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# Lifetime Distributional Effects of Publicly Financed Health Care in Canada

## Summary

Publicly financed health care provides access to a package of valuable core services to all Canadians—services that provide necessary care when needed and help improve the health and well-being of Canadians. In addition to being a valuable public service, publicly financed health care plays another role that is often overlooked: it redistributes income among different socio-economic groups. In effect, how much different population groups pay for health care through various mechanisms, such as income taxation, and how much they receive back in terms of services vary. As a consequence, health care financing may affect the income of population groups differently. Since health care represents a large and growing part of public-sector spending (35% of total provincial and territorial expenditure in 2011), it is important to consider the redistributive effects of publicly financed health care in Canada.

This analysis estimates how publicly financed health care expenditures and associated tax payments vary across income groups. In this study, we estimated what happens to the distribution of income after taking the value of benefits received from publicly financed drugs, hospitals and physician services into account. This analysis is novel in that we estimated the distribution of health care expenditures and tax payments over the life course of Canadians and compared results with a more common approach that looks at the effect on one year only. A life course approach incorporates the fact that those in higher-income groups tend to live longer and therefore benefit from publicly funded health care services over a longer period.



Analysis in Brief

## Supporting Factors Influencing Health

### Our Vision

Better data. Better decisions.  
Healthier Canadians.

### Our Mandate

To lead the development and maintenance of comprehensive and integrated health information that enables sound policy and effective health system management that improve health and health care.

### Our Values

Respect, Integrity, Collaboration,  
Excellence, Innovation

#### Federal Identity Program

Production of this report is made possible by financial contributions from Health Canada and provincial and territorial governments. The views expressed herein do not necessarily represent the views of Health Canada or any provincial or territorial government.

In this study, we found that publicly financed health care has a redistributive effect on income, but that this effect is reduced when a life course perspective is considered. Our key findings are the following:

- Health care costs are higher for low-income groups, but differences are not as pronounced when estimated over the life course instead of in a single year (2011 in this analysis).
  - Average lifetime health care costs are \$237,500 per person in the lowest income group and \$206,000 in the highest income group—a difference of 15%. The difference is much larger (60%) when considering the effect on a single year (2011).
- Tax payments to finance health care are higher among higher-income groups but, like health costs, the differences between income groups are less pronounced when taking a life course perspective.
  - Over a lifetime, average annual tax payments to finance health care costs are approximately 8.5 times as high in the highest income group as in the lowest income group. A more pronounced difference of 10 times between groups is estimated when looking at 2011 only.
- Patterns of health care costs and tax payments for different income groups have an effect on the distribution of income.
  - Average annual health care costs represent 24% of the income of the lowest income group (\$4,220 of \$17,500) but 3% of the highest income group's average income (\$3,350 of \$114,900).
  - Although the corresponding tax payment amounts are much higher in high-income groups, in an average year over a lifetime, the lowest income group pays 6% of its income toward publicly funded health care services; the highest income group pays just less than 8%.
  - Lifetime average after-tax income in the highest income group is 5.1 times the income of the lowest group; after adding the dollar value of health care costs, the gap was reduced to 4.3 times.

## Glossary

**Income quintile:** Income quintiles are population groups that each represent one-fifth (20%) of the population. The population is first ordered by income, from lowest to highest, before the five groups are defined. The lowest income quintile represents the 20% of the population with the lowest incomes. The highest income quintile is the highest 20% of the population by income. The income concepts used differ based on data source and are described in Appendix C. For tax data, the bottom income quintile represents people earning less than \$24,000 and the top quintile is those earning more than \$72,000, based on household income before taxes and adjusted for household size.

**Net gain/loss:** In this study, the net gain or loss is the difference in the average value of health care services received after subtracting the corresponding payments made through taxes. For example, on average, the value of health care services used by lower-income groups is greater than the amount they pay in taxes, resulting in a net gain.

**Progressivity:** Progressivity refers to how much tax payments and the value of benefits received change with increasing income. A progressive health care benefit is one where average health care expenditures, as a proportion of income, decrease as the income of the recipient increases. Tax payments are defined as progressive when they increase, as a proportion of income, as income increases. For example, federal income taxes in Canada are progressive in that there are different tax rates for different income brackets; as incomes increase, individuals pay more both in absolute terms and as a proportion of their income.<sup>1</sup>

**Redistribution:** In this analysis, redistribution refers to a change in the distribution of household income.<sup>2</sup> A simple way to look at the distribution of income is the ratio of income in the highest to the lowest income group. A change in that ratio before and after incorporating publicly financed health care expenditures and payments indicates that there has been a redistribution of income. Several analyses employ more complex measures, including Gini coefficients, concentration indices and Kakwani indices, to measure the redistributive effect.<sup>4, 5</sup> These methods are out of scope for this analysis.

**Progressive redistribution:** Progressive redistribution occurs when a change in the distribution of income reduces the ratio of income in the highest to the lowest income group, or more generally causes other measures of income inequality to decline. Regressive redistribution has the opposite effect.

## Introduction

Among the roles of the public sector in modern governments are providing certain goods and services as well as adjusting the distribution of income.<sup>3</sup> Publicly financed health care is a form of insurance that pools risks between healthy and sick. When general taxation revenue is a significant source of funds, public finance also has a redistributive effect in transferring income from the more to less affluent.<sup>6, 7</sup> The focus of this study is the redistributive effect of publicly financed health care: who pays for and who uses health care, and what is the resulting effect on the distribution of income in Canada.

In Canada, roughly 70%<sup>i</sup> of health care services are publicly financed.<sup>8</sup> Financing health care services through general tax revenue means that everyone contributes regardless of use, and that the use of publicly financed services does not depend on an individual's ability to pay.<sup>6</sup>

A stated objective of the tax system is to raise tax revenues in a way that is fair and efficient.<sup>1</sup> For example, Canadians with higher income are taxed at progressively higher personal income tax rates, which means they pay a higher proportion of their incomes in taxes.<sup>1</sup> On the other hand, commodity taxes, such as the Goods and Services Tax (GST), tend to be regressive, in that they represent a higher proportion of the income of lower-income groups.<sup>9, 10</sup> The effects of tax and cash transfer policies on the distribution of income have been commonly studied, and policies have been assessed for their effects on different groups.<sup>1, 11, 12</sup>

The distributional effects of public services, such as health care, have been less well examined, even though publicly financed programs are recognized as additional mechanisms by which governments can influence the distribution of income,<sup>1</sup> and health care represents a large and growing part of public-sector spending.<sup>13</sup> A common method of assessing the impact of health care services on income treats the value of health services used as a benefit received. Adding the dollar value of health benefits received through public financing to an individual's income has been shown to reduce measures of income inequality in countries with tax-financed systems, including Canada.<sup>2, 14</sup> This effect has also been demonstrated specifically within Canadian provinces.<sup>4, 15</sup>

There are important variations across age groups in health care use and tax payments that affect patterns of both over the life course. People tend to pay more in taxes when they are middle-aged<sup>1</sup> and to receive more in health care services when they are older.<sup>8</sup> Further, people in lower-income groups have shorter average life expectancies than those in higher-income groups<sup>16, 17</sup> and thus do not live as long in the periods of life when health costs are higher and tax payments are lower. The interactions among income, health and age suggest that average health care expenditures and taxes paid to finance health care are more evenly distributed when they are measured over the lifetime than when they are measured for a single year. Indeed, research from Australia and the United Kingdom using a life course perspective shows that this is the case.<sup>18, 19</sup>

This analysis estimates the effects of tax-financed publicly funded health care on different income groups. Health expenditures and taxes within each income group were combined to consider the effects of health financing in relation to the average income in each income group. In other words, the analysis explored what happens to the distribution of income after taking the value of benefits received from publicly financed health care into account. This analysis marks an advance in that it estimated lifetime distribution patterns of health care expenditures and payments that take life expectancy differences into account.

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i. The proportion of public funding of health care in Canada is just below the average among 30 member countries of the Organisation for Economic Co-operation and Development, where the public portion ranges from just less than 50% (Mexico and the United States) to roughly 86% of all health care costs (Norway and the Netherlands).<sup>8</sup>

Our goal was to contribute baseline distributional patterns of health care expenditures and tax payments. From here, options for financing sources or different health care use patterns could be considered and compared with the baseline to look at possible effects of changes to publicly financed health care on different income groups. The information is intended to be valuable to policy-makers and health system managers by demonstrating the importance of considering both the revenue and expenditure sides of the equation when it comes to publicly financed health care. Decisions made on both sides of this equation are likely to have distributional consequences on income in Canada.

## Approach

Lifetime distributions of the costs of health care services received and payments made through taxation were estimated in a manner similar to research that simulated the lifetime of a cohort based on information from a single point in time<sup>18, 19</sup> and other Canadian research on lifetime health costs.<sup>20</sup> Lifetime health expenditures and tax payments were estimated for a cohort as if it were exposed every year to the patterns observed in only a single year, in this case 2011. Results were based on the population age 20 and older in Canada, excluding the territories.<sup>ii</sup> The main steps in this approach included

- Estimating the current per capita costs of public-sector **health care** for hospitals, physicians and drugs by age and income group;
- Calculating the portion of household commodity and income **taxes** that would be required to cover the selected health care expenditures, and applying these proportions to estimate per capita taxes by age and income group; and finally
- Using these per capita estimates for 2011 to estimate **lifetime** distributional patterns of health costs and taxes by incorporating information on differences in mortality.

More details on the data sources and steps are provided in the appendices.

## Distribution of Health Care Expenditures

Health expenditures used in the analyses were based on the most recently available data for hospitals, physicians and drugs. These categories represent the three largest cost components of provincial and territorial government health expenditure for 2011, accounting for just more than two-thirds of spending (\$90 billion of \$131 billion).<sup>21</sup> More than 90% of total hospital and physician expenditures are paid for by governments, while less than half (38%) of total drug spending is financed by the public sector.<sup>8</sup>

Health expenditure data by income group is not routinely available. Therefore, it was necessary to use a mix of administrative and survey data sources to allocate costs to income groups. (For more details on health data sources and methods, see Appendix A.) Total health expenditures accounted for in the analysis were \$81 billion, for a population of 27 million people age 20 and older in the 10 provinces (Table 1). From these totals, per capita health expenditures<sup>iii</sup> by age and income group were calculated that pooled all users and reflected average costs of all beneficiaries covered in a year. Per capita costs by income and age group are shown in Figure 1. Health costs increase substantially with age, and there is generally a pattern of higher costs in lower-income groups.

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ii. While those younger than 20 do use health services, they were excluded from the analysis because they contribute little in taxes and because their health care distributions were assumed to be similar to those of their parents. Tax distribution data by income group for the territories was not available.

iii. The distribution of cost was based on patterns of services used, not the distribution of appropriate medically necessary care.

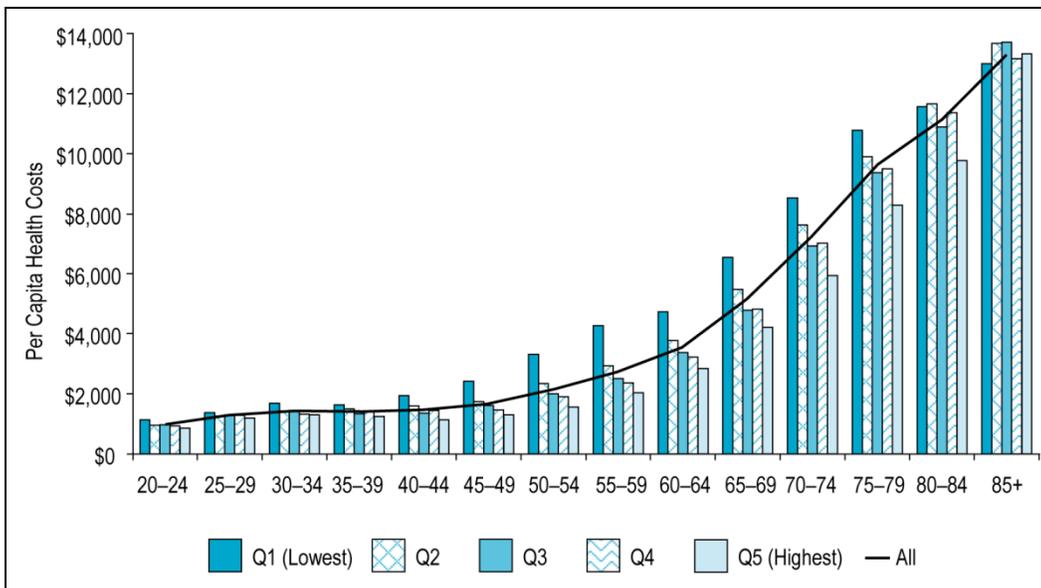
**Table 1: Total Public-Sector Health Expenditures, by Income Group, 10 Provinces, Population Age 20 and Older, 2011**

(\$ Billions)	Q1 (Lowest)	Q2	Q3	Q4	Q5 (Highest)	Total
<b>Total Health Costs</b>	\$21.3	\$18.1	\$15.2	\$14.2	\$12.6	\$81.4
<b>Drug Costs</b>	\$3.8	\$2.9	\$1.4	\$1.3	\$0.8	\$10.2
<b>Physician Costs</b>	\$6.5	\$5.3	\$4.6	\$4.2	\$3.9	\$24.5
<b>Hospital Costs</b>	\$11.0	\$9.9	\$9.2	\$8.7	\$7.9	\$46.7

**Source**

Analysis by the Canadian Institute for Health Information.

**Figure 1: Per Capita Public-Sector Health Care Costs, by Income Group and Age Group, 10 Provinces, Population Age 20 and Older, 2011**



**Source**

Analysis by the Canadian Institute for Health Information.

## Distribution of Taxes to Finance Health Expenditures

Most publicly funded health care expenditure in Canada (97%) is financed through provincial and federal governments.<sup>8</sup> In turn, roughly half of federal and provincial revenues come from two major tax bases—commodity taxes (such as sales taxes and gasoline taxes) and income taxes; commodity taxes make up a much larger share of provincial revenue than of federal revenue (Appendix B). For the purposes of this analysis, health care expenditures were assumed to be financed by provincial governments, and by the federal government through transfers, completely from these household tax revenues. In doing so, other revenue sources, such as corporate income taxes and resource royalties, were assumed to have the same distributional effects by income group. This assumption was necessary in the absence of data. Research on the direct and indirect effects of corporate taxes on different income groups is inconsistent, with no consensus on the distributional effects.<sup>12, 22</sup>

Federal government funding primarily takes the form of fiscal transfers to the provinces, which the provinces in turn use for a wide range of activities, including health care. As a result, this analysis assumed that federal fiscal transfers to the provinces are not earmarked, that de facto they contribute to general provincial revenues, a proportion of which is then used to pay for health services. Under these assumptions, the distribution of payments toward health care costs was estimated using data on household income and commodity taxes (Appendix B). In Canada’s 10 provinces in 2011, total federal and provincial household taxes were \$152 billion and \$129 billion, respectively, for the population age 20 and older (Table 2).

Consistent with methods in other research,<sup>18</sup> the amount of total tax payments was set up to exactly equal total health expenditures (\$81 billion). In order to do so, two fractions were calculated:

- First, the proportion of all federal income and commodity taxes that would be transferred to provinces, and therefore be available for health care expenditures; and
- Second, the proportion of provincial taxes, including these federal transfers, needed to cover the selected health care costs described in Table 1.

From these totals, per capita tax payments by income and age group were calculated that represented the average payments in each group (Figure 2). Unlike health care expenditures, tax payments tend to be highest in the middle age groups and lower in older age groups, and they have a significantly stronger gradient, with taxes increasing steeply with increasing income.

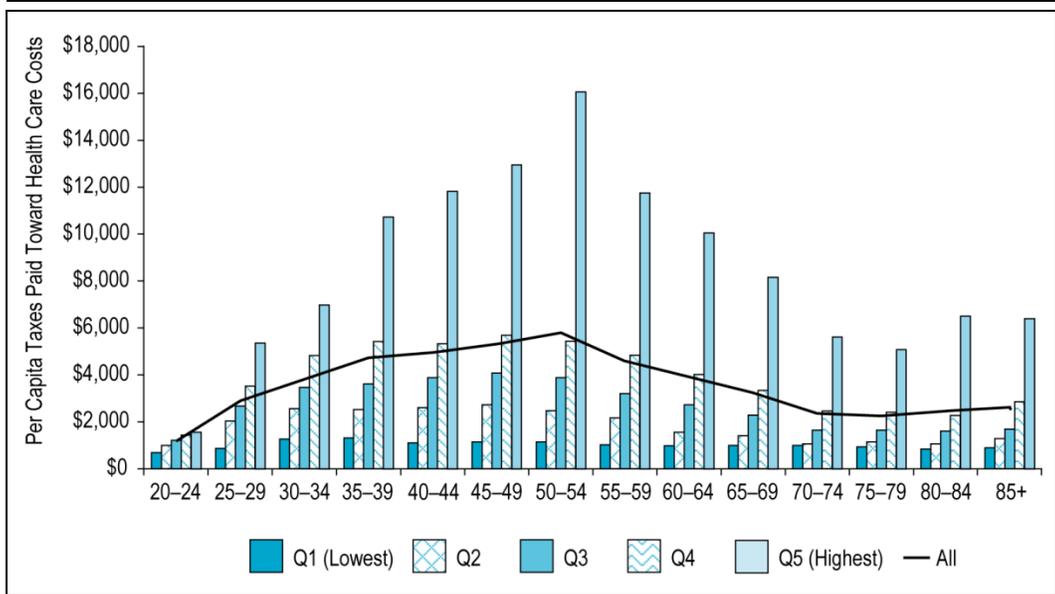
**Table 2: Total Tax Payments Toward Health Care Costs, by Income Group, 10 Provinces, Population Age 20 and Older, 2011**

(\$ Billions)	Q1 (Lowest)	Q2	Q3	Q4	Q5 (Highest)	Total
<b>Federal Household Income and Commodity Taxes</b>	\$4.8	\$10.4	\$19.2	\$31.7	\$85.5	\$151.6
<b>Provincial Household Income and Commodity Taxes</b>	\$6.9	\$12.0	\$19.2	\$28.5	\$62.5	\$129.1
<b>Tax Payments Toward Health Care Costs = 45% × (Provincial Taxes + 34% Federal Taxes)</b>	\$3.8	\$7.0	\$11.6	\$17.7	\$41.3	\$81.4

**Source**

Analysis by the Canadian Institute for Health Information.

**Figure 2: Per Capita Tax Payments Toward Health Care Costs, by Age and Income Group, 10 Provinces, Population Age 20 and Older, 2011**



**Note**

Income quintiles are defined within age groups in this figure. See Appendix C for more details.

**Source**

Analysis by the Canadian Institute for Health Information.

## Estimating Lifetime Distributions of Health Expenditures and Payments to Finance Health

The data assembled represents a cross-sectional picture of health expenditures and taxes by age and income group. Examining results in a cross-sectional analysis by income group alone fails to account for pronounced differences by age (figures 1 and 2). To address this, a simple simulation model, similar to life tables, was used to estimate how these patterns across age groups play out over a life course. The model simulated a cohort of 50,000 Canadians (10,000 in each income group) starting at age 20 and living to a maximum of 100. For each year while the individual record was age 20 to 24, it was assigned the average taxes and health expenditures of 20 to 24 year olds in that income quintile, based on figures 1 and 2. While in age groups 25 to 29, the record was assigned the corresponding averages for that age group, and so on to the end of the simulated record's life. Therefore, the assumption is that relationships among age, income, taxes and health expenditures for 2011, as shown in figures 1 and 2, are followed throughout the life course. The assumption of no movement of an age cohort between income groups over the life course is not completely realistic; this simplifying assumption was made to get a baseline. Research on movement of individuals between income quintiles shows that over a five-year period roughly half of people move between income groups; between 2009 and 2010, about 16% of Canadians moved up an income quintile and 14% moved down.<sup>23</sup>

It is important to consider differences in life expectancy when estimating life course results. Mortality patterns that differ by age, sex and income quintile were incorporated in the model and resulted in the life expectancies and survival patterns by income group shown in Table 3. On average, those in the highest income group live about five years longer than those in the lowest income group (Appendix C).

**Table 3: Survival and Life Expectancy Differences, by Income Group of Simulated Cohort**

	Q1 (Lowest)	Q2	Q3	Q4	Q5 (Highest)
<b>Percentage Alive at Age 65</b>	78%	84%	86%	87%	89%
<b>Percentage Alive at Age 75</b>	60%	66%	70%	72%	76%
<b>Percentage Alive at Age 85</b>	35%	39%	43%	44%	47%
<b>Life Expectancy at 20</b>	56.3	58.6	60.1	60.4	61.4

### Source

Analysis by the Canadian Institute for Health Information.

Annual health expenditures and tax payments for each year lived were accumulated for each income group over the life course. Average lifetime costs per person and average costs per year, also called annualized costs for the lifetime simulation, were calculated from these totals. These calculations were used to explore the following points:

- Cross-sectional distributions of health care expenditures and tax payments were compared with lifetime estimates to explore the extent to which a lifetime approach may even out distributional patterns across income groups.
- The net gains or losses in health care costs after taxes are paid at different ages over the lifetime were examined to show the transfers of resources that occur, which may not be between income quintiles only.
- Finally, health expenditures and tax payments are shown relative to average income, and the distribution of income before and after accounting for publicly financed health care was estimated. The dollar value of health benefits received was treated as an in-kind benefit and added to average income. The ratio of average income between income quintiles was calculated before and after incorporating health costs to estimate the possible redistributive effect. This approach is consistent with research that assesses the effects of government programs on income distribution.<sup>2, 14</sup>

## Results

### Distribution of Health Care Costs

Health care costs by income group under three alternative perspectives are shown in Table 4:

- First, the annual costs and percentage cost shares in each quintile are presented for 2011.
- Next, lifetime average per person and average annualized costs from the simulation are reported
  - First, with no differences in life expectancy; and
  - Second, accounting for differences in mortality by income groups.

The percentage of annual costs and lifetime costs are presented, representing the share of overall costs spent on the corresponding income group.

**Table 4: Cross-Sectional and Lifetime Health Cost Distributions**

	Cross-Section, 2011		Lifetime (Equal Life Expectancy)			Lifetime (Unequal Life Expectancy)		
	Annual Health Cost per Person	Percentage of Annual Costs	Lifetime Average Health Cost per Person	Annualized Health Cost per Person	Percentage of Lifetime Costs	Lifetime Average Health Cost per Person	Annualized Health Cost per Person	Percentage of Lifetime Costs
<b>Q1 (Lowest)</b>	\$3,860	25.4%	\$280,750	\$4,580	23.6%	\$237,470	\$4,220	21.5%
<b>Q2</b>	\$3,320	21.9%	\$246,270	\$4,020	20.7%	\$223,890	\$3,820	20.2%
<b>Q3</b>	\$2,880	19.0%	\$230,940	\$3,760	19.4%	\$219,200	\$3,650	19.8%
<b>Q4</b>	\$2,710	17.9%	\$227,370	\$3,720	19.1%	\$220,410	\$3,650	19.9%
<b>Q5 (Highest)</b>	\$2,410	15.9%	\$205,670	\$3,350	17.2%	\$205,670	\$3,350	18.6%
<b>All</b>	\$3,050	100%	\$238,200	\$3,880	100%	\$221,330	\$3,730	100%
<b>Ratio Q1/Q5</b>	1.60	1.60	1.37	1.37	1.37	1.15	1.26	1.15

#### Notes

The cost per year ratio is not the same as the cost per lifetime ratio because, while the number of records in each income group is 10,000, the number of years lived under the different life expectancy patterns varies.

The annualized lifetime costs are higher than the cross-sectional costs because the age structure of the lifetime cohort is older.

See Appendix D for more details.

#### Source

Analysis by the Canadian Institute for Health Information.

The 2011 cross-sectional results show annual public-sector health care costs for the lowest income group of \$3,860, which is 60% higher than the \$2,410 in average costs for the highest group. When differences in life expectancy were taken into account, less difference appeared in lifetime average health expenditures between the highest and lowest income groups. Every income group consumes close to 20% of lifetime costs. Lifetime average health care costs per person range from \$237,470 to \$205,670 for the lowest to highest income groups—that is, spending is 15% higher in the lowest income group than in the highest. Annualized average yearly costs across the lifetime are 26% higher in the lowest income group, reflecting fewer years lived in the lowest income group.

If all income groups had the same life expectancy as the highest income group, health care spending for the lowest income group would have been 37% more than spending for the highest group. These results were more similar to the cross-sectional results. Thus a portion of the evening out in the share of health care costs in each income group in the lifetime results appears to be due to differing life expectancy. The remainder of the analysis on lifetime results includes differing mortality.

## Distribution of Tax Payments to Finance Health

Turning to the financing side, Table 5 shows the distribution of taxes paid to finance health, in the context of the average incomes of each income group. Cross-sectional results were compared with annualized lifetime average and annual average values. The tax share distributions are quite similar. In both cases, the highest income group accounts for nearly half of the total taxes paid. The lifetime distribution is slightly less uneven, with the highest income group accounting for 47% of payments, compared with 49% in the cross-section. In the lifetime results, the ratio between high and low income groups is narrower than in the cross-sectional estimates, showing an evening out of the distributions of both average income and taxes paid.

**Table 5: Cross-Sectional and Lifetime Distributions of Taxes Paid Toward Health Care Costs**

	Cross-Section, 2011				Lifetime			
	Average Income	Share of Income	Annual Taxes Toward Health Care per Person	Share of Taxes	Lifetime Annualized Income	Share of Income	Annualized Taxes Toward Health Care per Person	Share of Taxes
<b>Q1 (Lowest)</b>	\$16,850	7.6%	\$740	5.0%	\$17,370	7.8%	\$1,020	5.6%
<b>Q2</b>	\$27,890	12.5%	\$1,360	9.2%	\$28,400	12.8%	\$1,910	10.4%
<b>Q3</b>	\$37,530	16.9%	\$2,210	14.9%	\$37,830	17.0%	\$2,780	15.2%
<b>Q4</b>	\$49,750	22.4%	\$3,260	22.1%	\$49,740	22.3%	\$3,960	21.6%
<b>Q5 (Highest)</b>	\$90,230	40.6%	\$7,210	48.8%	\$89,220	40.1%	\$8,650	47.2%
<b>All</b>	\$45,450	100%	\$3,050	100%	\$40,910	100%	\$3,730	100%
<b>Ratio Q5/Q1</b>	5.4		9.7		5.1		8.5	

### Note

Income refers to household disposable income: total income, transfers and capital gains minus income taxes, adjusted for household size to approximate an individual's after-tax income. See Appendix C for details on income quintiles.

### Source

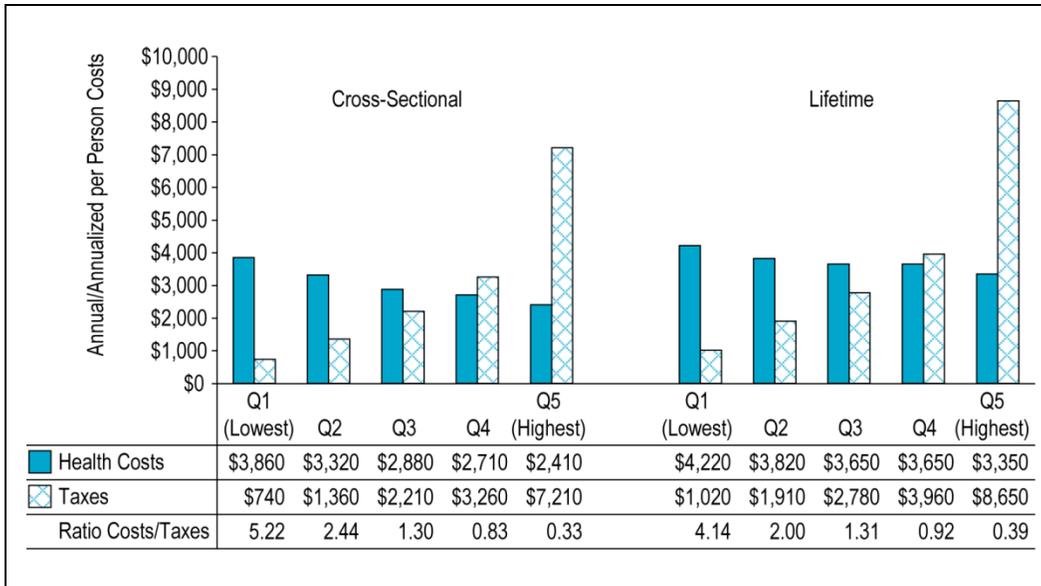
Analysis by the Canadian Institute for Health Information.

## Combining Health Care Expenditures and Tax Payments

Health care expenditures and financing are brought together in Figure 3, where cross-sectional and life course estimates for average annual health care costs and tax payments toward those costs are shown. From a cross-sectional perspective, those in the lowest income group received about \$3,860 in health care services in 2011, and they paid \$740 through taxes. In other words, they received more than five times as much as they paid. In contrast, for the highest income group, health care expenditures were about one-third of corresponding taxes paid.

Taking a life course perspective reduced the differences between the top and bottom income groups, though they were still large. The ratio of health care expenditures to taxes paid drops in the lowest income group, from more than five times to about four times higher; the corresponding ratio for those in the highest income group increases somewhat (from 0.33 to 0.39). Looked at another way, the ratio of health care services to taxes paid in the cross-sectional perspective ranges from 5.22 to 0.33, a wider range than the corresponding ratio for the life course perspective (4.14 to 0.39). Thus taking a lifetime perspective rather than the more conventional cross-sectional approach reduced the estimated distributional effects of publicly funded health care.

**Figure 3: Annual Cross-Sectional and Annualized Lifetime Health Care Costs and Tax Payments, by Income Group**

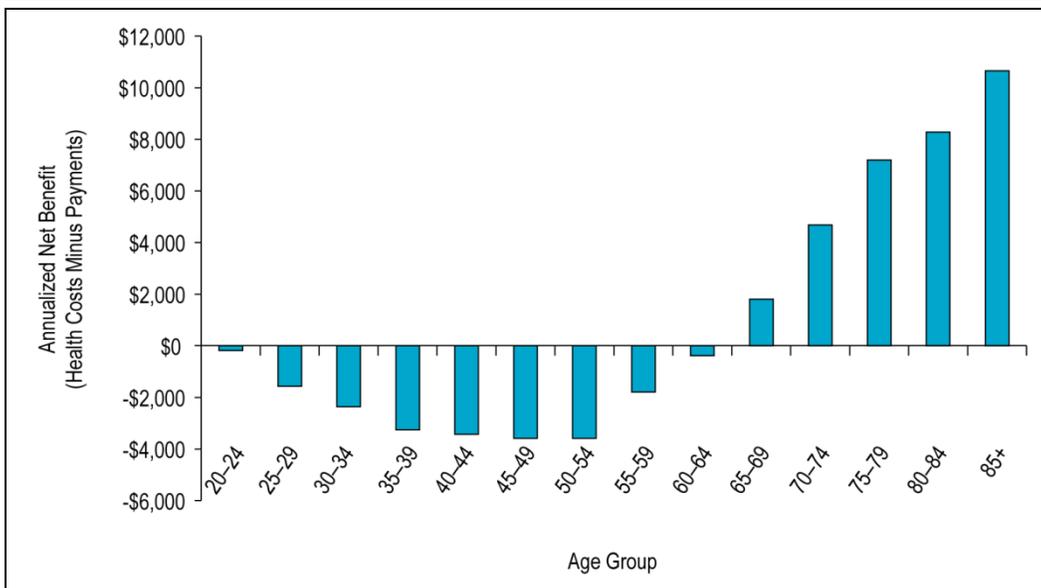


**Source**

Analysis by the Canadian Institute for Health Information.

The distribution of net gains or losses over the life course is shown in Figure 4, where average net gain or loss is shown by age group. A lifetime pattern unfolds, where on average younger age groups have a net loss (that is, they receive less in publicly financed health services than they pay in taxes toward financing these services) between the ages of 20 and 65. Older age groups (65+) are net gainers, in that they receive more in benefits from the health system than they pay. These results based on group averages do not distinguish within-group transfers in resources, where the healthy within each age or income group pay more than they use and the sicker use more than they pay.

**Figure 4: Annualized Net Gain or Loss in Dollar Value of Health Care Costs After Tax Payments, by Age Group**



**Source**

Analysis by the Canadian Institute for Health Information.

## Health Expenditures and Tax Payments in Relation to Income: Estimating Redistributive Effects

The value of health care expenditures and tax payments were considered relative to the income of each group and summarized in Table 6. In an average year in the lifetime, the highest-income group receives an average of \$114,900, of which it pays about 8% (\$8,650) toward publicly financed health care costs. The lowest-income group, while paying a lower amount in taxes (\$1,020) still pays 6% of its \$17,500 average yearly income toward health care costs. Tax payments made to finance health care are still progressive, but they are getting closer to being proportional to the average income in each group. In contrast, health expenditures make up a higher portion of lower-income groups' income, compared with higher-income groups, and represent a progressive benefit. The combination of progressive benefits and payment patterns results in a net gain of 18% of income in the lowest income group.

The value of health expenditures was then treated as a non-cash transfer or in-kind benefit and added to average disposable income. In this way, it was possible to estimate the redistributive effect across income groups attributable to publicly financed health care. Before considering the value of public-sector health care services, lifetime average income after taxes in the highest income group is 5.1 times the income of the lowest group. After adding the value of health care costs as an in-kind benefit, the gap reduced to 4.3 times between the lowest and highest income groups—a 16% reduction. In other words, incorporating the value of average services received through publicly financed health care evened out the distribution of income across income groups and had a progressive redistributive effect (cross-sectional results are provided in Appendix D).

**Table 6: Annualized Lifetime Health Care Costs and Payments in Relation to Average Income**

Annualized Lifetime	Q1 (Lowest)	Q2	Q3	Q4	Q5 (Highest)	Ratio Q5/Q1
<b>Average Income</b>	\$17,500	\$31,400	\$43,900	\$60,100	\$114,900	6.6
<b>Health Care Costs</b>	\$4,220	\$3,820	\$3,650	\$3,650	\$3,350	
<b>Health Care Costs as Percentage of Income</b>	24.1%	12.2%	8.3%	6.1%	2.9%	
<b>Tax Payments Toward Health Care</b>	\$1,020	\$1,910	\$2,780	\$3,960	\$8,650	
<b>Tax Payments Toward Health Care as Percentage of Income</b>	5.8%	6.1%	6.3%	6.6%	7.5%	
<b>Net Gain or Loss (Health Care Costs Minus Taxes)</b>	\$3,200	\$1,910	\$870	-\$310	-\$5,300	
<b>Net Gain or Loss as Percentage of Income</b>	18.3%	6.1%	2.0%	-0.5%	-4.6%	
<b>Average Disposable Income</b>	\$17,370	\$28,400	\$37,830	\$49,740	\$89,220	5.1
<b>Average Disposable Income Plus Health Care Costs</b>	\$21,590	\$32,220	\$41,480	\$53,390	\$92,570	4.3

**Note**  
Disposable income represents total household income plus transfers and capital gains minus income taxes. It was adjusted for household size and assigned to each individual in the household.

**Source**  
Analysis by the Canadian Institute for Health Information.

## Discussion

In 2011, total health expenditure was estimated at \$200 billion, with the public-sector share remaining relatively stable at 70% since 1997.<sup>8</sup> As the share of provincial expenditures dedicated to health care increased from 28% in 1993 to 35% in 2011,<sup>8</sup> the distribution of benefits across income groups may have changed, with some groups receiving more benefits or paying more to finance health through taxes.

This analysis estimated patterns in health care spending and tax payments to finance health across income groups, as well as the potential effects of these patterns on the income of each group using a life course perspective.

The analysis focused on public-sector spending for hospitals, physicians and drugs, which together represent approximately half of all health spending. Average lifetime health care expenditures were estimated to range from \$237,470 in the lowest income group to \$205,670 in the highest—a difference of 15%. Analyzing a single year showed more pronounced differences, with health care costs that are 60% higher in the lowest income group than the highest. One driver of the evening out of health care expenditures across the life course is higher life expectancy among higher-income groups: people in these groups live longer in the years when health care expenditures are higher and tax payments are lower. The evening out of health care costs over the life course is consistent with international research on lifetime distributional patterns.<sup>18, 19</sup> In some cases, larger differences in lifetime health care costs between income groups have been observed, where the costs in the lowest income group were twice as high<sup>18</sup> and lifetime differences remained 50% to 60% higher.<sup>20</sup> This may be because an area-based measure of income was used to analyze hospital and drug distributions. Compared with individual measures, area-based measures have been shown to underestimate differences in health.<sup>17</sup>

Average annual publicly financed health care costs over the lifetime represent nearly one-quarter (24%) of the income of the lowest income group, compared with 3% of the highest group's income—making it a progressive benefit. While not considered in detail here, research has shown that some types of health care spending are more progressive than others. Public spending on drugs is consistently higher in lower-income groups; this is in part by design, since some provincial programs subsidize lower-income groups.<sup>24</sup>

Tax payments made to finance health care are much higher in higher-income groups, but differences become less pronounced over a life course, due in part to the averaging out of periods of higher and lower incomes across age groups. A study from the United Kingdom showed that the share of tax payments paid by the top two income deciles ranged from 53% at a single point in time to 42% in the lifetime analysis.<sup>19</sup> In the analysis presented here, the share of payments made in the highest income quintile was reduced from 49% at a point in time to 47% using a life course perspective. The assumption made here to keep lifetime income group fixed may be one reason there is a smaller evening out in the distribution of tax payments in the life course perspective in this analysis. An older cross-sectional study in Manitoba for 1986 and 1994 showed that there was a more-even distribution in payments, with the highest income quintile making 42% of total payments to finance health care costs.<sup>15</sup>

While the amounts paid in taxes to finance health care costs are much higher in the highest income groups, the proportion of average income that these tax payments represents is more similar. Tax payments make up about 6% of income in the lowest income group and 8% in the highest income group—still a somewhat progressive pattern. This is consistent with an Alberta-based analysis showing a similar range in financing payments as a proportion of income; the range in that study was from 5% to 11% in the lowest and highest income groups, respectively.<sup>5</sup> Other provincial analyses show that tax payments may be closer to proportional. In an analysis from British Columbia, payments toward publicly financed hospital and physician services ranged from just less than 4% of income in the lowest income groups to just more than 5% of income among the highest.<sup>4</sup> The Alberta study also found that federal financing is more progressive than provincial financing, but since health care is funded primarily through provincially generated revenues, federally financed health care has a smaller overall effect.<sup>5</sup> In addition, federal revenues come in larger part from income taxes, which are progressive,<sup>1</sup> while provincial revenues come in larger part from commodity taxes, which have been shown to be regressive.<sup>9, 10</sup>

After the age of 65, when populations reach retirement age, contribute less in taxes and use more in health services, people on average use more services than they pay for through taxes in a year. However, they have paid more on average than the value of health services used at earlier stages in life. In both Australia and the United Kingdom,<sup>18, 19</sup> roughly 70% of the total value of health care services received in a lifetime within each income group was paid for by the individuals themselves at some point in life.

The progressive distributions of health expenditures and tax payments combined have an impact on the distribution of income by reducing a broad measure of income inequality. The value of health care services received was added to average income, treating it as an in-kind benefit. Assuming one dollar spent on services is equivalent to one dollar of value to the recipient of the services is a standard way to estimate the income value to individuals of public services such as health care, although it does not necessarily reflect the user's value.<sup>14</sup> Lifetime average disposable income in the highest income group is 5.1 times the income of the lowest group. Incorporating the value of health benefits reduced the gap to 4.3 times, a reduction of 16%. These results are comparable to cross-sectional research showing that the ratios of income between groups before and after in-kind health benefits were included were 4.9 to 4.2.<sup>2</sup> A Manitoba study based on data from 1994 also showed that the top to bottom ratio of income between deciles went from 3.4 to 2.8 after incorporating the dollar value of health benefits.<sup>15</sup> Both public and private health care costs were examined in an Alberta study. Public finance reduced income inequality, while private financed increased it.<sup>5</sup> Therefore, understanding the mix of health service financing options is an important part of the overall picture of the effects of health care financing on the distribution of income.

## Limitations and Future Work

Several assumptions and limitations should be kept in mind as context for these results. Assessing the distribution of health care expenditures and tax payments across income groups involves significant challenges, given a range of data limitations (discussed in the appendices). Of particular note, there are important data gaps, namely public-sector costs for institutional or long-term care settings, where costs by income group are not easily attributed. Incorporating these costs would mark a significant improvement in assessing the distributional effects of health care services. Health care costs have been shown to be much higher at the end of life and also to have varying patterns of inequity based on types of expenditures, where in some cases higher-income groups have higher average costs.<sup>25</sup> Finally, analysis based on group averages masks differences within income groups; therefore, the proportion of people using services in each income group, and to what extent there are high users of services, was not considered in this analysis.

The analysis in this study represents an important step in estimating the distributional effects of publicly financed health care from a life course perspective. Future analyses could look more at the effects of potential policy changes to health financing, including the distributional effects of different mixes of provincial and federal funding or mixes of revenue sources from income and commodity taxes. In addition, distributional patterns by household types, between sexes or across provinces could be incorporated to better understand effects on these populations. Other key improvements to the model would be incorporating income mobility and measures of health to separate out transfers between healthy and sick groups, as well as separating out types of health care costs to better understand their respective impacts. With these improvements, models such as this would more readily enable researchers to test the distributional consequences of changes to health care use or financing.

## Conclusion

Canada's publicly financed health care system is a right of citizenship, providing everyone with a substantial level of guaranteed care from hospitals and doctors. At their most fundamental level, these categories of publicly financed health care represent insurance against illness, and they pool and redistribute risk between the healthy and the ill at every age. Additionally, publicly financed health care also acts to redistribute income from the more to less affluent by overlaying patterns of progressive health benefits and tax payments. Measures of income inequality are reduced when publicly financed health care is taken into account. Income inequality is strongly linked conceptually to inequalities in health. However, to what extent reductions in income inequality through health financing would affect health or inequalities in health remains challenging to measure.

The impact of taxation policies on the distribution of income is commonly studied, in contrast to the effects of publicly provided services like health care. Publicly financed health care does play a role in redistributing income. As a result, changes to health care financing policy can also be considered for their distributional effects in a more systematic way, similar to the analyses undertaken for tax policy options. To this end, data and methods for studying the distributional effects of health care need to be further developed and standardized, and considered from a life course perspective.

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## Appendix A: Health Care Use and Expenditure Data

The distribution of publicly financed health care costs was estimated in two steps for each of hospital, physician and drug costs:

- First, utilization patterns and associated costs for hospitals, pharmaceuticals and physician services were estimated by income group, five-year age group and sex using several administrative and survey sources, as described below.
- Second, using National Health Expenditure Database (NHEX) distributions of total costs for all provinces combined, an income distribution within each age and sex group was estimated based on usage information, preserving aggregate costs. Due to data availability, only the 10 provinces were included in the analysis for the population age 20 and older.

### Hospitalization Cost Distribution

The distributions of inpatient, day surgery and emergency hospitalization costs were obtained using the Discharge Abstract Database, Hospital Morbidity Database and National Ambulatory Care Reporting System for 2010. Each hospital visit was assigned a Resource Intensity Weight (RIW). RIWs are cost weight values relative to average typical inpatient case information submitted to the Canadian Patient Cost Database, based on the 2009 Case Mix Group methodology. Methodology specific to Day Procedure Groups and the Comprehensive Ambulatory Classification System was used to assign corresponding day surgery weights relative to inpatient weights. To estimate the average cost per typical case, cost per weighted case estimates based on hospital inpatient expenses (both direct and indirect) from the Canadian MIS Database were used.

*Hospitalization Costs = Sum of Resource Intensity Weights × Cost per Weighted Case*

- Cost values were assigned to a patient record based on the province in which care was received. They were based on 2010 data for all provinces except Prince Edward Island and Quebec, for which 2009 was the most recent data year.
- Various other exclusions were made because use or cost data was not available. Mental health hospitalizations for Ontario are captured in the Ontario Mental Health Reporting System and were excluded from costs, as methods are not yet well established. Emergency department visits are available for Ontario and Alberta only.
- Income quintile, based on 2006 Census information, was linked to hospitalization data based on the Postal Code Conversion File and methodology developed by Statistics Canada (PCCF+ version 5G).<sup>26</sup> Postal codes are not on Quebec hospitalization records; therefore, a pre-linked file previously provided was used to link hospitalization data to income information. Records missing postal code or income quintile were excluded.
- The costs of all types of hospitalizations were combined to get total costs by income quintile, age group and sex for the 10 provinces combined for the population age 20 and older. The distribution of costs by income quintile was calculated within each five-year age–sex category.

### Drug Cost Distribution

Information from the National Prescription Drug Utilization Information System Database was used to estimate the distribution of publicly financed drug costs by income group. As for hospitalizations, neighbourhood income was linked to provincial databases by postal code, where full postal codes were available. Alberta was missing data for non-seniors covered under the public plan and was excluded. Manitoba and P.E.I. were the only two provinces with full postal codes and that, during testing, had consistent cost patterns by income group for both 2006 and 2011 that were comparable with NHEX totals. Therefore, drugs claims data for 2011 was used for these two provinces combined to estimate the distribution of costs by income quintile, within each age and

sex group. In other words, age and sex totals were maintained, and the best available data was used to allocate totals in each group to income groups. Drug costs have been shown to be consistently higher in lower-income groups, both in studies of publicly financed drug coverage for seniors<sup>27</sup> and in analyses of prescription drugs.<sup>28</sup> The higher health care costs observed in lower-income groups in publicly financed drug claims is due in part to specific programs targeted to these groups.<sup>24</sup>

## Physician Cost Distribution

Data from the Canadian Community Health Survey (CCHS) for 2009–2010 was used to estimate the number of general and specialist physician consultations by income, age and sex group, weighted to the Canadian population. The survey covered the population age 12 and older, excluding persons living on reserves, full-time members of the Canadian Forces, and people living in institutions and some remote areas.<sup>29</sup> To estimate total costs, and to then estimate the cost distribution by income group, national average costs per visit for general and medical specialist consultations were sourced from the National Physician Database for 2010<sup>iv, 30</sup> and were multiplied by number of visits, as follows:

*Physician Costs = (Number of General Practitioner Visits) × \$40.51 + (Number of Specialist Visits) × \$72.51*

## Allocating Health Care Cost Totals Using Cost Distributions

NHEX total and per capita costs and population counts for 2010<sup>8</sup> (the most recent year at the time) formed the base from which health expenditures were allocated to income groups within each five-year age and sex group using the cost distributions of the bottom-up analysis described above. Provincial government health expenditures by age and sex were inflated to projected total provincial costs for hospitals, physicians and drugs for 2011 for the 10 provinces and the population age 20 and older. In other words, while the most recent data for age and sex totals was from 2010, these totals were projected to 2011.

Total cost estimates for 2011 for all three sources were \$81 billion, broken down into

- \$47 billion in hospitalization costs;
- \$24 billion in physician costs; and
- \$10 billion in drug costs covered by provincial governments.

Per capita estimates were based on 27 million Canadians: the population of the 10 provinces age 20 and older, sourced from Statistics Canada's demography division.

Per capita estimates representing average costs of health services used in each age, sex and income group were assigned to each individual in the group. In this analysis, these costs were treated similarly to insurance premiums. Each person's insurance premium in this case is paid by the government and set up so that what the government funds is equivalent to funding a (non-profit) insurance policy where everyone in the same age, sex and income group costs the same amount.<sup>31</sup>

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iv. Table B.3.1: Family Medicine—Cost per Service by National Grouping System Strata and Province/Territory, 2010–2011 and Table B.3.2: Medical Specialists—Cost per Service by National Grouping System Strata and Province/Territory, 2010–2011 were used to obtain national cost averages for total consultations and visits.

## Appendix B: Taxes

A breakdown of the main sources of federal and provincial revenue is shown in Table B1. Household income taxes make up nearly half of federal revenue and about one-quarter of provincial revenue. Commodity taxes or sales taxes account for the next-largest portion of revenues, at 16% and 18%, respectively. Corporate taxes, investment income and other sources of revenue are not easily attributed to individuals or income groups. Consistent with other analyses, tax revenues to finance health were assumed in this analysis to be sourced entirely from household taxes.<sup>15, 18</sup>

**Table B1: Revenue Sources for Federal and Provincial/Territorial Governments, and Comparable Survey Source Household Tax Totals**

	2011 (\$ Millions)	Percentage
<b>Federal Government Revenue Sources</b>		
<b>General Government Revenue</b>	\$240,918	100%
<b>Household Income Tax</b>	<b>\$118,764</b>	<b>49%</b>
<b>Commodity/Excise Taxes (e.g. GST)</b>	<b>\$38,190</b>	<b>16%</b>
<b>Corporate Income Tax</b>	\$32,838	14%
<b>Contributions to Social Insurance Plans</b>	\$18,614	8%
<b>Excise Duties and Custom Import Duties</b>	\$7,411	3%
<b>Investment Income (Royalties, Interest)</b>	\$8,884	4%
<b>Sales of Goods and Services</b>	\$7,345	3%
<b>Other (Taxes From Non-Residents, Other Production Taxes, Other Transfers)</b>	\$8,872	3%
<b>Provincial/Territorial Revenue Sources</b>		
<b>Provincial/Territorial Revenue (Minus Federal Transfers)</b>	\$293,152	100%
<b>Household Income Tax</b>	<b>\$74,956</b>	<b>26%</b>
<b>Provincial/Territorial Sales Taxes</b>	<b>\$52,397</b>	<b>18%</b>
<b>Gasoline and Motive Fuel Taxes</b>	<b>\$8,334</b>	<b>3%</b>
<b>Liquor, Gaming, Amusement and Other Taxes</b>	<b>\$15,476</b>	<b>5%</b>
<b>Corporate and Government Business Enterprises Income Tax</b>	\$23,533	8%
<b>Contributions to Social Insurance Plans</b>	\$11,453	4%
<b>Taxes on Production (Licenses, Property Taxes, Payroll Taxes)</b>	\$24,310	8%
<b>Investment Income</b>	\$34,941	12%
<b>Sales of Goods and Services</b>	\$33,342	11%
<b>Other (Transfers or Taxes)</b>	\$14,410	5%

### Sources

Statistics Canada. 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.

Statistics Canada. CANSIM Table 380-0081—Revenue, expenditure and budgetary balance—Provincial administration, education and health, annual (dollars).

<http://www.statcan.gc.ca/nea-cen/hr2012-rh2012/data-donnees/cansim/tables-tableaux/iea-crd/c380-0081-eng.htm>. Updated October 10, 2012.<sup>32, 33</sup>

Estimates of total and per capita household taxes by income, age and sex from the Social Policy Simulation Database and Model (SPSD/M) were provided by Statistics Canada for 2011.<sup>v</sup> The database combines individual administrative data from personal income tax returns with survey data on family incomes, employment and expenditure patterns.<sup>34</sup> The model portion applies effective tax rates such as sales taxes. In addition, goods and services tax exemptions on prescription drugs and other indirect tax policies also contribute to the financing of health care but are not considered in this analysis. Coverage does not extend to Yukon, Nunavut or the Northwest Territories. Therefore, these regions are not part of the tax portion of the analysis and were excluded from the overall analysis. Federal and provincial income tax payable amounts for households were allocated to individuals by adjusting for household size. Similarly, federal commodity taxes associated with household consumption were allocated to individuals. Provincial health values for B.C. and Ontario were also included in provincial taxes. Total federal and provincial household taxes considered in the model, for the population age 20 and older in the provinces only, were \$152 billion and \$129 billion, respectively.

## Proportion of Taxes to Finance Health

The proportion of federal and provincial taxes required to cover selected health care costs was calculated in two steps, summarized below. The first step was to estimate the proportion of federal taxes transferred to the provinces available to go toward health financing, assuming that all federal transfers come from household taxes. Canadian System of National Accounts data was used to estimate these transfers at approximately \$51 billion; this was less than the \$71 billion<sup>32</sup> in total transfers to the provinces, as transfers earmarked for the territories or other specific non-health programs were excluded. Transfers for official languages and the Canadian Social Transfer, while not directly for health, were considered as being in the overall funding bucket from which provinces could pay for health care costs.

$$\text{Proportion of Federal Taxes Transferred to Provinces} = \text{Federal Transfers} / \text{Federal Household Taxes} = \$51 \text{ Billion} / \$152 \text{ Billion} = 33\%$$

**Table B2: Selected Federal Transfers to Provinces/Territories, Estimates**

	2011 (\$ Millions)
<b>Total Federal Transfers to Provinces/Territories Potentially Used Toward Health Costs</b>	<b>\$51,311</b>
<b>Taxation Agreements (Equalization Payments)</b>	\$16,288
<b>Canadian Health Transfer</b>	\$24,593
<b>Canadian Social Transfer</b>	\$10,182
<b>Official Languages</b>	\$248

### Source

Adapted from Statistics Canada. 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.<sup>32</sup>

The second step was to calculate the proportion of total provincial household taxes, including federal transfers, needed to cover selected health costs. Using the total health expenditure estimate of \$81 billion, approximately 45% of the \$129 billion collected in provincial taxes plus \$51 billion in federal transfers is needed to cover these health costs completely from household income and commodity tax sources.

v. This analysis is based on Statistics Canada's Social Policy Simulation Database and Model. The assumptions and calculations underlying the simulation results were specified by CIHI, and responsibility for the use and interpretation of this data is entirely that of the authors.

The proportion (B) of total provincial taxes, including federal transfers, needed to cover health costs was calculated as follows:

$$\text{Health Costs} = (B) \times (\text{Provincial Taxes} + 33\% \times \text{Federal Taxes})$$

$$\text{\$81 Billion} = B \times (\text{\$129 Billion} + 0.33 \times \text{\$152 Billion})$$

$$B = 45\%$$

The proportion of taxes needed to cover health costs had to be recalculated for the life course results. Assuming the federal portion of transfers is fixed, the portion of provincial household tax revenue, including transfers, was calculated to determine what would be required to cover lifetime health costs.

## Appendix C: Income

Lack of income information in administrative health data sources required that linkage to area-based income information be used as a proxy. Further, four different measures were used to define income quintile based on the best available data for each information source for health care expenditures, taxes and mortality. Inconsistency among income concepts is an important limitation to this aggregate-level analysis. A summary of the key sources of information about income cut-offs is provided in Table C1.

The analysis used many definitions to bring together different costs and taxes. Further, the use of area-based income to link health costs to income groups has been shown to underestimate that relationship.<sup>17</sup> In addition, assuming quintile is fixed within each age group underestimates the extent to which lower-income groups pay for themselves and may overestimate lifetime redistribution.

Two versions of income quintiles were used to obtain distributions of provincial and federal taxes by income. For the cross-sectional results, one standard national quintile was used, with upper bounds as defined in Table C1. For the lifetime estimates, income quintiles defined within each five-year age group by sex were used to satisfy the assumption that the income group of a quintile is fixed throughout the lifetime relative to the rest of the cohort but that there is variation with age.

**Table C1: Characteristics of Income Quintiles**

Income Variable (Data Source)—Use in Analysis	Q1 Upper Bound	Q2 Upper Bound	Q3 Upper Bound	Q4 Upper Bound	Q5 Upper Bound
<b>Household Income Quintile (CCHS, 2009–2010)—Physician Visits</b>	\$21,000	\$34,286	\$47,059	\$65,217	Unlimited
<b>Household Income National Quintile (SPSD/M, 2011)—Tax Distribution for Cross-Sectional Model</b>	\$24,040	\$36,920	\$51,024	\$71,756	Unlimited
<b>Neighbourhood Income (2006 Census)—Hospital and Drug Costs<sup>35</sup></b>	32% in Low Income	18% in Low Income	12% in Low Income	8% in Low Income	6% in Low Income

### Notes

SPSD/M: Social Policy Simulation Database and Model.

Neighbourhood income quintile was based on 2006 Census data. It was adjusted for household size by dividing by the single-person equivalents implied by the 2006 low-income cut-offs (1.00 for 1 person, 1.25 for 2 persons, 1.55 for 3 persons, 1.95 for 4 or 5 persons, and 2.44 for 6 or more persons in the household). Quintiles were constructed within large centres separately, then pooled across areas, thus taking into account differences in housing costs in different areas, for example.<sup>26</sup>

In the SPSPD/M, adjusted household income was determined by taking household total income (sum of all market and transfer income in the household) and subtracting actual household capital gains, which was then adjusted for household size. The household size factors were set at 1.0 for one-person households, 1.4 for two-person households, 1.7 for three-person households, 2.0 for four-person households, 2.3 for five-person households, 2.6 for six-person households and 2.9 for seven-person households. Total household income minus household capital gains was then divided by the household size factors. The resulting adjusted household income was then applied to each individual in the household and the income quintile was determined.

### Source

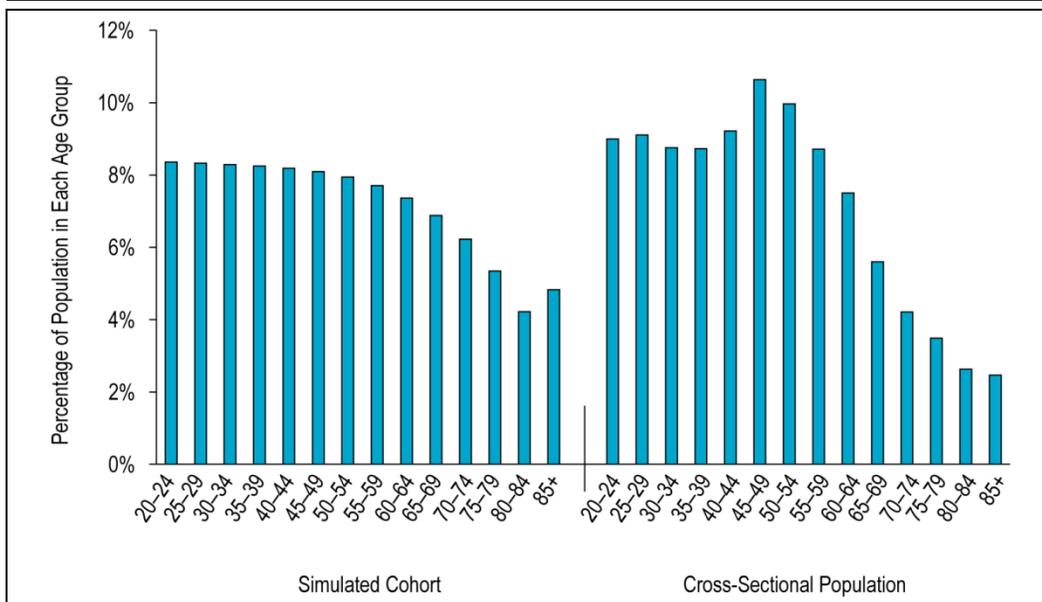
Analysis by the Canadian Institute for Health Information.

## Appendix D: Lifetime Analysis

Lifetime distributions of health care services and corresponding estimates of payments through taxation were estimated using an extension of standard life table methods. Life tables are the basis for widely used statistics like life expectancy. A life table starts with an arbitrary population, and then year by year exposes this population to age- and sex-specific mortality rates. This analysis proceeded similarly, except that instead of having two life tables, one for males and another for females, we had 10 life tables: each table included both sexes and one of five income quintile groups.<sup>vi</sup> In addition, at each age and for each sex and income group, average amounts of income, taxes paid and dollar values of health care services used were tracked. Five-year age groups were used rather than single years of age due to limitations in allocating health care costs and taxes to income, age and sex groups. Finally, instead of using spreadsheets for these calculations, a small micro-simulation model was used that produced identical results (subject to only Monte Carlo error, which was kept small) and that allowed the analysis to be much more easily generalized.

The analysis employed a micro-simulation model tool (ModGen).<sup>36</sup> The simple model simulated a cohort of 50,000 Canadians, with 10,000 in each income quintile, from age 20 until death or age 100. At age 20, a simulated record was assigned an income quintile and sex. With each year of life, average annual health care costs, tax payments and taxes were assigned to each record based on its income, age and sex, assuming that mortality and cost patterns were fixed at the same level as the inputs. The year of death for each record was generated randomly, with the probability of dying based on current research on mortality rates for 2008<sup>37</sup> and differences in mortality by age, sex and income group.<sup>17</sup> By taking every observation for every year of the simulated record's life, we could look at each observation or year lived as if it were a separate observation of adults of every age, resulting in a population age structure (as seen in Figure D1). The cross-sectional population clearly shows the bulge of the baby boom population, which is just beginning to move into the age 65+ range. The life table population for the simulated population was, on average, older.

Figure D1: Age Distribution of Simulated Cohort and 2011 Cross-Sectional Population



**Source**

Analysis by the Canadian Institute for Health Information.

vi. While the underlying per capita data and subsequent analysis were stratified by sex, this study focused on results for males and females combined.

**Table D1: Cross-Sectional Health Care Costs and Payments in Relation to Income**

<b>Annual Cross-Sectional (2011)</b>	<b>Q1 (Lowest)</b>	<b>Q2</b>	<b>Q3</b>	<b>Q4</b>	<b>Q5 (Highest)</b>	<b>Ratio Q5/Q1</b>
<b>Average Adjusted Household Income</b>	\$16,700	\$30,400	\$43,800	\$60,700	\$117,200	7.0
<b>Health Care Costs</b>	\$3,860	\$3,320	\$2,880	\$2,710	\$2,410	
<b>Health Care Costs as Percentage of Income</b>	23.1%	10.9%	6.6%	4.5%	2.1%	
<b>Taxes Toward Health</b>	\$740	\$1,360	\$2,210	\$3,260	\$7,210	
<b>Taxes Toward Health as Percentage of Income</b>	4.4%	4.5%	5.0%	5.4%	6.2%	
<b>Net Gain or Loss (Health Care Costs Minus Taxes)</b>	\$3,120	\$1,960	\$670	-\$550	-\$4,800	
<b>Net Gain or Loss as Percentage of income</b>	18.7%	6.4%	1.5%	-0.9%	-4.1%	
<b>Average Adjusted Household Disposable Income</b>	\$16,850	\$27,890	\$37,530	\$49,750	\$90,230	5.4
<b>Average Disposable Income + Health Care Cost</b>	\$20,710	\$31,210	\$40,410	\$52,460	\$92,640	4.5

**Source**

Analysis by the Canadian Institute for Health Information.

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