Does Public Health Care Redistribute from Me to You, or Just to Myself When I'm Old? On the Lifetime Redistributive Impact of Publicly Financed Health Care in Canada

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IARIW Session 3, "What about STIK: How to Treat in-kind Government Benefits at Micro and Macro Levels", August 2014

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Abstract

Impressions of the degree of income inequality can be substantially altered when publicly financed in- kind benefits like health care are included (e.g. Smeeding et al (1993); Verbist et al., 2012). The vast majority of these analyses have been cross-sectional. But age is then a major confounder, since the elderly tend to have both lower incomes and higher health care utilization, while the middle aged are both healthier and have higher incomes. As a result, from a lifetime perspective, the redistributive impact of publicly financed health care is likely overstated compared to typical cross-sectional estimates.

In this analysis, we provide both cross-sectional and lifetime estimates of the distribution of Canada's publicly funded health care. This analysis is complicated by Canada's fiscal federalism, where most health care is provided at the provincial level, while provincial revenues come not only from provinces' own taxes, but also from federal to provincial fiscal transfers. Further, life expectancy increases with income, which may be important when taking a life course perspective.

These various elements have been woven together into a microsimulation model that synthesizes period birth cohorts for men and women, disaggregated by income group. The result is estimates of the lifetime as well as cross-sectional distributional impacts of Canada's publicly funded health care. While the extent of redistribution is attenuated by taking a life course perspective, publicly financed health care remains substantially redistributive with impacts on the same order as the personal income tax.

Introduction – There is a longstanding appreciation that conventional measurements of economic inequality, for example based on money income, may be seriously misleading due to the omission of publicly provided benefits in kind, such as health care, education, and housing (Smeeding et al., 1993; Verbist et. al., 2012). From another vantage point, with the Stiglitz, Sen, Fitoussi (2009) report, there has been a resurgence of interest in the proper measurement of government-provided goods and services, especially in the framework of official measures of income and income distribution.

This paper builds on these strands, plus an earlier less detailed analysis for Canada (CIHI, 2013) by producing estimates of the redistributive impact of Canada's publicly funded health care services.[1] Further, and unlike most other such analyses, we produce not only cross-sectional, but also lifetime estimates. With cross-sectional estimates, age is a major confounder, since the elderly tend to have both lower incomes and higher health care utilization, while the middle-aged are both healthier and have higher incomes. A lifetime perspective will therefore likely attenuate the estimated redistributive impact of publicly financed health care (e.g. Harding et al., 2002; Propper, 1995). On the other hand, taking differential mortality by income into account (the rich live longer) will likely have the opposite effect.

[1] CIHI (2013) used quintile data, and then only for the population aged 20 and over, while this analysis breaks incomes and healthcare costs into deciles, and includes the under 20 population. We also include sensitivity of the results to discounting.

In Canada, these estimates are complicated by the political structure being a confederation, with longstanding policies of fiscal federalism. Constitutionally, responsibility for health care rests primarily with the provinces.[2] While provincial tax revenues pay for the majority of health care, very substantial monies are also raised at the federal government level and then transferred to the provinces pursuant to a variety of federal programs, most importantly Equalization, and the Canada Health Transfer. As a result, we have included both federal and provincial government activities, and both taxation and expenditure, as they pertain to publicly funded health care services provided in kind.

A further challenge is the available data. For this analysis, data on taxes paid and health care services received need to be disaggregated by sex, age, and income. Table 1 shows the aggregate dollar amounts involved on the expenditure side. We have been able to access data with the required disaggregations for $89.8 billion out of a total of $131.0 billion in 2011. (CIHI 2013, CIHI 2012) On the revenue side, we have used Statistics Canada's Social Policy Simulation Database and Model (Statistics Canada, SPSD/M, 2013) which provides essentially complete coverage of federal and provincial income, payroll, and commodity taxes.

Table 1 – Publicly Funded Health Care in Canada, 2011

Type of Publicly Funded Health Care (Provincial Governments)	Total Public Expenditure	Estimated by Age, Sex, and Income
Hospitals	52.4	52.1
Physicians	27.4	27.3
Drugs	10.5	10.4
Other Health Care Professionals	1.0	0
Other Health Care Institutions	14.2	0
Other (e.g. Public Health, Admin, Capital)	25.5	0
Totals	131.0	89.8

This paper is organized as follows: the next section discusses the conceptual foundation for the estimation and allocation of the benefits of publicly-funded health care and taxes paid to individuals, including how we have taken Canada's fiscal federalism into account. Following this, we describe the methods by which essentially cross-sectional data will be used to estimate lifetime distributional impacts. We then present the main results, and close with discussion of their import.

Valuing Individual Benefits from Publicly-Funded Health Care Services – The raison d'etre of publicly-funded health care is not only to provide health care services, but even more importantly to provide *insurance* against the risk of very costly health care. It is obvious that those who are seriously ill receive far more health care services than those who are well. Thus, analyses of the distributional impacts of publicly-funded health care ignore actual differences in utilization between well and ill individuals. Instead, the benefits of publicly-funded health care (PFHC for short) will be treated as an insurance policy, where the value of the benefit is the annual insurance premium.[3]

Since the main focus of this analysis is on the redistributive impacts of PFHC, it is essential that we differentiate PFHC utilization by income group. We are also interested in a life course perspective, where it is well known that there are major health care cost differences by age group and sex, with per capita PFHC costs rising dramatically especially at

[2] Exceptions include federal responsibility for aboriginals living on reserves, the military and RCMP, veterans, and federal prison inmates.

[3] There is also a utility value from the insurance itself, readily apparent for example in the relative peace of mind experienced by Canadians compared to Americans with regard to their health care prospects. This value has not been included in our analysis.

higher ages. In order to capture this life cycle pattern of PFHC utilization, five year age intervals have been used to partition individuals into risk groups, and hence their implied insurance premia. [4]

One important caveat is that we are assuming that the "value" of PFHC, and the resulting estimated insurance premia, can be measured in monetary terms, and that these monetary values are directly related to the dollar value of expenditures on health care service inputs – including the dollar costs of payments to physicians, purchases of drugs, and the salaries of the doctors and nurses working in hospitals. This is a weak assumption given the longstanding evidence of large variations in health care utilization across small geographic areas, often without any apparent correlation with health outcomes (Fisher et al., 2003; Johansen et al., 2009). This "small area variations" literature suggests very substantial inefficiencies in Canadian (and U.S.) PFHC, which in turn means that the dollar value of health care services used by patients need not bear any relationship to the actual health (care and cure) benefits received. This point, while clearly important, is ignored in the analysis to follow.

Estimating the Distribution of Individual's Tax Payments – Assessing the redistributive impact of Canada's PFHC requires distributional data both on who receives (the insurance value of) the services, and who pays. Of course, ultimately, individuals pay for public sector activities via taxes. But there is considerable and longstanding controversy in the economics literature as to how the burden of taxation is distributed (Kesselman, 2004; Warren, 2008; Harris, 2009). First, government's fiscal positions are rarely neutral, where revenues exactly equal expenditures; rather they are more often in either a deficit or surplus position. Thus, expenditures in one (deficit) year may in fact be financed by taxes paid in another (surplus) year.

Further the nominal payer of a given tax may not be the person actually bearing the burden of the tax. Rather, taxes may be shifted. For example, income taxes paid by high income individuals may have been shifted to their employers (or to their funders in the case of physicians paid as part of PFHC) in the form of higher pre-tax incomes. Or sales taxes paid on highly competitive commodities may have been shifted back to the vendors.

In both of these cases, however, the data and evidentiary base for estimating the inter-temporal relationships entailed by fiscal deficits or surpluses, and for tax shifting, are simply inadequate. We therefore focus only on first round impact estimates of who bears the costs of taxes used to finance PFHC.

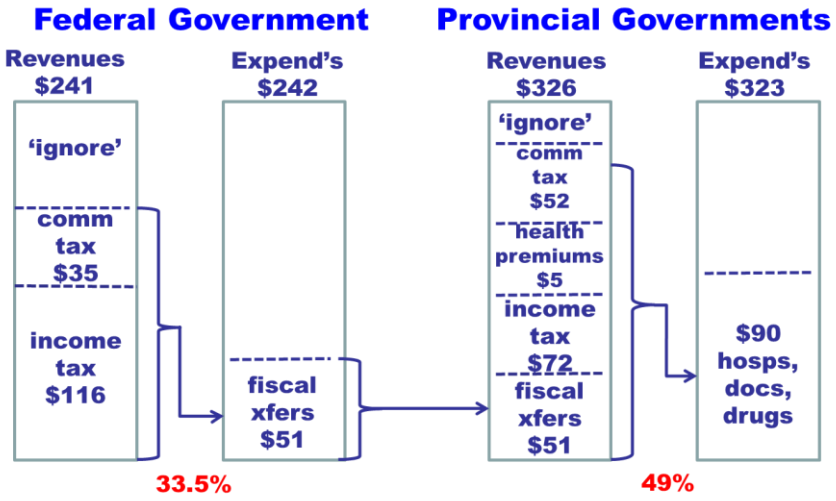
Taking Account of Canada's Fiscal Federalism – As already noted, Canada's fiscal structure is complicated in that provinces pay for the bulk of PFHC, while both provincial and federal governments are involved in the taxation used to fund public health care services. Figure 1 provides an overview of the financial flows being considered in our analysis.

In 2011, if we exclude the deficit (i.e. bond issues) on the revenue side, and payments of interest on the accumulated outstanding debt on the expenditure (outlay) side, then both the federal and provincial governments were roughly in balance. As a result, we focus only on tax revenues and expenditures other than interest on accumulated government debt.

At the provincial level, as shown in Figure 1, we can explicitly identify and allocate to age / sex / income groups $170 billion out of a total of $326 billion in revenues. On the spending side, the PFHC which can be correspondingly disaggregated by age / sex / income totalled $90 billion. This in turn was 49% of the identified sources of revenue at the provincial level. For these revenues, we have direct estimates of their age / sex/ income breakdowns for all but the monies received as fiscal transfers from the federal government. We therefore have to go upstream to determine what the breakdown of these transfers was based on the distribution of federal sources of revenue.

[4] Note that unlike many other analyses (e.g. Verbist et al., 2012) where the household is the unit of analysis, this analysis focuses on individuals. In turn, discussion of specialized equivalence scales is not relevant.

Figure 1 – Federal-Provincial Fiscal Arrangements and the "Taxes Paid" for Publicly Funded Health Care (PFHC) in Canada, 2011 ($ billions) [5]



At the federal level, was can similarly identify the age / sex / income distribution of income and commodity taxes, which totalled $151 billion in 2011. Fiscal transfers from the federal government were $51 billion, which was 33.5% of the identified revenues. We have therefore assumed that on the financing side, PFHC was paid for by a combination of 49% or provincial income taxes + provincial commodity taxes + provincial health premiums (collected as part of income tax filing) + 49% of federal transfers. In turn, federal transfers have been assumed to be 33.5% of federal income taxes + federal commodity taxes. Thus, for individuals, 49% x 33.5% = 16.4% of federal taxes have been earmarked as paying for PFHC.[6]

Cross-Sectional Distributions of PFHC and Taxes, 2011 – To begin, we have produced detailed estimates of PFHC spending. Table 2 shows the aggregate (CIHI 2012) and per capita amounts by income decile.

Table 2 – PFHC Spending by Income Decile, both sexes, all ages, 2011

	Aggregate ($ billions)				Per Capita ($)			
	Hospitals	**Physicians**	**Drugs**	**Total**	**Hospitals**	**Physicians**	**Drugs**	**Total**
D1 (Lowest)	6.39	3.66	2.29	12.34	2,193	997	787	3,978
D2	5.79	3.53	1.60	10.92	1,967	970	546	3,483
D3	5.51	3.10	1.79	10.40	1,812	880	589	3,282
D4	5.28	2.70	1.14	9.12	1,655	772	357	2,784
D5	5.18	2.56	0.73	8.48	1,565	731	221	2,516
D6	5.10	2.57	0.72	8.40	1,458	745	206	2,409
D7	4.94	2.41	0.75	8.10	1,356	708	205	2,269
D8	4.92	2.36	0.57	7.85	1,280	690	149	2,119
D9	4.55	2.28	0.46	7.29	1,122	672	113	1,906
D10 (Highest)	4.40	2.11	0.39	6.90	1,037	666	91	1,794
Total / Overall	52.06	27.29	10.44	89.79	1,501	787	301	2,589

[5] **Source:** Statistics Canada (specialised request) using the SPSD/M version 20.0 for 2011 based on tax data for 2008 and projections. The proportion of federal taxes transferred to the provinces available to go toward PFHC was estimated via Canadian System of National Accounts at approximately $51 billion; this was slightly less than the $71 billion in total transfers to the provinces, as transfers earmarked for the territories or other specific non-health programs were excluded. CANSIM Table 380-0080—Revenue, expenditure and budgetary balance—General governments, annual (dollars). http://cansim2.statcan.gc.ca/cgi-win/cnsmcgi.pgm. Updated October 10, 2012.

[6] Note that for all other federal and provincial revenue sources, one way to view our results is that we are implicitly assuming that their distributional impacts by age/sex/income decile are the same as those for the tax sources we have explicitly included.

Correspondingly, Figures 2 a and b show the age pattern of these per capita expenditures for selected deciles, in this case for males and females.[7] Bringing age into the picture shows the dramatically higher PFHC spending at higher ages. Still, within each age group, there are important differences by income – those with lower incomes use more PFHC services.

Figure 2a – PFHC Spending by Age and Selected Income Decile, 2011, males

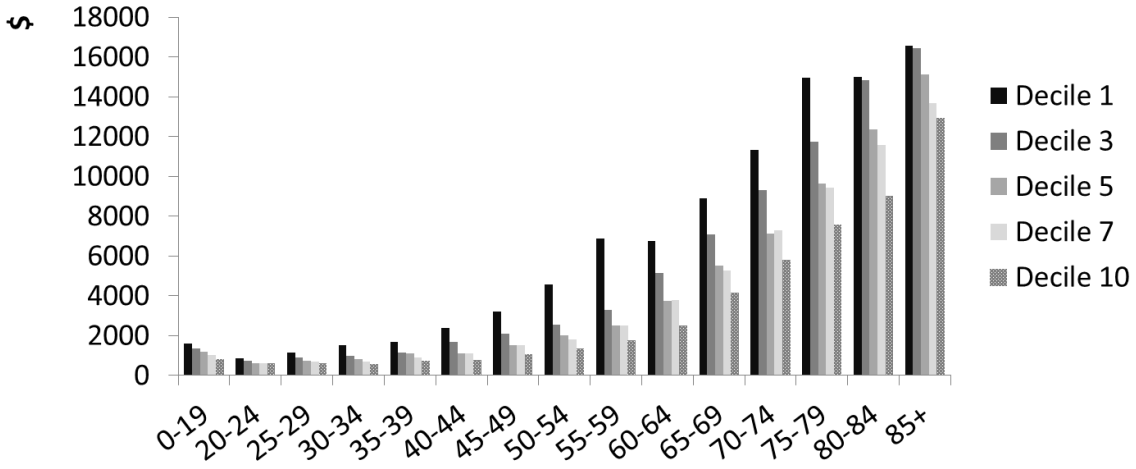
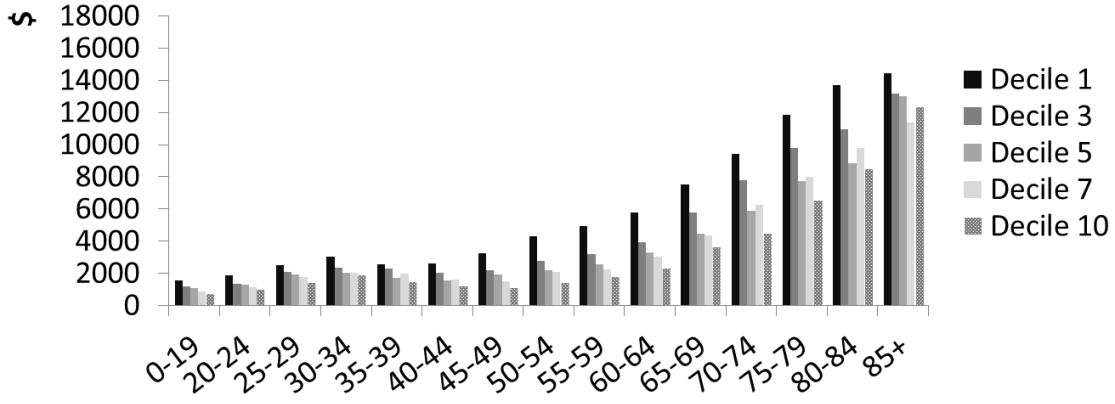


Figure 2b – PFHC Spending by Age and Selected Income Decile, 2011, females



Looking more closely, the differences by income group in Figures 2 a and b are narrower amongst the very young and the very old than the overall differences shown in Table 2 for all age groups combined, though wider in the middle age groups.

Turning to the revenue side of the picture, Table 3 provides the breakdown of federal and provincial income and commodity tax revenues by income decile. As expected, income taxes (both federal and provincial) are the most progressively distributed. Commodity taxes, on the other hand, are likely regressive. (While the dollar amounts are generally increasing going up the decile income spectrum, they are likely decreasing as a proportion of the average incomes in each decile – the criterion for determining whether a tax is progressive or regressive.)

[7] Note that for the first 0-19 age group, distributions of physician costs by income decile were based on distribution for the 12 to 18 age group using data from the Canadian Community Health Survey. Hospital and Drug distributions by income decile and sex for this age group were based on data for all those age 0 to 19. See the appendix for further detail.

Table 3 – Federal and Provincial Tax Revenues, 2011

	Aggregate ($ billions)					Per Capita ($)				
	Federal Income Taxes	Federal Commodity Taxes	Provincial Income Taxes	Provincial Commodity Taxes	Provincial Health tax	Federal Income Taxes	Federal Commodity Taxes	Provincial Income Taxes	Provincial Commodity Taxes	Provincial Health tax
D1 (Lowest)	0.34	1.86	0.21	3.00	0.03	101	545	63	881	7
D2	1.14	2.34	0.73	3.70	0.14	331	541	213	1,078	41
D3	2.91	2.69	1.97	4.12	0.27	856	689	579	1,212	80
D4	4.48	2.95	2.99	4.50	0.41	1,314	790	878	1,320	119
D5	6.02	3.18	3.96	4.74	0.47	1,759	861	1,158	1,385	138
D6	8.16	3.51	5.38	5.27	0.52	2,398	934	1,582	1,548	152
D7	10.44	3.84	6.84	5.82	0.60	3,042	1,023	1,992	1,696	175
D8	13.22	4.02	8.27	5.94	0.64	3,874	1,126	2,424	1,741	186
D9	18.38	4.52	11.25	6.60	0.73	5,390	1,177	3,298	1,936	215
D10 (Highest)	50.49	6.23	29.99	8.63	0.85	14,752	1,320	8,761	2,522	247
Total / Overall	115.58	35.13	71.59	52.32	4.65	3,384	1,029	2,096	1,532	136

Correspondingly, Figures 3 a and b show the age pattern of these per capita tax revenues for selected deciles for males and females. In this case, the progressivity of the tax system is clearly evident within each age group, especially for the top income decile.

Figure 3a –Provincial and Federal Taxes by Age and Selected Income Decile, 2011, males

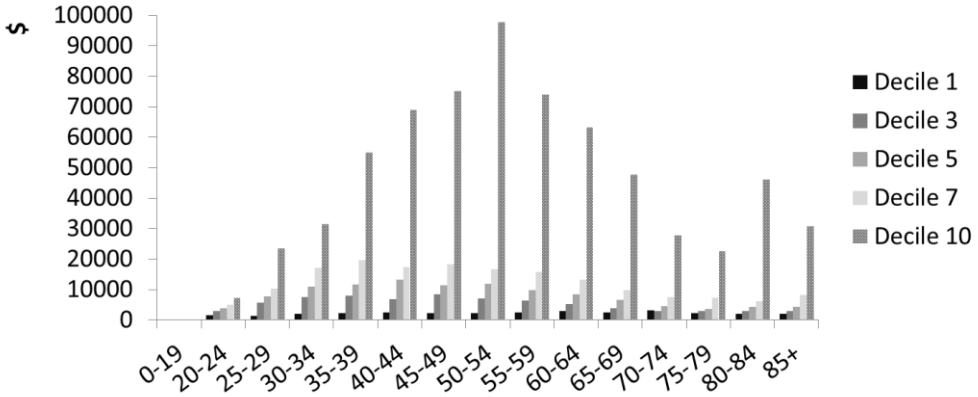
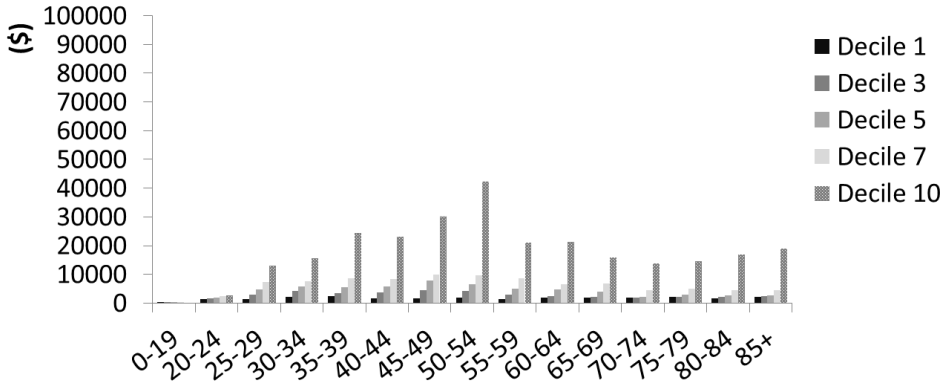


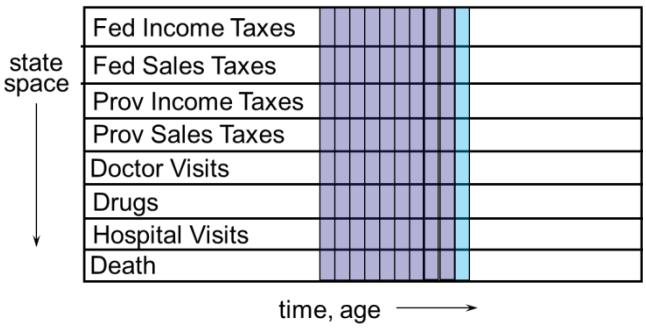
Figure 3b – Provincial and Federal Taxes by Age and Selected Income Decile, 2011, females



Note: values for 0-19 age group for males and females are below $200 and not showing up on this scale.

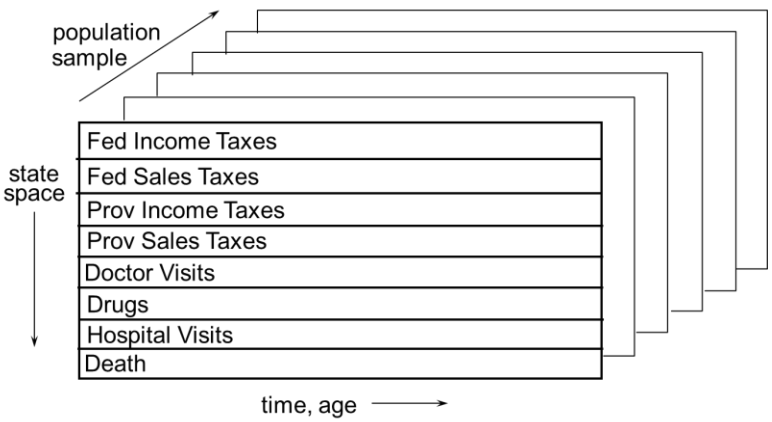
Simulating Lifetime Distributional Impacts – Given the detailed data just described, breaking PFHC and its corresponding revenue sources down by age / sex / income, the key step in our analysis is developing lifetime estimates. To do this, we have constructed a relatively simple microsimulation model. This model generates 50,000 individuals – 2,500 males and 2,500 females in each of 10 income decile groups.[8]

Figure 4 – Simulating an Individual Biography



The starting point is the simulation of a single individual. This is illustrated in Figure 4 which shows the partially completed simulation of one individual biography. The "biography" consists of the values, at each single year of age, of the four revenue sources and three PFHC components shown, plus the time of death. The individual is born at age zero, and is assigned a sex and income decile. Every year thereafter, the individual is assigned the per capita PFHC and revenues corresponding to their age / sex/ income decile, based on the data described above. This process continues year after year, proceeding from left to right in Figure 4, until the individual dies, based on mortality rates described below.

Figure 5 – Simulating a Population Sample of Individuals



Next, this process is repeated 50,000 times in order to generate a population sample of individual biographies, as indicated in Figure 5.[9] It is important to note one simplifying assumption – there is no income mobility between income deciles. Once an individual is born an i-th income decile person, they remain in that income decile throughout their life. This assumption is unrealistic, but incorporating realistic income mobility is beyond the scope of this analysis. The assumption of no inter-decile income mobility represents a polar case: to the extent that individuals do in fact move across income decile boundaries over their lifetimes, the extent of lifetime income inequality will be lower than estimated here, as will be the spread of lifetime PFHC and taxes.

Once the simulation is complete, it is straightforward to cross-tabulate the resulting synthetic longitudinal population sample in order to estimate lifetime redistributive impacts.[10]

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[8] The model was written in Statistics Canada's Modgen language, see http://www.statcan.gc.ca/microsimulation/modgen/modgen-eng.htm

[9] The choice of 50,000 is somewhat arbitrary. It was approximately the smallest sample, thereby reducing execution time, that was at the same time sufficiently large to render Monte Carlo error negligible for the main results of the analysis.

[10] In demographic terms, we are creating a period cohort. Doing so ignores any time trends in PFHC costs, which have been increasing over time. Thus, we are implicitly ignoring any resulting inter-generational transfers. But see Wolfson and Rowe (2007) for analysis and estimates.

Lifetime Results — The starting point for the lifetime analysis is the disaggregation of PFHC by age / sex / income decile, summaries of which are shown above in Tables 2 and 3. The one further input needed is mortality rates. Table 4 shows that there are significant differences by income decile, based on very robust data, an 11 year mortality follow-up for a 15% sample of the 1991 population census. For example, those in the top income decile have almost half again the chance of surviving to age 85 than those in the bottom income decile (Statistics Canada, 2008).

Table 4 – Percentages Surviving and Life Expectancies by Income Decile, Canada

	Percent Alive at Age			Life Expectancy at birth	
	65	75	85	males	females
D1 (Lowest)	80%	64%	38%	73.8	79.8
D2	84%	68%	40%	75.5	80.9
D3	86%	71%	44%	76.9	82.3
D4	87%	72%	46%	77.7	82.6
D5	89%	74%	46%	78.7	83.2
D6	90%	76%	48%	79.4	83.1
D7	89%	76%	49%	79.2	83.5
D8	90%	77%	49%	79.7	83.3
D9	91%	79%	50%	80.5	83.7
D10 (Highest)	92%	80%	53%	80.8	83.9
All	88%	74%	46%	78.2	82.6

Table 5 – Cross-Sectional and Lifetime Health Cost Distributions[11]

	Cross-Section, 2011		Lifetime (Equal Mortality by Income)			Lifetime (Observed Mortality by Income)		
	Annual PFHC Cost per capita	Percentage of Annual Costs	Lifetime PFHC Cost per capita	Annualized PFHC Cost per capita	Percentage of Lifetime Costs	Lifetime PFHC Cost per capita	Annualized PFHC Cost per capita	Percentage of Lifetime Costs
D1 (Lowest)	3,978	15.4%	382,971	4,728	14.6%	342,165	4,457	13.3%
D2	3,483	13.5%	312,500	3,880	11.9%	290,561	3,716	11.3%
D3	3,282	12.7%	300,012	3,713	11.4%	289,661	3,638	11.2%
D4	2,784	10.8%	262,167	3,252	10.0%	257,970	3,220	10.0%
D5	2,516	9.7%	248,867	3,075	9.5%	248,867	3,075	9.7%
D6	2,409	9.3%	244,434	3,021	9.3%	246,475	3,034	9.6%
D7	2,269	8.8%	235,542	2,920	9.0%	240,396	2,956	9.3%
D8	2,119	8.2%	230,820	2,863	8.8%	236,989	2,907	9.2%
D9	1,906	7.4%	211,758	2,617	8.1%	218,901	2,667	8.5%
D10	1,794	6.9%	194,563	2,415	7.4%	206,748	2,510	8.0%
All	2,589	100.0%	262,363	3,249	100.0%	257,873	3,207	100.0%
Ratio D1/D10	2.22	2.22	1.97	1.96	1.97	1.65	1.78	1.65
Ratio D2/D9	1.83	1.83	1.48	1.48	1.48	1.33	1.39	1.33

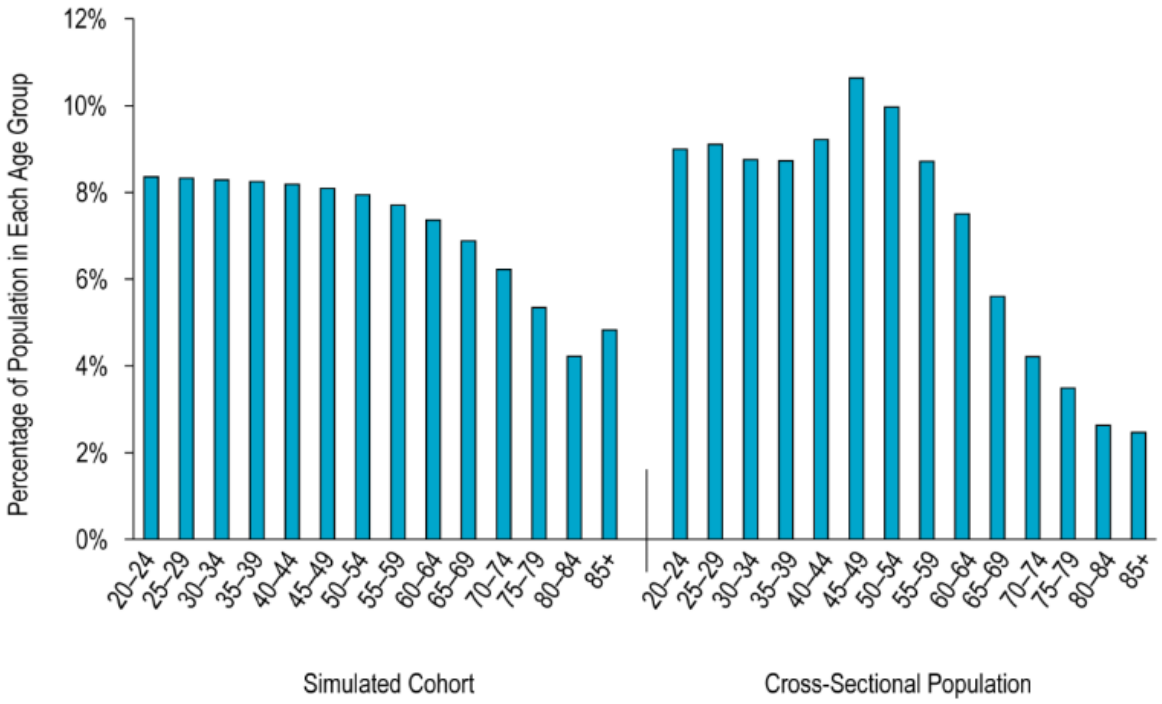
[11] Note the dollar values are the same in decile 5. This result is because the differential mortality rates by income decile were expressed as relative risks, and we have used the 5th decile as the reference point.

Given these mortality data, we have simulated two scenarios, one where these differences in mortality rates are ignored, and another where these observed differential mortality rates are fully included. Table 5 shows three sets of results for the distribution of PFHC costs: the 2011 cross-sectional data, and then the results of two simulations of lifetime costs, one with the same mortality rates across income deciles, the other applying the observed differential mortality rates.[12]

The most striking result in Table 5 is the increase in per capita PFHC costs in moving from the cross-sectional to the lifetime perspective, from $2,589 to $3,249 for equal mortality, and but then down somewhat to $3,207 for observed mortality. The large change from cross-sectional to lifetime amounts is the result of the change in the age structure, shown below in Figure 6. The 2011 population age structure, shown here for the population 20 and over, has the peak of the "baby boom" cohort in the 45-49 age group. However, for the lifetime perspective, we are using the steady state population implied by the observed age- (and sex-) specific mortality rates. As a result, population size decreases monotonically with age. More importantly, the proportion of the population at higher ages increases. Since health care costs increase significantly at higher ages (recall Figure 3), this shift in the age structure increases overall health care costs. The further change in annualized PFHC costs from equal to observed mortality is due to the shorter life expectancies of those in lower deciles, who also have higher PFHC costs than those in higher deciles. [13]

Given this difference in age structure, and hence the aggregate amounts of PFHC, another important result in Table 6 is that taking a lifetime perspective reduces the measured differences in PFHC by income decile, first from about 2.2 for the D1/D10 ratio in cross section to about 2.0 for lifetime PFHC costs (both lifetime and annualized), and then further to about 1.7 when observed relative mortality risks are used.

Figure 6 – 2011 Observed Population by Age and Simulated Population Age Structure



[12] Note that the discount rate used here is zero. See below for results using different discount rates.

[13] There is substantial evidence that health care costs are particularly high in the last year or months of life. With higher mortality rates for those with lower incomes, the last year of life is on average shifted to younger ages. This factor is implicitly included in our analysis because health care costs are differentiated by income decile as well as age (and sex).

A further implication of the different lifetime age structure is that the aggregate amount of tax revenue to be earmarked to fund PFHC costs is different from the cross-section amounts shown in Figure 1 above. As a result, the 49% figure has been adjusted to ensure that over the cohort's lifetime, the proportion of taxes earmarked for PFHC exactly equals the cohort's lifetime PFHC costs, resulting in a 65.2% figure for the lifetime (observed mortality) results. (The federal-provincial fiscal arrangements are assumed not to change, so the 33.5% proportion in Figure 1 also does not change.)

Table 6 shows the results. Taxes, even though they are mixtures of income and commodity taxes, overall are progressive. For example the ratio of the top decile to the bottom decile of taxes is 14.8 times, while that for disposable income is 8.8 times. The corresponding figures for the D9 to D2 ratio are not nearly as dramatic, 3.0 and 4.5. Shifting to lifetime incomes shifts both distributions – disposable incomes and taxes paid for PFHC – to be somewhat more progressive looking at the D10 to D1 ratio, though there is no change looking at the D9 to D2 ratio.

Table 6 – Cross-Sectional and Lifetime Distributions of Taxes Paid Toward PFHC

	Cross section 2011				Lifetime (Observed Mortality)			
	Disposable Income ($)	Share of Income	Taxes paid for PFHC ($)	Share of Taxes	Disposable Income ($)	Share of Income	Taxes paid for PFHC ($)	Share of Taxes
D1 (Lowest)	13,146	3.0%	573	2.2%	13,554	3.1%	767	2.4%
D2	20,944	4.7%	834	3.2%	20,824	4.8%	1,068	3.3%
D3	25,964	5.9%	1,193	4.6%	25,521	5.9%	1,492	4.6%
D4	30,274	6.8%	1,498	5.8%	29,712	6.8%	1,870	5.8%
D5	34,930	7.9%	1,779	6.9%	34,233	7.9%	2,215	6.8%
D6	40,168	9.1%	2,170	8.4%	39,343	9.0%	2,716	8.4%
D7	45,705	10.3%	2,610	10.1%	44,795	10.3%	3,279	10.1%
D8	53,088	12.0%	2,986	11.5%	52,038	12.0%	3,744	11.5%
D9	63,611	14.4%	3,787	14.6%	62,362	14.3%	4,799	14.8%
D10 (Highest)	115,401	26.0%	8,471	32.7%	112,730	25.9%	10,556	32.5%
All	44,309		2,589		43,493		3,249	
Ratio D10/D1	8.8		14.8		8.3		13.8	
Ratio D9/D2	3.0		4.5		3.0		4.5	

Given these two sides of government budgets shown in Tables 5 and 6 for PFHC expenditures and taxes paid to finance them respectively, Tables 7 and 8 put the results together to estimate the extent of lifetime redistribution.

Table 7 shows the results assuming equal mortality rates across income deciles, while Table 8 uses the observed differential mortality rates. In both cases, we have added columns on the left showing average household adjusted income, and again average disposable income.[14]

Perhaps surprisingly, the differences between Tables 7 and 8 are not that large. From a lifetime perspective, while taking account of observed differential mortality rates by income, compared to ignoring these differences, has an effect, it is small compared to the redistributive effects of PFHC generally. For example, the D10/D1 ratio drops by about 20 times as much with the move from disposable income to disposable income + PFHC, compared to the move from equal

[14] Household adjusted income is the total income of the household before income taxes and before capital gains divided by an equivalent adult unit scale. This scale, based on Statistics Canada's Low Income Measure (LIM) is 1.0 for a single individual, 1.4 for a couple, and there is an added 0.3 for each additional household member. Disposable income is household adjusted income plus capital gains minus income taxes.

to observed mortality rates (2.0 versus 0.1). However, this is in part an artefact since Tables 7 and 8 are showing only annualized amounts. From a lifetime perspective, as shown in Table 5 above, the differences related to the mortality assumption are considerably larger.[15]

Table 7 – Annualized Lifetime Income, PFHC Costs, and Taxes Paid Toward PFHC ($)
(equal mortality assumption)

	Household Adjusted Income	Disposable Income	PFHC Annual Costs	PFHC as % Disposable Income	Taxes Paid for PFHC Costs	Taxes to PFHC as % of Income	Net Gain/Loss	Disposable Income + PFHC
D1 (Lowest)	13,168	13,554	4,728	34.9%	767	5.7%	3,961	18,282
D2	21,368	20,824	3,880	18.6%	1,068	5.1%	2,811	21,420
D3	27,538	25,521	3,713	14.5%	1,492	5.8%	2,221	26,429
D4	33,514	29,712	3,252	10.9%	1,870	6.3%	1,382	30,721
D5	39,549	34,233	3,075	9.0%	2,215	6.5%	860	35,360
D6	46,165	39,343	3,021	7.7%	2,716	6.9%	306	40,721
D7	53,974	44,795	2,920	6.5%	3,279	7.3%	-359	46,214
D8	63,627	52,038	2,863	5.5%	3,744	7.2%	-880	53,435
D9	78,040	62,362	2,617	4.2%	4,799	7.7%	-2,183	64,049
D10 (Highest)	148,323	112,730	2,415	2.1%	10,556	9.4%	-8,141	116,126
All	52,502	43,493	3,249	7.5%	3,249	7.5%	0	46,742
Ratio D10/D1	11.26	8.32	0.51		13.76			6.35
Ratio D9/D2	3.65	2.99	0.67		4.49			2.99

Table 8 – Annualized Lifetime Income, PFHC Costs, and Taxes Paid Toward PFHC
(Observed Mortality by Income)

	Household Adjusted Income	Disposable Income	PFHC Annual Costs	PFHC as % Disposable Income	Taxes Paid for PFHC Costs	Taxes to PFHC as % Disposable Income	Net Gain/Loss	Disposable Income + PFHC
D1 (Lowest)	13,045	13,418	4,457	33.2%	731	5.4%	3,727	17,875
D2	21,371	20,811	3,716	17.9%	1,033	5.0%	2,683	24,527
D3	27,558	25,522	3,638	14.3%	1,448	5.7%	2,190	29,160
D4	33,531	29,716	3,220	10.8%	1,818	6.1%	1,402	32,935
D5	39,549	34,233	3,075	9.0%	2,154	6.3%	921	37,309
D6	46,148	39,339	3,034	7.7%	2,641	6.7%	393	42,373
D7	53,928	44,778	2,956	6.6%	3,190	7.1%	-235	47,734
D8	63,570	52,019	2,907	5.6%	3,646	7.0%	-739	54,926
D9	77,991	62,355	2,667	4.3%	4,687	7.5%	-2,020	65,021

[15] A further caveat relates to the general observation that the largest consumption of health care services occurs in the last year of life. Thus, even if those in the lowest income deciles tend to die at an earlier age than those with higher incomes, if one of the main factors driving health care costs is proximity to death (as well as age more generally), then the fact of deaths occurring in somewhat earlier ages in lower income deciles may not reduce per capita health care costs by as much as any shift in age group might suggest.

D10 (Highest)	148,050	112,601	2,510	2.2%	10,330	9.2%	-7,819	115,111
All	53,057	43,910	3,207	7.3%	3,207	7.3%	0	47,117
Ratio D10/D1	11.35	8.39	0.56		14.13			6.44
Ratio D9/D2	3.65	3.00	0.72		4.54			2.65

Discounting – So far, all the analysis has been undertaken with a zero discount rate. There is considerable controversy regarding the choice of this rate. The UK's NICE (2013) recommends a discount rate of 1.5%, while Glied (2008), one of the few researchers to estimate lifetime redistribution, used both a zero and a 5% discount rate. Figure 7 shows per capita lifetime PFHC by income decile and per capita lifetime taxes to finance PFHC by income decile at two discount rates – the zero rate used up to this point, and the NICE recommended 1.5% rate. (Note that these are both real discount rates.) The zero discount rate figures are those in the corresponding columns of Table 8, using the observed mortality rates.

The effects for both the revenue and expenditure sides are similar – there is a proportional reduction in the dollar amounts, but the general shapes of the curves are not changed.

Figure 7 – Per Capita Lifetime PFHC and Taxes to Finance PFHC at Zero and 1.5% Discount Rates (r)

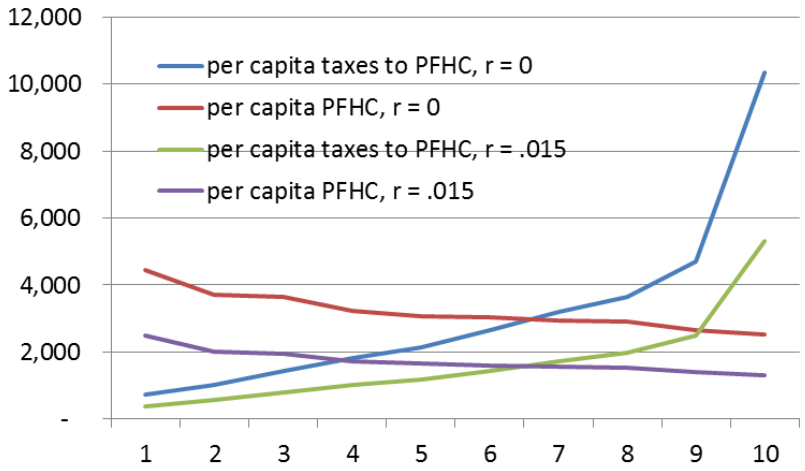


Figure 8 – Per Capita Lifetime PFHC minus Taxes to Finance PFHC at Four Discount Rates (r)

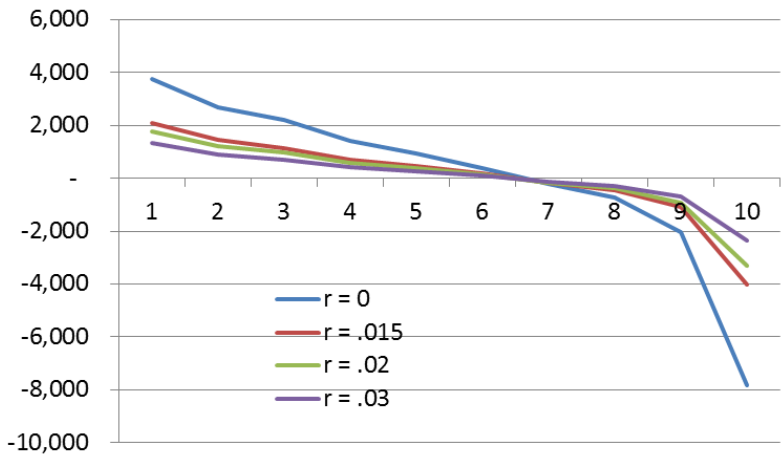


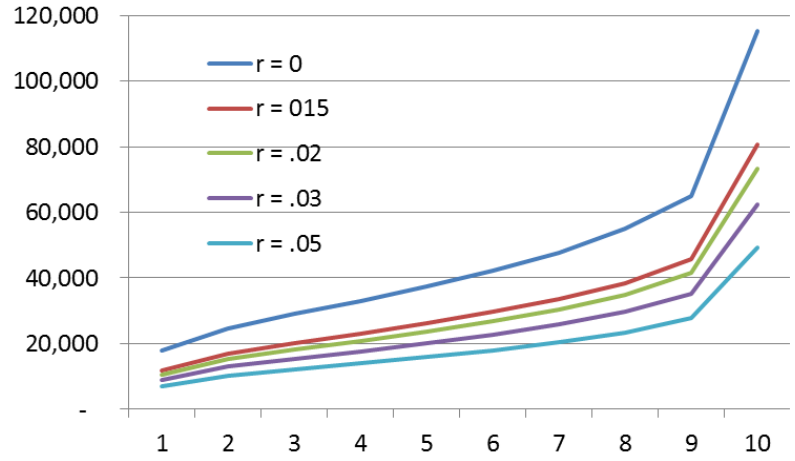
Figure 8 shows the results corresponding to the penultimate column of Table 8, the difference between PFHC and taxes paid for financing PFHC by income decile, but in this case for a wider range of discount rates, from zero to 3% (again, all real). Again, the patterns are all similar. The main effect of higher discount rates is to shrink the average dollar amounts, both positive and negative, toward zero.

Finally, Table 9 shows the D10 to D1 and D9 to D2 ratios as indicators of inequality for a range of discount rates.

Table 9 – Decile Ratios for Per Capita Lifetime Disposable Income plus PFHC by Discount Rate (r)

	Disposable Income		Disposable Income + PFHC	
Discount Rate	D10/D1	D9/D2	D10/D1	D9/D2
r = 0	8.39	3.00	6.44	2.65
r = .015	8.45	2.97	6.80	2.69
r = .02	8.46	2.96	6.89	2.70
r = .03	8.44	2.94	7.04	2.72
r = .05	8.37	2.91	7.19	2.73

Figure 9 – Per Capita Lifetime Disposable Income plus PFHC at Four Discount Rates (r)



And Figure 9 shows the corresponding distributions by decile of disposable income plus PFHC (both per capita) at a range of discount rates (r). In Table 9, the variation in the results by discount rates is small. Similarly in Figure 9, while the levels of the curves shrink toward zero with higher discount rates, the general shape is unchanged.

Concluding Comments – In this analysis, we have explored the redistributive impacts of Canada's publicly funded health Care (PFHC) services. This analysis is complicated by Canada being a confederation, with the financing of health care, a provincial responsibility, involving both senior levels of government.

We have further pressed beyond the more common cross-sectional analyses to produce estimates of lifetime impacts. In so doing, we have addressed the confounding of age with health care utilization inherent in cross-sectional analyses. To produce these lifetime estimates, we have relied on detailed estimates of major components of PFHC (hospital, physician and drug costs) disaggregated by 5 year age groups, sex, and income deciles. We have also drawn on detailed data on income and commodity taxes at both the federal and provincial government levels, similarly disaggregated by 5 year age groups, sex, and income decile.

In order to produce our estimates, we have constructed a simple Monte Carlo microsimulation model and produced period cohort estimates for 2011.

One major question is whether PFHC is mainly about redistribution across income groups, or across the life cycle. In more vernacular terms (and abstracting from inter-temporal factors such as time trends in health care costs and fiscal deficits and surpluses), this question can be restated as, "does health care redistribute from me to you, or just to myself in old age?" Based on the our simulation results, we find that PFHC does both. Roughly speaking, PFHC costs generate about one-third of their redistribution over individuals' lifecycles, and about two-thirds between income deciles (Table 5). Further, relatively little of these redistributive patterns is affected by differential mortality by income group, even though there are pronounced differences in life expectancy and survival to older ages by income decile in Canada (as in most jurisdictions, Table 4).

In sum, PFHC is a major source of income redistribution, albeit in kind. Its redistributive impacts in Canada approach those of the individual income tax (Table 8).

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Appendix

Disaggregation by Income Deciles – Given the different sources of the data, several methods have been used to disaggregate the various amounts used in this analysis by income decile. The appendices to CIHI (2013) provide more detail.

Microsimulation Model – The model used in this analysis is freely available on request from the authors.