC, Karan AK. Reducing out-of-pocket expenditures to reduce poverty: A disaggregated analysis at rural-urban and state level in India. *Health Policy Plan* 2009; 24(2): 116-28. <http://dx.doi.org/10.1093/heapol/czn046> PMID: 19095685
- [28] Van Doorslaer E, O'Donnell O, Rannan-Eliya RP, et al. Paying out-of-pocket for health care in Asia: Catastrophic and poverty impact. 2005. Available from: <https://ideas.repec.org/s/ess/wpaper.htmlhttps://www.kebijakanke-sehatanindonesia.net/sites/default/files/file/Pembiayaan/sigit/Artikel/Out%20of%20Pocket%20Payment%20in%20Asia.pdf>
- [29] Basumatary J. Out-of-pocket health care expenditure and poverty impact in a fragile indian state of Assam. *Health Economics and Management Review* 2022; 3(4): 23-34. <http://dx.doi.org/10.21272/hem.2022.4-03>
- [30] Sahoo AK, Madheswaran S. Financial Risk Protection: The Role of Health Insurance. Institute for Social and Economic Change 2014. Available from: http://103.154.2.116/~max233devise/wp-content/uploads/2023/07/WP-330-Amit-Kumar-Sahoo_3.pdf
- [31] Kumar AKS, Chen LC, Choudhury M, et al. Financing health care for all: Challenges and opportunities. *Lancet* 2011; 377(9766):

- 668-79.
[http://dx.doi.org/10.1016/S0140-6736\(10\)61884-3](http://dx.doi.org/10.1016/S0140-6736(10)61884-3) PMID: 21227490
- [32] Sisira Kumara A, Samaratunge R. Relationship between healthcare utilization and household out-of-pocket healthcare expenditure: Evidence from an emerging economy with a free healthcare policy. *Soc Sci Med* 2019; 235(112364): 112364.
<http://dx.doi.org/10.1016/j.socscimed.2019.112364> PMID: 31208779
- [33] Maulana N, Soewondo P, Adani N, Limasalle P, Pattnaik A. How Jaminan Kesehatan Nasional (JKN) coverage influences out-of-pocket (OOP) payments by vulnerable populations in Indonesia. *PLOS Global Public Health* 2022; 2(7): e0000203.
<http://dx.doi.org/10.1371/journal.pgph.0000203> PMID: 36962301
- [34] Walsan R, Mitchell RJ, Braithwaite J, *et al.* Is there an association between out-of-pocket hospital costs, quality and care outcomes? A systematic review of contemporary evidence. *BMC Health Serv Res* 2023; 23(1): 984.
<http://dx.doi.org/10.1186/s12913-023-09941-3> PMID: 37705006
- [35] Mahapatro SR, Singh P, Singh Y. How effective health insurance schemes are in tackling economic burden of healthcare in India. *Clin Epidemiol Glob Health* 2018; 6(2): 75-82.
<http://dx.doi.org/10.1016/j.cegh.2017.04.002>
- [36] Rahman MM, Islam MR, Rahman MS, *et al.* Forgone healthcare and financial burden due to out-of-pocket payments in Bangladesh: A multilevel analysis. *Health Econ Rev* 2022; 12(1): 5.
<http://dx.doi.org/10.1186/s13561-021-00348-6> PMID: 35006416
- [37] Sehgal A, Sangita S. Impact of government funded health insurance scheme on non-reimbursable and quality of health care: A study of maternal health care in Rajasthan. *J Health Manag* 2024; 0(0): 09720634241246946.
- [38] Schokkaert E, Steel J, Van de Voorde C. Out-of-pocket payments and subjective unmet need of healthcare. *Appl Health Econ Health Policy* 2017; 15(5): 545-55.
<http://dx.doi.org/10.1007/s40258-017-0331-0> PMID: 28432643
- [39] Bhojani U, Thriveni BS, Devadasan R, *et al.* Out-of-pocket healthcare payments on chronic conditions impoverish urban poor in Bangalore, India. *BMC Public Health* 2012; 12(1): 990.
<http://dx.doi.org/10.1186/1471-2458-12-990> PMID: 23158475
- [40] Sanni TA, Daniel EO, Aderukuola B. Cost of ante-natal care among health insurance (HI) enrollees and out-of-pocket (non-reimbursable) payers Accessing maternal Healthcare services in a tertiary health institution in Southwest Nigeria. *TJPH* 2021; 9(2): 11-22.
<http://dx.doi.org/10.21522/TJPH.2013.09.02.Art002>
- [41] Ayón C, Ramos Santiago J, López Torres AS. Latinx undocumented older adults, health needs and access to healthcare. *J Immigr Minor Health* 2020; 22(5): 996-1009.
<http://dx.doi.org/10.1007/s10903-019-00966-7> PMID: 31898077
- [42] Hajizadeh M, Pandey S, Pulok MH. Decomposition of socioeconomic inequalities in catastrophic out-of-pocket expenditure for healthcare in Canada. *Health Policy* 2023; 127: 51-9.
<http://dx.doi.org/10.1016/j.healthpol.2022.12.005> PMID: 36535813
- [43] Sanmartin C, Hennessy D, Lu Y, Law MR. Trends in out-of-pocket health care expenditures in Canada, by household income, 1997 to 2009. *Health Rep* 2014; 25(4): 13-7.
PMID: 24744043
- [44] White Hughto JM, Murchison GR, Clark K, Pachankis JE, Reisner SL. Geographic and individual differences in healthcare access for US transgender adults: A multilevel analysis. *LGBT Health* 2016; 3(6): 424-33.
<http://dx.doi.org/10.1089/lgbt.2016.0044> PMID: 27636030
- [45] Quiñonez C, Grootendorst P. Equity in dental care among Canadian households. *Int J Equity Health* 2011; 10(1): 14.
<http://dx.doi.org/10.1186/1475-9276-10-14> PMID: 21496297
- [46] Smith JP. Healthy bodies and thick wallets: The dual relation between health and economic status. *J Econ Perspect* 1999; 13(2): 145-66.
<http://dx.doi.org/10.1257/jep.13.2.145> PMID: 15179962
- [47] Coombes M, Barer M, Morgan S, Pagliccia N. Who's the fairest of them all? Which provincial pharmacare model would best protect Canadians against catastrophic drug costs? *Healthc Q* 2004; 7(4) (Suppl.): 13-9.
<http://dx.doi.org/10.12927/hcq.2004.17236> PMID: 15540402
- [48] Dewa CS, Hoch JS, Steele L. Prescription drug benefits and Canada's uninsured. *Int J Law Psychiatry* 2005; 28(5): 496-513.
<http://dx.doi.org/10.1016/j.ijlp.2005.08.003> PMID: 16125777
- [49] Luffman J. Out-of-pocket spending on prescription drugs. 2005. Available from: <https://citeseerx.ist.psu.edu/document?repid=rep1&type=pdf&doi=0f3edbf091b1627712c67e63e2aabde94b67d5d>
- [50] Law MR, Cheng L, Dhalla IA, Heard D, Morgan SG. The effect of cost on adherence to prescription medications in Canada. *CMAJ* 2012; 184(3): 297-302.
<http://dx.doi.org/10.1503/cmaj.111270> PMID: 22249979
- [51] Hennessy D, Sanmartin C, Ronsley P, *et al.* Out-of-pocket spending on drugs and pharmaceutical products and cost-related prescription non-adherence among Canadians with chronic disease. *Health Rep* 2016; 27(6): 3-8.
PMID: 27305075
- [52] de Oliveira C, Bremner KE, Ni A, Alibhai SMH, Laporte A, Krahn MD. Patient time and out-of-pocket costs for long-term prostate cancer survivors in Ontario, Canada. *J Cancer Surviv* 2014; 8(1): 9-20.
<http://dx.doi.org/10.1007/s11764-013-0305-7> PMID: 23975612
- [53] Carpenter A, Islam MM, Yen L, McRae I. Affordability of out-of-pocket health care expenses among older Australians. *Health Policy* 2015; 119(7): 907-14.
<http://dx.doi.org/10.1016/j.healthpol.2015.03.010> PMID: 25896218
- [54] Al-Hanawi MK, Mwale ML, Qattan AM. Health insurance and out-of-pocket expenditure on health and medicine: Heterogeneities along income *Front Pharmacol* 2021; 12: 638035.
<http://dx.doi.org/10.3389/fphar.2021.638035>
- [55] Wang SY, Valero-Elizondo J, Ali HJ, *et al.* Out-of-pocket annual health expenditures and financial toxicity from healthcare costs in patients with heart failure in the United States. *J Am Heart Assoc* 2021; 10(14): e022164.
<http://dx.doi.org/10.1161/JAHA.121.022164>
- [56] Shen YC, McFeeters J. Out-of-pocket health spending between low-and higher-income populations: Who is at risk of having high expenses and high burdens? *Med Care* 2006; 44(3): 200-9.
<http://dx.doi.org/10.1097/01.mlr.0000199692.78295.7c> PMID: 16501390
- [57] Crystal S, Johnson RW, Harman J, Sambamoorthi U, Kumar R. Out-of-pocket health care costs among older Americans. *J Gerontol B Psychol Sci Soc Sci* 2000; 55(1): S51-62.
<http://dx.doi.org/10.1093/geronb/55.1.S51> PMID: 10728130
- [58] Ruger JP, Kim HJ. Out-of-pocket healthcare spending by the poor and chronically ill in the Republic of Korea. *Am J Public Health* 2007; 97(5): 804-11.
<http://dx.doi.org/10.2105/AJPH.2005.080184> PMID: 17395834
- [59] Kotlarz H, Gunnarsson CL, Fang H, Rizzo JA. Insurer and out-of-pocket costs of osteoarthritis in the US: Evidence from national survey data. *Arthritis Rheum* 2009; 60(12): 3546-53.
<http://dx.doi.org/10.1002/art.24984> PMID: 19950287
- [60] Duncan KA, Shooshtari S, Roger K, Fast J. Care-related out-of-pocket costs. 2013. Available from: https://rapp.ualberta.ca/Portals/116/Documents/Reports/Duncan%20et%20al%20%282013%29%20Care-related%20out-of-pocket%20costs%20final%20report_2013Aug19.pdf
- [61] Gladman M, Dharamshi C, Zinman L. Economic burden of amyotrophic lateral sclerosis: A Canadian study of out-of-pocket expenses. *Amyotroph Lateral Scler Frontotemporal Degener* 2014; 15(5-6): 426-32.
<http://dx.doi.org/10.3109/21678421.2014.932382>
- [62] Cardwell FS, Elliott SJ, Chin R, *et al.* Economic burden of food

- allergy in Canada. *Ann Allergy Asthma Immunol* 2022; 129(2): 220-230.e6.
<http://dx.doi.org/10.1016/j.anai.2022.04.027> PMID: 35500863
- [63] Forget EL, Roos LL, Deber RB, Walld R. Variations in lifetime healthcare costs across a population. *Health Policy* 2008; 4(1): e148-67.
 PMID: 19377335
- [64] Tran DT, Ohinmaa A, Thanh NX, Welsh RC, Kaul P. The healthcare cost burden of acute myocardial infarction in Alberta, Canada. *Pharmacoecon Open* 2018; 2(4): 433-42.
<http://dx.doi.org/10.1007/s41669-017-0061-0>
- [65] Essue BM, Oliveira C, Bushnik T, et al. The burden of health-related out-of-pocket cancer costs in Canada: A case-control study using linked data. *Curr Oncol* 2022; 29(7): 4541-57.
<http://dx.doi.org/10.3390/curroncol29070359> PMID: 35877219
- [66] Ocran FE. The distribution and determinants of catastrophic out-of-pocket prescription drug expenditures in Canada. PhD Thesis, University of Saskatchewan 2020.
- [67] Srivastava S, Kumar M, Mishra S, Chaurasia H, Singh SK. Gender differentials in out of pocket health expenditure among older adults in India: evidence from National Sample Survey 2014 and 2018. *Ageing Int* 2022; 47(4): 779-800.
<http://dx.doi.org/10.1007/s12126-021-09451-9>
- [68] Fast JE, Williamson DL, Keating NC. The hidden costs of informal elder care. *J Fam Econ Issues* 1999; 20: 301-26.
- [69] O'Lynn TM, Zuckerman SL, Morone PJ, Dewan MC, Vasquez-Castellanos RA, Cheng JS. Trends for spine surgery for the elderly: Implications for access to healthcare in North America. *Neurosurgery* 2015; 77 (Suppl. 1): S136-41.
<http://dx.doi.org/10.1227/NEU.0000000000000945> PMID: 26378351
- [70] National Health Expenditure Trends, 1975 to 2018 2018. <https://www.cihi.ca/sites/default/files/document/nhex-trends-narrative-report-2018-en.pdf>
- [71] Law MR, Daw JR, Cheng L, Morgan SG. Growth in private payments for health care by Canadian households. *Health Policy* 2013; 110(2-3): 141-6.
<http://dx.doi.org/10.1016/j.healthpol.2013.01.014> PMID: 23419418
- [72] Tran DT, Ohinmaa A, Thanh NX, et al. The current and future financial burden of hospital admissions for heart failure in Canada: A cost analysis. *CMAJ Open* 2016; 4(3): E365-70.
<http://dx.doi.org/10.9778/cmajo.20150130> PMID: 27730101
- [73] Rosella LC, Fitzpatrick T, Wodchis WP, Calzavara A, Manson H, Goel V. High-cost health care users in Ontario, Canada: Demographic, socio-economic, and health status characteristics. *BMC Health Serv Res* 2014; 14(1): 532.
<http://dx.doi.org/10.1186/s12913-014-0532-2> PMID: 25359294
- [74] Paez KA, Zhao L, Hwang W. Rising out-of-pocket spending for chronic conditions: A ten-year trend. *Health Aff* 2009; 28(1): 15-25.
<http://dx.doi.org/10.1377/hlthaff.28.1.15> PMID: 19124848
- [75] Jo M, Lee Y, Kim T. Medical care costs at the end of life among older adults with cancer: A national health insurance data-based cohort study. *BMC Palliat Care* 2023; 22(1): 76.
<http://dx.doi.org/10.1186/s12904-023-01197-2> PMID: 37349710
- [76] Phillips K. Catastrophic drug coverage in Canada. 2016. Available from:
<https://oaresource.library.carleton.ca/wcl/2016/20160503/YM32-2-2016-10-eng.pdf>
- [77] Longo CJ, Fitch M, Deber RB, Williams AP. Financial and family burden associated with cancer treatment in Ontario, Canada. *Support Care Cancer* 2006; 14(11): 1077-85.
<http://dx.doi.org/10.1007/s00520-006-0088-8> PMID: 16896878
- [78] Kobelt G, Andlin-Sobocki P, Maksymowych WP. Costs and quality of life of patients with ankylosing spondylitis in Canada. *J Rheumatol* 2006; 33(2): 289-95.
 PMID: 16465660
- [79] Ogwal E. Out of pocket expenditures on healthcare across Canadian provinces. Master's Thesis, University of Northern British Columbia 2020.
- [80] Global expenditure on health: Public spending on the rise? 2021. Available from:
<https://iris.who.int/bitstream/handle/10665/350560/9789240041219-eng.pdf?ts>
- [81] Jalali FS, Bikineh P, Delavari S. Strategies for reducing out of pocket payments in the health system: A scoping review. *Cost Eff Resour Alloc* 2021; 19(1): 47.
<http://dx.doi.org/10.1186/s12962-021-00301-8> PMID: 34348717
- [82] Labrie Y. The unintended experiment with accessory fees in Quebec. 2024. Available from:
<https://www.fraserinstitute.org/sites/default/files/unintended-experiment-with-accessory-fees-in-quebec.pdf>
- [83] Bodenheimer T. High and rising health care costs. Part 2: Technologic innovation. *Ann Intern Med* 2005; 142(11): 932-7.
<http://dx.doi.org/10.7326/0003-4819-142-11-200506070-00012> PMID: 15941701
- [84] Belza C, Cohen E, Orkin J, et al. Out-of-pocket expenses reported by families of children with medical complexity. *Paediatr Child Health* 2024; 29(4): 216-23.
<http://dx.doi.org/10.1093/pch/pxad040> PMID: 39045474
- [85] Jacques O, Arpin E, Ammi M, Noël A. The political and fiscal determinants of public health and curative care expenditures: Evidence from the Canadian provinces, 1980-2018. *Can J Public Health* 2023; 114(4): 584-92.
<http://dx.doi.org/10.17269/s41997-023-00751-y> PMID: 36988906