

SOCIETY OF ACTUARIES

Funding Public Health Insurance Plans Canada and Globally

SOA Research Report

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Background

Have Associates has been engaged by the Society of Actuaries (SOA) to review the funding of public health insurance in Canada and other Organisation for Economic Co-operation and Development (OECD) countries.

With costs ever increasing as a percentage of GDP, public health care and its costs are now receiving greater attention. Given actuaries' strong analytical and modeling skills, actuaries could have a larger role in evaluating funding models for public health care plans or the examination of public health care costs and trends. This report will serve to identify areas where actuarial analysis can provide additional insights.

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Executive Summary

Most countries, especially the Organisation for Economic Co-operation and Development (OECD) nations, have some version of public health insurance. Their current funding and delivery models are largely the result of their own history. Some Nordic countries have had some form of public health insurance for over 200 years while others have relatively new programs.

With overall health care spending (public and private) now exceeding 10 percent of gross domestic product (GDP) in most OECD countries—up significantly in the last 20 years, and with the recent financial downturn along with aging populations—health care spending is receiving significant attention in all OECD countries. Public health care operations and budgets are being reviewed carefully to limit annual cost increases to no more than growth in GDP. Hence, much attention is currently being given to developing health care metrics that allow countries to compare themselves with other OECD countries in order to identify any relative inefficiencies in their health care system. Direct comparison by country can be complex because each country's population demographics and current overall health care status will vary. A country with an older underlying population or whose population is experiencing more illness and disease than countries with a healthier or younger population may actually need to incur larger health care costs to produce similar outcomes.

This report briefly looks at the actual health care funding models and metrics in seven countries (Canada, Sweden, France, Germany, Switzerland, the United Kingdom, and the United States) along with health care metrics for another 13 countries (20 OECD countries in total).

Except for public health care plans requiring some level of prefunding, actuaries have had very little input into the evaluation and management of public plans. Even as countries develop metrics linking the cost of health care to outcomes, a natural role for actuaries, actuaries have been excluded during the process. Actuaries can develop health care metrics from a population demographics vantage point that include health care cost while taking a longer-term view and quantifying the core issues in simple terms. This report suggests a number of possible areas where actuaries could provide expertise to assist in the management of public health care plans.

Health Care Funding Models

Funding for health care costs vary by country and may come from a number of sources, such as:

- Regular government (G) taxes: federal, province, state, region, county, or municipal
- National (N) sources: payroll taxes
- Mandated (M) insurance: insurance premiums
- Private insurance (P)
- Patients' out-of-pocket payments (OOP).

N, M, and P countries use regular government subsidies to fund health care costs for their seniors, disabled and those with low income.

All countries use a combination of three or four of the above funding sources. In this report, each country has been assigned a main funding type based on the funding model used for the core hospital and physician services for their main population—not seniors, disabled, or low-income. This assignment allows for analysis by funding type to identify the advantages of each.

Funding Model by Country			
G	N	M	P
Canada	Austria	Germany	United States
UK	Belgium	Netherlands	
Ireland	France	Switzerland	
Australia			
New Zealand		Japan	
Denmark			
Norway			
Finland			
Sweden			
Italy			
Portugal			
Spain			

A quick review of the above table suggests that neighbouring countries or those with prior or current government affiliations have tended to adapt similar funding models for their health care.

The table below show the sources of funds, for total 2010 health care costs, by the main funding types. On average, the cheapest by percentage of GDP is the G funding model at 9.8 percent. Canada uses the G funding model.

Average Source of Funds by Main Funding Type (%)						
Main Type	Countries	% GDP	Govt	N + M	Private	OOP
G	12	9.8	73.0	3.5	6.8	16.7
N	3	11.0	17.2	59.5	9.3	14.0
M	4	11.1	11.2	63.2	7.9	15.8
P	1	17.6	13.4	39.7	35.1	11.8
All	20	10.7	49.3	25.7	8.8	15.9
Canada		11.4	69.2	1.3	14.9	14.7

While the United States has a P funding model for 35.1 percent of their health care expenses, G, N, and M funding models still account for 53.1 percent of health care costs primarily for its seniors, disabled, and low-income populations. Out-of-pocket costs account for the remaining 11.8 percent of costs. The United States is currently transitioning to an M funding model as a result of the Affordable Care Act.

In 2010 total health care expenses (including private insurance and out-of-pocket expenses), for the 20 OECD countries, averaged 10.7 percent of GDP (ranging from 8.9 percent for Ireland to 17.6 percent for United States). In 1990, the comparable figures averaged 7.6 percent, with Ireland at 6.0 percent and the United States at 12.4 percent. Canada moved from 8.9 percent in 1990 to 11.4 percent of GDP in 2010.

For many years, increases in health care costs have exceeded increases in GDP—both in aggregate and on a per capita basis. For the 20 OECD countries, from 1990 to 2010, the average per capita real growth rate for health care costs was 3.2 percent per annum compared with real growth in income per capita of just 1.4 percent. This represents a 1.8 percent real annual increase in health care costs over the growth in income per capita. On average, aging contributed 0.5 percent per annum of those increases. Health care has been taking a larger and larger share of every country’s GDP.

Over the same period, Canada’s real per capita health care costs grew at 2.6 percent with income at just 1.3 percent per annum. Canada’s annual increase due to aging was also 0.5 percent.

On average, for the OECD 20, it appears that the real growth in health care costs is slowing—from a high of 3.9 percent per annum for the 1995–2005 period to just 2.2 percent for the 2005–10 period. Was this slowing caused by the recent economic events of 2008–10? Is this reduction in growth temporary or permanent? Canada’s economy was not hit nearly as hard as some other countries, and its health care costs still grew at 3.1 percent for the period 2005–10; recently these also appear to be slowing.

Measuring Health Care Outcomes

Measuring health care outcomes and efficiencies that produced those outcomes has dominated much of the OECD health care literature for the last 10 years. Many health care metrics are in use. At a high level, mortality metrics shown below are frequently cited. Mortality metrics from 1990 to 2010 have shown significant improvements:

- **Life expectancy** at birth continues to increase

2010 Life Expectancy at Birth with Increase Since 1990				
Main Type ▼	Female	F +	Male	M +
G	83.3	4.1	78.5	5.6
N	83.7	3.9	77.8	5.2
M	84.3	3.9	79.2	5.3
P	81.1	2.3	76.2	4.4
All	83.5	3.9	78.4	5.4
Canada	83.1	2.3	78.5	4.1

- **Infant mortality** has been reduced by over 50 percent, on average, over the last 20 years

Annual Infant Mortality / 1000			
Main Type <input type="button" value="v"/>	1990	2010	Reduction
G	7.7	3.5	54%
N	7.7	3.7	52%
M	6.4	3.3	48%
P	9.2	6.1	34%
All	7.5	3.6	51%
Canada	6.8	5.1	25%

- **Potential years of life lost (PYLL)** prior to age 70 provides an estimate of the average additional years a person would have lived if they had not died prematurely prior to age 70. Some view mortality prior to age 70 as mostly avoidable mortality—hence, a good measure of the access and quality of a country’s health care system.

PYLL is derived by weighting the deaths, according to the country’s current mortality rates, at each age by 70-age. This gives higher weights to younger than older deaths.

Annual PYLL / 100K			
Main Type <input type="button" value="v"/>	1990	2010	Reduction
G	5,142	3,103	40%
N	5,253	3,447	34%
M	4,507	2,808	38%
P	6,382	4,870	24%
All	5,093	3,184	37%
Canada	4,817	3,217	33%

The improvement in PYLL, over the last 20 years, was obviously influenced by reduction in infant and younger age mortality. The United States continues to lag other nations and showed less improvement over the 20-year period.

One way actuaries can contribute to the management of public health care plans is to refine some of the measurement methodologies or develop additional outcome measures. For example, an actuarial analysis of PYLL by population segments such as age groups and socioeconomic status would provide further insights, possibly making it easier to identify the efficiencies and inefficiencies within a health care system.

Lifestyle Index

Future population health, health care costs, and needs are influenced by current health status as well as future health status as predicted by a country's lifestyles. This report introduces a Lifestyle Index, by country, as a combination of alcohol consumption levels, smoking, and obesity prevalence rates. While alcohol consumption and smoking have declined, obesity is on the increase. A higher Lifestyle Index will result in poorer health, leading to higher health care needs and costs now and in the future.

The Lifestyle Index is simply determined as

$$\begin{aligned} & (\text{ONE}) \times \text{alcohol consumption} + \\ & (\text{TWO}) \times \text{smoking prevalence rate} + \\ & (\text{THREE}) \times \text{obesity prevalence rate}. \end{aligned}$$

The Index varies from 55.3 (Japan) to 123.2 (United States). Canada's is 93.3. The values indicate expected variation in current and future costs as well as future chronic health disorders such as diabetes. This report suggests health care costs alone will vary by about 10 percent of the difference in the Index value. Hence, someone who is obese can be expected to incur about 30 percent more in health care costs, over their lifetime, than someone who is not obese. Hence, the United States can expect 10 percent of $(123.2 - 55.3)$ or 6.8 percent more in health care costs than Japan—solely as a result of lifestyle differences.

The Lifestyle Indices for other countries are shown below.

Japan has the lowest Lifestyle Index of 55.3:

- Lowest infant mortality rate (2.3 per 1,000) and highest female life expectancy (86.4 years).

Sweden has a Lifestyle Index of 74.0:

- Lowest PYLL (2,487).

Switzerland has a Lifestyle Index of 75.1:

- Highest male life expectancy (80.3 years).

Canada has a Lifestyle Index of 93.3:

- Female life expectancy of 83.1 years
- Male life expectancy of 78.5 years
- Infant mortality rate of 5.1
- PYLL of 3,217.

Report Conclusions

Based on costs as percentage of GDP and mortality, life expectancy, and PYLL results, it appears that reasonable results can come from any of the G, N, and M funding models as long as all their populations have adequate access to health care. On average, countries using the M funding model appear to have the best mortality results.

The P funding model is more costly and appears to deliver poorer results overall. However, this no doubt varies by socioeconomic class and access to health care—hence, the suggestion, in this report, to look at health care metrics and Lifestyle Indices by socioeconomic status. According to the OECD, obesity tends to be higher among low-income earners with less education and lower among high-income earners and the well-educated.

Each country must seek out improvements in efficiencies and be responsive to any advantages available through new technology that fit with their standards of medical practice.

According to the World Health Organization’s report “Global Health Risks: Mortality and Burden of Disease Attributable to Selected Major Risks,” even in developing countries, disease patterns are changing just as in the rest of the world. Soon most of their illnesses and diseases will no longer be those you can catch from other people or insects. Hence, in developing nations, rates of noncommunicable diseases are rising—the usual chronic diseases, many caused by obesity. However, those with chronic diseases now require continuous treatment for them to lead healthy productive lives.

Public health care systems operate very much in political environments, which must be responsive to the needs of the population as a whole. A continuous flood of reports are produced by health care economists and medical experts every year, many using complex (and perhaps new) methodologies to develop ideas for changes to health care funding and policies with results and messages that are sometimes very complex and difficult to communicate in a political environment. This may result in misunderstanding of the outcomes and implications. Hence, not all health care policy decisions are optimal.

Actuaries can add significant value to public health care plans by quantifying the core issues and simplifying the discussions, thus leading to better and more optimal health care policy decisions. Examples of how actuaries can participate in managing public health care plans are explained in the next section.

Possible Roles for Actuaries in Public Health Care

While medical experts can identify the obvious technical opportunities, actuaries can quantify the associated costs by performing in-depth analyses connecting the costs with the population demographics and trends in illnesses and attaching values to improved health status while looking at the longer term. Longer-term analysis is needed not only to determine who should pay the bill and develop next year’s budget but also to attach values to potential innovation in health care and prevention strategies. Once detailed long-term actuarial models are in place, actuaries along with medical experts can test various

scenarios related to new emerging trends in demographics, illnesses, and their treatments. This allows for the development of incentive and investment models related to improving health care and prevention strategies. An example is modeling incentives to reduce the prevalence of obesity.

Actuaries have significant skills in modeling contingent health care events for given population groups along with their associated costs. The probability of needing health care and associated costs are dynamic and ever changing with the current pace of new medical technology advances along with a population's changing health status. Actuaries can apply their dynamic modeling skills to quantify how medical advances impact future medical costs and outcomes.

This report contains a few of the main health care metrics in use; however, most analyses do not attach any costs or values to improving those metrics. There is obviously a significant need to develop additional health care metrics that attach economic values from the perspective of population health and socially responsible vantage points. Such metrics should be easy to apply, understand, and communicate. Actuaries can attach economic values to improved health from a long-term basis, hence, allowing for the modeling of prevention strategies.

Aside from lower health care costs, what is an extra year or two of healthy living worth from a GDP productivity perspective? There are currently no reliable methods and models that translate those improvements into economic values. What values do we assign from a social good perspective?

We now talk about the compression of the mortality curve into older ages. Can we also expect a morbidity compression with more chronic diseases and major health care costs being deferred to older ages? There is a need to model the economic effect of this possibility.

Actuarial models should focus on the larger demographic picture and take a longer-term view of health care needs. At the same time the models need to include a complete understanding of the underlying components and how they connect together and must be meaningful to health care providers and the various levels of governments that help maintain the plans. To accomplish this, models may need to start at the patient level using their health care needs and usage patterns by health status/illnesses and have layers that build upon each other until the end results are in a format that can be easily communicated. Examples include the following:

- Changing health care utilization patterns over time by age group and health status including chronic conditions from cost and health outcome perspectives.
- Changing health care technology utilization patterns over time from a cost perspective including health outcome.

Introduction

This report will examine the main funding models now in use by Organisation for Economic Co-operation and Development (OECD) countries and look at a few countries in more detail along with some health care resource and performance metrics.

Is there any difference in performance of a health care system based on the funding models in use? This is not easy to answer since, health status, and outcomes may vary widely from one country to another and are heavily influenced by education, lifestyles, socioeconomic status, and culture.

Public health care funding models range from government service models (similar to public education funding models) to mandated insurance models.

Brief details and metrics of costs and health care outcomes are provided for seven countries (Canada, Sweden, United Kingdom, France, Germany, Switzerland, and United States). These countries were selected since they are frequently cited in any comparisons with the Canadian health care system. They also represent examples of all three funding methods.

Metrics are also provided for another 13 countries (Australia, Austria, Belgium, Denmark, Finland, Ireland, Italy, Japan, the Netherlands, New Zealand, Norway, Portugal, and Spain) to expand the metric comparisons for total of 20 countries, labeled the OECD 20 in this report.

This report relies on publicly available reports from a number of sources such as the European Observatory on Health Care Systems (Observatory), Organisation for Economic Co-operation and Development (OECD), World Health Organization (WHO), and Canadian Institute for Health Information (CIHI).

Appendix A summarizes the data used in this report. All results were developed from OECD data along with CIHI per capita health care cost data by age group. No attempt was made to verify in detail the data with individual country data sources.

A final goal of this project is to identify areas of future actuarial research leading to research papers of interest to both actuaries and nonactuaries.

Actuaries obviously have input into the mandated private insurance models. But interestingly, except for models requiring some level of prefunding—typically for seniors such as U.S. Medicare—very few actuaries have any significant role in developing and maintaining the public funding models. This report will explore some ways where actuaries can contribute significantly to the current debates on public and private health care affordability and sustainability, now and in the future, ongoing in all the OECD countries.

Health Care Funding Models

Source of Funds

Funding of public health care varies by country. Funds may come out of general taxation, earmarked taxes, payroll taxes, insurance premiums, or out of pocket (OOP).

Funding models which depend on earmarked taxes, payroll taxes, or premiums will typically have much less flexibility in adjusting benefits and offering new services. Expanding their benefits will then require an immediate increase in earmarked taxes or premiums—not usually very popular politically. Lately, some countries, like Germany, have put a ceiling on their earmarked payroll taxes with any extra costs being funded from other taxes. Even then, many OECD countries are now reaching overall taxation levels that force them to evaluate different options.

There are three basic public health care funding models as described below along with examples of countries that use the models as their main funding model.

Government Service Model (G)

Essentially this model typically uses regular tax revenue such as value added and income taxes, at federal, province/state, region and municipal levels, as the main source of funds:

- Canada, Sweden, the United Kingdom, and U.S. Medicaid follow this model.

National Insurance Model (N)

This is typically funded by compulsory employer and employee payroll deductions with additional funding through taxes and direct insurance premiums as required. Government subsidies are usually available for low-income individuals and families:

- France and U.S. Medicare follow this model.

Mandated Insurance Model (M)

All must purchase at least basic health insurance from an insurer of their choice, which may include a government insurance option. Government subsidies are usually available for low-income individuals and families.

- Germany and Switzerland follow this model. German employees with incomes below a threshold must choose the government insurance option.

Some countries use a combination of models. Many will use a Government Service model for their low-income families directly or by subsidizing their premiums to an insurer of their choice.

In addition, private insurance (P) and patients' OOP are additional sources of funds.

The United States has used the P funding model for their main population but is now transitioning over to an M funding model.

In this report, each country has been assigned a funding type based on the funding model used for the core hospital and physician services for their main population—not seniors, disabled, or low-income. See the table below. This assignment allows for analysis by funding type to identify the advantages of each.

Funding Model by Country			
G	N	M	P
Canada	Austria	Germany	United States
UK	Belgium	Netherlands	
Ireland	France	Switzerland	
Australia			
New Zealand		Japan	
Denmark			
Norway			
Finland			
Sweden			
Italy			
Portugal			
Spain			

The above table has been organized to recognize that most neighboring countries or those with prior or current government affiliations have tended to adapt similar funding models for their health care.

Use of Funds

Public health care services are typically delivered by a combination of public and private health care providers. Some hospitals and clinics may be publicly owned while physicians are mostly private. Hence, payment models need to accommodate a wide variety of providers and their services. Such models may be either *retrospective* (based on actual services already provided) or *prospective* (based on expected future services needed for a defined population segment or just a single patient).

Examples of payment models for public health care providers include the following:

- Activity—such as activity-based funding—essentially fee for service based on negotiated maximum fee schedules for any activity
- Diagnosis—with predetermined fee values based on diagnosis-related groups (DRGs)—mostly used in hospitals for acute conditions
- Annual budgets—common for hospitals. Typically adjusted by type of services provided (e.g., teaching hospital, whether they have cardiac facilities) and the region’s population and geographic circumstances
- Capitation—providers are paid a monthly fee per population member they will be serving typically subject to some risk adjustment and insurance for patients requiring significant medical treatment.

Appendix C provides brief descriptions of the seven OECD countries’ public health care systems and references the above payment models.

Transfers from federal governments to state, regional, and municipal governments and/or health authorities may be risk adjusted based on the population demographics and geographic locations for which they are expected to provide health care services.

In order to manage access and control the costs of the public health care system various cost containment approaches have been devised, such as internal markets, gatekeeping practices, incentives, policy, or rationing systems have been developed. An example of gatekeeping requires access to a specialist only after a formal referral from the family physician serving as primary care provider.

Health Care Costs

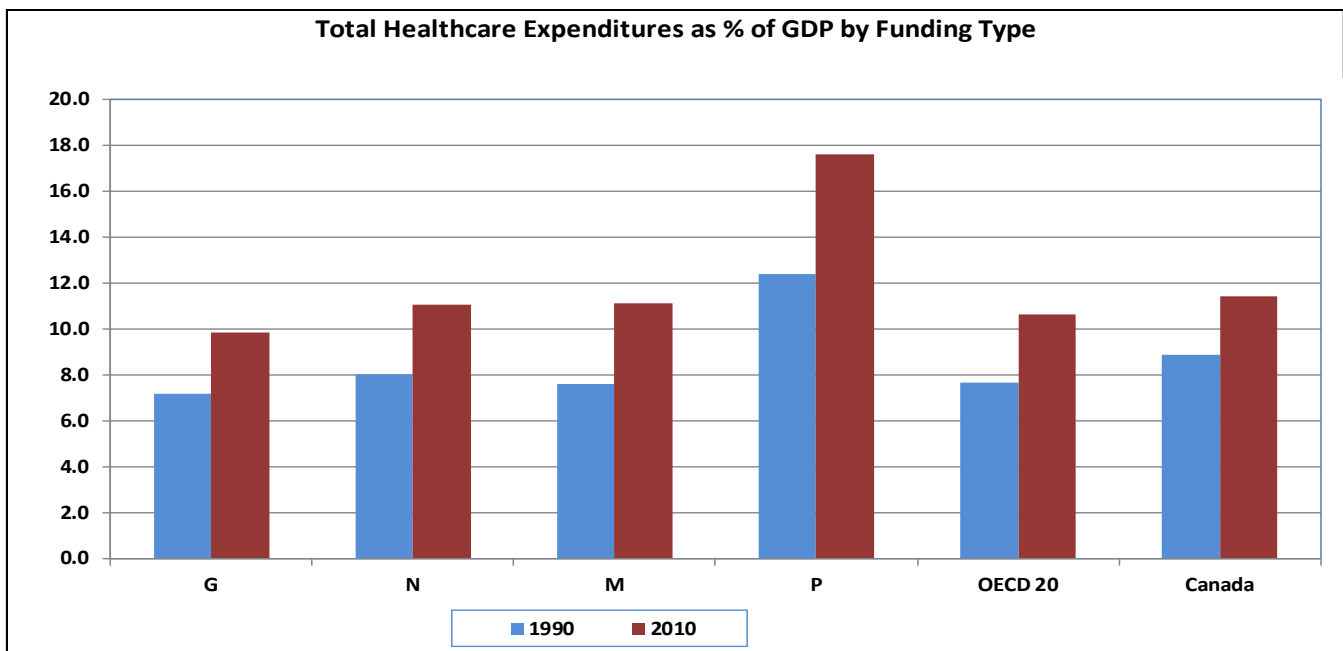
The table below shows the source of funds, for total 2010 health care costs, by the main funding types. On average, the least expensive by percentage of GDP is the G funding model at 9.8 percent. Canada uses the G funding model.

Average Source of Funds by Main Funding Type (%)						
Main Type	Countries	% GDP	Govt	N + M	Private	OOP
G	12	9.8	73.0	3.5	6.8	16.7
N	3	11.0	17.2	59.5	9.3	14.0
M	4	11.1	11.2	63.2	7.9	15.8
P	1	17.6	13.4	39.7	35.1	11.8
All	20	10.7	49.3	25.7	8.8	15.9
Canada		11.4	69.2	1.3	14.9	14.7

The funding codes: government (G), national (N), mandated (M), private insurance (P).

While the United States has a P funding model for 35.1 percent of their health care expenses, G, N, and M funding models still account for 53.1 percent of health care costs primarily for its seniors, disabled, and low-income populations. And out-of-pocket costs account for another 11.8 percent of costs. The U.S. is currently transitioning to an M funding model as a result of the Affordable Care Act.

Health care costs have grown significantly over the last 20 years. The chart below compares the 1990 with the 2010 total health care costs (including private and out-of-pocket costs). Over those 20 years, the average costs, for the 20 OECD countries, grew from 7.6 percent to 10.7 percent of GDP.



Health care costs for some of the 20 OECDs as a percentage of GDP are the following:

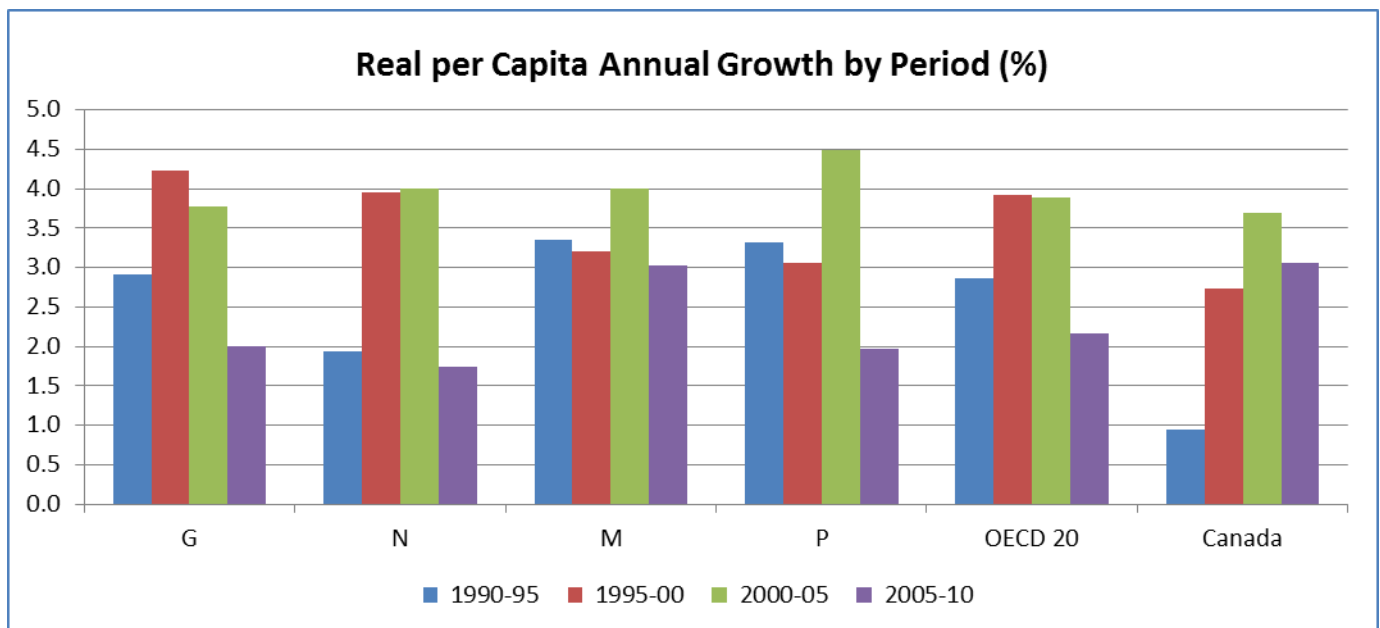
- Ireland had the lowest costs at 6.0 percent in 1990 and 8.9 percent in 2010.
- United States had the highest at 12.4 percent in 1990 and 17.6 percent in 2010.
- Canada moved from 8.9 percent in 1990 to 11.4 percent in 2010.

Health care costs have been taking a larger and larger share of every country’s GDP. For many years, increases in health care costs have exceeded increases in GDP—both in aggregate and on a per capita basis.

In order to analyze the sources for this growth, it is helpful to focus on the growth per capita after first removing the price inflation component by country. This was accomplished by deriving the per capita GDP and health care cost stated in each country’s own currency, at constant 2005 values, using 1990–2010 OECD data as follows:

- Per capita GDP restated using each country’s 2005 currency values
- Total health care cost restated using each country’s 2005 currency values
- Total population data for years 1990 through 2010 by OECD country.

Per capita results are shown in the chart below.



On average, for the OECD 20, it appears that the real growth in per capita health care costs are slowing—from a high of 3.9 percent per annum for the 1995–2005 period to just 2.2 percent for the 2005–10 period. Was this slowing caused by the recent economic events of 2008–10? Is this reduction in growth temporary or permanent? Canada’s economy was not hit nearly as hard as some other countries, and Canada’s health care costs still grew at 3.1 percent for the period 2005–10; however, since 2010 they also appear to be slowing.

For the OECD 20, the 1990–2010 real per capita health care annual growth varied from low of 1.6 percent for Italy to high of 5.6 percent for Ireland.

Aging Effect on Health Care Costs

Aging has and will continue to drive increases in health care. Using the population data split by year, country, and age groups of 0–14, 15–64, 65–74, and 75+, one can approximate this effect by simply applying relative per capita health care cost factors by age groups. For this purpose use was made of the Canadian 2010 CIHI per capita provincial health care costs to produce relative cost factors by age group as shown in the table below.

Age Group	Per Capita Cost	Factor
0-14	1,888	0.51
15-64	2,479	0.67
65-74	8,541	2.32
75+	20,113	5.46
All	3,682	1.00

For the OECD 20, from 1990 to 2010, the average per capita real growth rate for health care costs was 3.2 percent per annum compared with real growth in income per capita of just 1.4 percent. This represents a 1.8 percent real annual increase in health care costs over the growth in income per capita. On average, aging contributed 0.5 percent per annum of those increases, leaving 1.3 percent as the remaining real per annum increase in per capita health care costs.

For Canada, real per capita health care costs grew at 2.6 percent with income at just 1.3 percent per annum. Canada’s annual increase due to aging was also 0.5 percent, leaving 0.8 percent as the remaining real per annum increase in per capita health care costs.

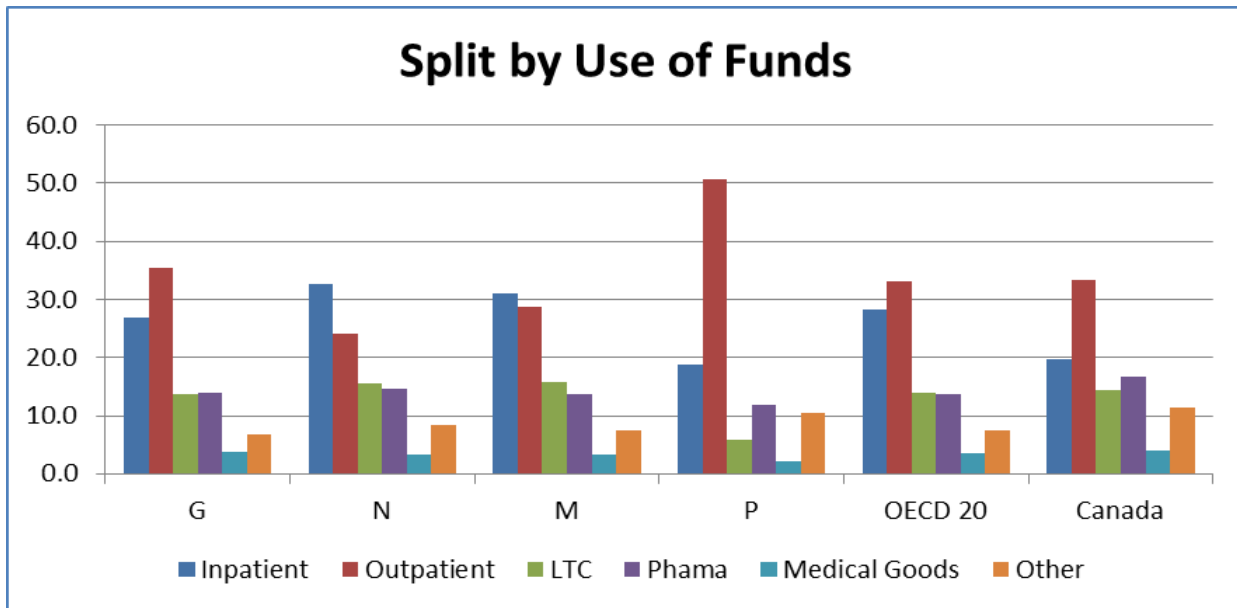
Identifying the Non-Aging Drivers of the Annual Increase in Health Care Costs

It would be interesting to separate out the non-aging causes of the real annual increase in health care costs. However, such analysis is beyond the scope of this report. Some potential reasons are the following:

- New technology—net effect of new medical practice and procedures, and new drugs
- Prevalence of chronic diseases—and their causes
- Changing social expectation in defining medically necessary health care
- Increased supply and demand for health care.

Use of Health Care Funds

How health care funds are used varies by country and their standards of medical practice. The chart below summarizes the percentage split for 2010.



Outpatient services include all physician services and regular hospital services performed on an out-patient basis. The P funding type (United States) has 50.6 percent of funds used for outpatient services. This can be misleading, when compared to other countries, since most U.S. physicians are independent and bill separately from the hospital even for procedures performed at the hospital.

Health Care Resources

Health Care Resources Available

How health care funds are used varies by country and their standards of medical practice. The chart below shows the key health care resources for 2010 per thousand or per million of population.

Healthcare Resources per Thousand						MRI and CTs per Million	
Funding Type	Physicians	Nurses	Phy+Nur*	Hosp Beds	Acute Beds	MRIs	CTs
G	3.3	10.0	8.3	3.4	2.4	11.9	21.9
N	3.7	10.4	8.9	6.8	4.4	12.1	18.3
M	3.2	11.5	8.9	7.9	5.0	20.9	40.0
P	2.4	11.0	7.9	3.1	2.6	31.6	40.7
OECD 20	3.3	10.4	8.5	4.8	3.2	15.0	15.0
Canada	2.4	9.3	7.1	3.2	1.7	8.2	14.2

Phy+Nur* - Combined measure of physicians + 50% nurses

One new measure (Phy+Nur) created in this report is simply combining physicians plus 50 percent of nurses since not all countries have the same standards of practice regarding the duties of nurses. Lately some nurses are taking on responsibilities previously performed by physicians.

The **Phy+Nur** measure varies from a low of 6.3 for Spain to a high of 11.8 per thousand for Switzerland.

Acute hospital beds vary from a low of 1.7 for Canada to a high of 8.1 per thousand for Japan.

MRI units vary from a low of 5.9 for the United Kingdom to a high of 43.1 per million for Japan.

CT units vary from a low of 8.2 for the United Kingdom to high of 97.3 per million for Japan.

Health Care Utilization

Health care utilization, for 2010, varies considerably by country (see tables below). It is obvious that each country uses their health care resources differently in keeping with their standards of medical practice, population needs, and expectations.

Annual Healthcare Utilization per Thousand Population				
Funding Type	Physician Consult	Hospital Days	MRI Exams	CT Scans
G	4,942	943	34	83
N	7,100	1,378	54	157
M	8,150	1,701	72	92
P	3,900	642	98	265
OECD 20	5,855	1,138	49	115
Canada	5,500	636	47	127

Annual Healthcare Utilization per Thousand Population				
Funding Type	COPD* Hosp	Coronary Angioplasty	Knee Replace	Hip Replace
G	2.1	1.5	1.2	1.6
N	2.1	2.8	1.6	2.3
M	1.5	2.9	1.8	2.7
P	2.3	3.8	2.1	1.8
OECD 20	2.0	2.0	1.4	1.9
Canada	1.8	1.0	1.4	1.2

COPD* - Chronic Obstructive Pulmonary Disease

Health Care Metrics

Measuring health care outcomes and efficiencies that produced those outcomes has dominated much of the OECD health care literature for the last 10 years. Many health care metrics are in use. At a high level, mortality metrics are frequently cited. At a more detailed level, actual outcomes from various hospital admissions may be used; however, comparison by country is not always easy since each country has its own standards of medical practice, as evidenced by the variation in health care resources and usage shown in the previous section.

Life Expectancy

Mortality metrics from 1990 to 2010 have shown significant improvements:

- Life expectancy at birth continues to increase

2010 Life Expectancy at Birth with Increase Since 1990				
Main Type ▾	Female	F +	Male	M +
G	83.3	4.1	78.5	5.6
N	83.7	3.9	77.8	5.2
M	84.3	3.9	79.2	5.3
P	81.1	2.3	76.2	4.4
All	83.5	3.9	78.4	5.4
Canada	83.1	2.3	78.5	4.1

- Infant mortality has been reduced by over 50 percent, on average, over the last 20 years

Annual Infant Mortality / 1000			
Main Type ▾	1990	2010	Reduction
G	7.7	3.5	54%
N	7.7	3.7	52%
M	6.4	3.3	48%
P	9.2	6.1	34%
All	7.5	3.6	51%
Canada	6.8	5.1	25%

2010 Life Expectancy at Age 65 with Increase Since 1970 and 1990						
Funding Type	F65	Since 1970	Since 1990	M65	Since 1970	Since 1990
G	21.3	5.3	2.9	17.9	5.1	3.5
N	21.8	6.1	2.9	17.9	5.7	3.2
M	22.1	6.5	3.1	18.3	5.6	3.4
P	20.3	3.3	1.4	17.7	4.6	2.6
OECD 20	21.5	5.6	2.8	18.0	5.3	3.4
Canada	21.5	4.2	1.6	18.3	4.6	2.6

The increase in life expectancy at age 65 has been significant. For the OECD 20, from 1970 to 2010, the life expectancy has increased by

- 41.7 percent for males from 12.7 years to 18.0 years
- 35.2 percent for females from 15.9 years to 21.5 years.

Canada's current life expectancy at age 65 is close to the OECD 20 average.

The highest age 65 life expectancy for males is Switzerland at 19.0 years. The highest for females is Japan at 23.9 years.

Potential Years of Life Lost (PYLL)

PYLL measures potential years of life lost prior to age 70. It provides an estimate of the average additional years a person would have lived if they had not died prematurely prior to age 70. Some view mortality prior to age 70 as mostly avoidable mortality, and, hence, a good measure of the access and quality of a country's health care system.

Interestingly, according to WHO,* the average life expectancy for the whole world's population in 2011 is now 70 years.

PYLL is derived by weighting the deaths, according to the country's current mortality rates, at each age by (70-age at death). It is expressed per 100,000 population and age standardized according to a reference population.

With this (70-age at death) weighting PYLL gives much higher weights to younger than older deaths. A one-year-old's death has a weight of 69 whereas a 65-year-old's death has a weight of just 5.

The table below shows the 1990 and 2010 PYLL for all causes of death. See the next page for split by some of the main illnesses.

Annual PYLL / 100K			
Main Type <input type="text"/>	1990	2010	Reduction
G	5,142	3,103	40%
N	5,253	3,447	34%
M	4,507	2,808	38%
P	6,382	4,870	24%
All	5,093	3,184	37%
Canada	4,817	3,217	33%

The improvement in PYLL, over the last 20 years, was obviously influenced by reductions in infant and younger age mortality.

*http://www.who.int/gho/mortality_burden_disease/life_tables/situation_trends/en/index.html

PYLL / 100K by Cause					
Funding Type	Cancer	Circulatory	Respiratory	Endocrine (Diabetes)	Digestive (Liver)
G	901	453	106	84	157
N	1,036	472	101	97	183
M	888	427	89	63	127
P	966	860	197	177	219
OECD 20	922	471	107	86	158
Canada	876	433	122	102	119

PYLL related to cancer is the largest cause of deaths prior to age 70 in all countries.

Future Changes for PYLL

While the above tables all reflect PYLL prior to age 70, some countries, for their internal reporting, have already moved to define PYLL as being prior to age 75, reflecting their now longer life expectancy. In Canada, CIHI uses PYLL prior to age 75 for internal reports comparing regional and provincial results.

Some countries are also separating the cause of deaths into those:

- (a) Avoidable by early prevention
- (b) Avoidable by timely and proper health care treatment and
- (c) Not avoidable.

Internally, CIHI in Canada uses such measures with the category assigned based on cause of death.

While the OECD has been working on developing this metric, there are currently no standard lists in use by all OECD countries.

Such standard lists will change over time. For example, the avoidable deaths list alone has changed significantly; not too many years ago many cardiovascular problems meant certain death that today can be treated (e.g., heart valves and blocked arteries in the heart). In addition, standards of medical practice and availability of health care services vary by country.

PYLL just focuses on premature mortality. Another metric frequently cited includes the years of prior illness or disability. Hence, it combines both premature mortality and disability into one metric. This is termed disability-adjusted life years (DALYs). Much discussion has taken place over the weightings to apply at each age—should they be determined from an economic value or a social value perspective? For example, one set of weightings, from a potential economic loss perspective, has the highest value at age 25 with lowest values before age 10 and over age 55.

Other Health Care Metrics

Each country has developed a number of health care metrics to allow them to rank health care regions/counties with one another. One such ranking system has been in development by the Population Health Institute at the University of Wisconsin. It is still a working paper but is already used as a guide by a number of American states and Canadian provinces. The link to the paper is below.

<http://www.countyhealthrankings.org/sites/default/files/differentPerspectivesForAssigningWeightsToDeterminantsOfHealth.pdf>

The rankings are separated into health outcomes and the health factors that influence those outcomes:

- *Health Outcome* measures include premature disability and mortality as well as current health status.
- *Health Factor* includes health behaviors, health care quality, socioeconomic factors, and the physical environment.

The rankings may be produced by annual or biannual population health surveys along with additional clinical data. A number of rankings are in use. One such ranking used by a few locations has the following factors:

Health Outcome:

- 50 percent for each of premature mortality
- 50 percent for current health status (e.g., level of wellness, chronic illness)

Health Factor:

- 40 percent for health behaviors (e.g., alcohol, smoking, obesity)
- 10 percent for health care (e.g., health care access, family physician?)
- 40 percent for socioeconomic factors (e.g., whether employed, level of education, income level)
- 10 percent for physical environments (e.g., air pollution).

Each of the Health Factor components has been assigned weights according to their relative contribution to health care costs and outcomes; it was arrived at through numerous studies. The Health Outcome weights were set to give equal weight to length of life and quality of life. Detailed score cards for each county may have 50 or more entries. A comparison of the score card with previous scores and other nearby counties may identify some opportunities and areas that may need attention.

These rankings are frequently cited as being difficult to communicate to politicians and the general public because they contain too many related items. Also there is no attempt to attach any fiscal or economic costs to the scores. For example, obesity may be related to socioeconomic factors but what are the real costs and possible prevention opportunities from a social and cost perspective, presented in simple terms?

Health Care Surveys

In addition to actual health care metrics (i.e., mortality and disability), each country uses population and health care practitioner surveys to measure overall effectiveness and responsiveness of their health care systems. Such surveys can be helpful in identifying strengths and weaknesses of the health care delivery by region within a given country.

This report includes the results of a population survey as compiled from individual countries by OECD. The survey simply asks whether individuals feel healthy. See Appendix A (Percentage of Population who Feel Healthy) for actual results by age and income level. It is interesting to observe that while the fewest Japanese feel they are healthy, they have one of the best mortality metrics. Only 30 percent of Japanese feel they are healthy versus Canadians at 88 percent. Hence, each country seems to have their own standard as to what healthy means based on their own history and health care expectations, and multicountry surveys can easily be biased and misleading.

World Health Organization Reports

Attempts have been made to use such surveys to compare health care systems by country. WHO has published many such surveys, which can be helpful in identifying major weaknesses and strengths of each country's health care system. In 2000 WHO published a report comparing 191 countries including developing countries and applied a ranking. The ranking was based on feedback from policy analysts and public health care practitioners, including WHO staff, in 125 countries. The practitioners had access to late 1990s health care data by country. They ranked five areas as follows:

50 percent—Level of health as measured by disability-adjusted life expectancy (DALE) as available

- 25 percent DALE and 25 percent for its distribution or equality

25 percent—Responsiveness of health care system

- 12.5 percent overall and 12.5 percent for its distribution or equality

25 percent—Fairness of financial contribution.

Fairness, distribution, and equality were judged by income level—accounting for 50 percent of the score.

The best 10 countries were France, Italy, San Marino, Malta, Singapore, Spain, Oman, Austria, and Japan. Canada was 30th and the United States was 38th. Surprisingly, Switzerland was 20th and Sweden was 23rd; given their good mortality metrics might one expect them to be ranked higher?

Although the WHO report has been widely discussed, 75 percent of the score is based on surveys and feedback, which can be biased based on respondent's background and experience. Even the DALE measure, where available, can vary by country since it depends on each country's own definition of disability, which may vary somewhat.

The WHO report should be viewed as a first attempt at ranking countries health care systems. It provides a useful framework for additional work. However, it used the same ranking method for too many and too broad of a range of countries (from France to Sierra Leone). Grouping by income level would have allowed for the inclusion of additional health care metrics for the higher-income countries

where more reliable metrics are typically available. A great opportunity for actuaries is to develop some additional health care metrics designed primarily for international comparisons.

Lifestyle Index

This report introduces a Lifestyle Index, by country, as a weighted combination of their obesity, smoking, and alcohol consumption levels. While smoking and drinking have declined, obesity is on the increase.

High prevalence rates of smoking, alcohol use, and obesity are all good predictors of higher levels of current and future health care costs. This simple index is created by combining all three lifestyle measures using OECD data. In the table below:

- **Alcohol** is defined as the average number of liters consumed per year per person age > 15
- **Smoking** is the percentage of the population age > 15 who smoke every day
- **Obesity** is the percentage of self-reported obesity with body mass index (BMI) > 30. Self-reporting tends to understate the actual BMI based on clinical data by up to 25 percent. However, one might expect that this understatement is similar for all countries, and hence, the measure is still useful.

Based on a 2002 Health Affairs report,* someone who is obese can be expected to incur up to 30+ percent more health care costs over their lifetime. Similarly, a smoker can expect up to 20+ percent more in health care costs, and someone who consumes alcohol above the defined level up to 10+ percent more in health care costs. These numbers are very approximate since they are greatly affected by other factors such as existing levels of chronic illness, age, and socioeconomic status as well as standards of medical practice for that country or region.

Definition of alcohol use will vary. For example, the OECD uses liters/year for populations age 15+. In Canada, CIHI reports on percentage of population, age 15+, who consumes five or more alcoholic drinks at least once per month. For the Health Affairs report, alcohol is the percentage of the population who have a drinking problem as defined by WHO's "Alcohol Use Disorders Identification Test."**

The extra future health care costs will also depend on many other factors:

- In a country with lower levels of health care, an obese person may have a shorter expected life span and hence incur just 10 percent extra medical costs over their shorter life expectancy.
- Excessive alcohol, smoking, and obesity will typically result in chronic diseases. Hence, countries with efficient medical practice dealing with chronic diseases may have lower costs.

The Lifestyle Index is determined as

$$(\text{ONE}) \times \text{Alcohol} + (\text{TWO}) \times \text{Smoking} + (\text{THREE}) \times \text{Obesity}$$

Each factor represents the approximate *relative increase* in health care costs for that lifestyle measure for countries with extensive health care for chronic illnesses; these countries include most of the OECD 20. The actual extra cost is approximately 10 percent of the index value. The factors of 1, 2, and 3 were selected in order to produce a simple index reflecting the extra health care costs for countries in which significant levels of health care practice is prevalent.

*<http://content.healthaffairs.org/content/21/2/245.full>

** http://whqlibdoc.who.int/hq/2001/who_msd_msb_01.6a.pdf

Lifestyle Index				
Funding Type	Alcohol	Smoking	Obesity	Lifestyle Index
G	9.5	20.0	15.7	96.6
N	11.7	22.3	13.0	95.4
M	9.6	20.7	9.3	78.9
P	8.7	15.1	28.1	123.2
OECD 20	9.8	20.2	14.6	94.2
Canada	8.2	16.3	17.5	93.3

The Index varies from 55.3 (Japan) to 123.2 (United States). Canada's Index is 93.3. The values indicate expected variation in current and future costs as well as future chronic health disorders such as diabetes. The health care costs alone will vary by about 10 percent of the difference in the Index value. Hence, the United States can expect to incur 10 percent of (123.2 – 55.3) or 6.8 percent more in health care costs than Japan—solely as a result of lifestyle differences.

Japan has the lowest Lifestyle Index of 55.3:

- Lowest infant mortality rate (2.3 per 1,000) and highest female life expectancy (86.4 years)

Sweden has a Lifestyle Index of 74.0:

- Lowest PYLL(2,487)

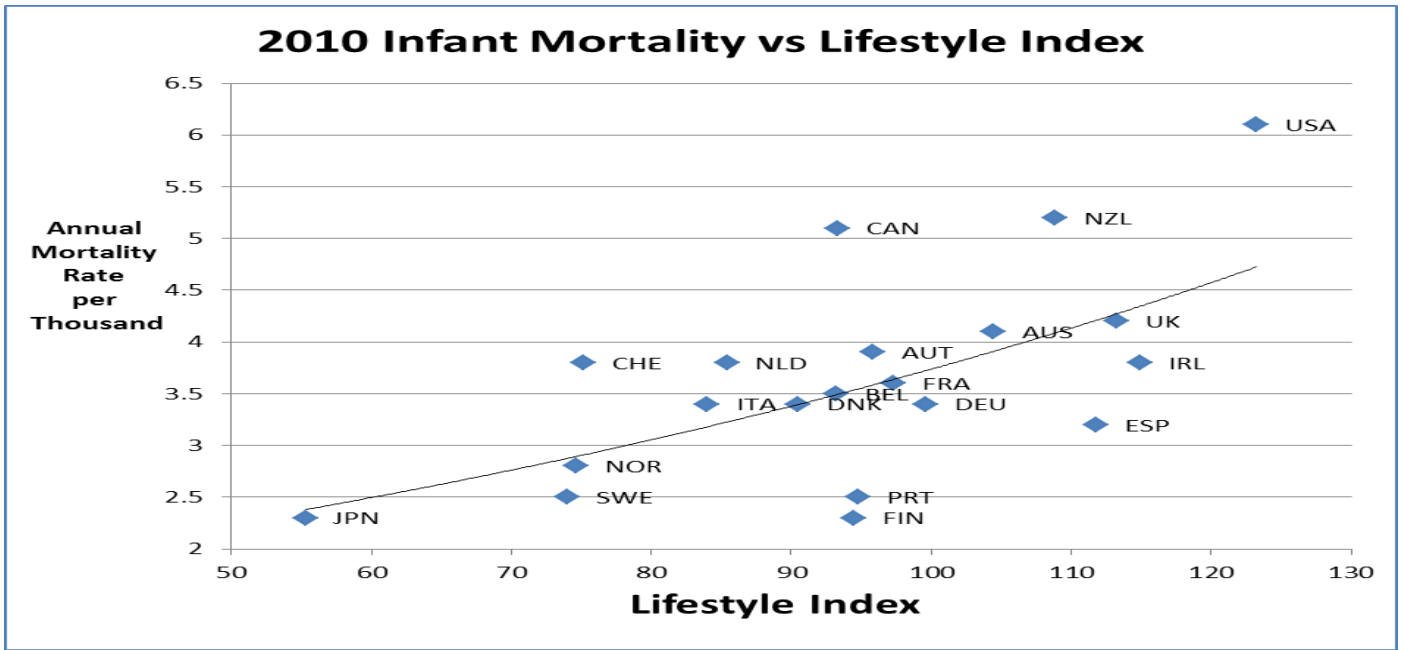
Switzerland has a Lifestyle Index of 75.1:

- Highest male life expectancy (80.3 years)

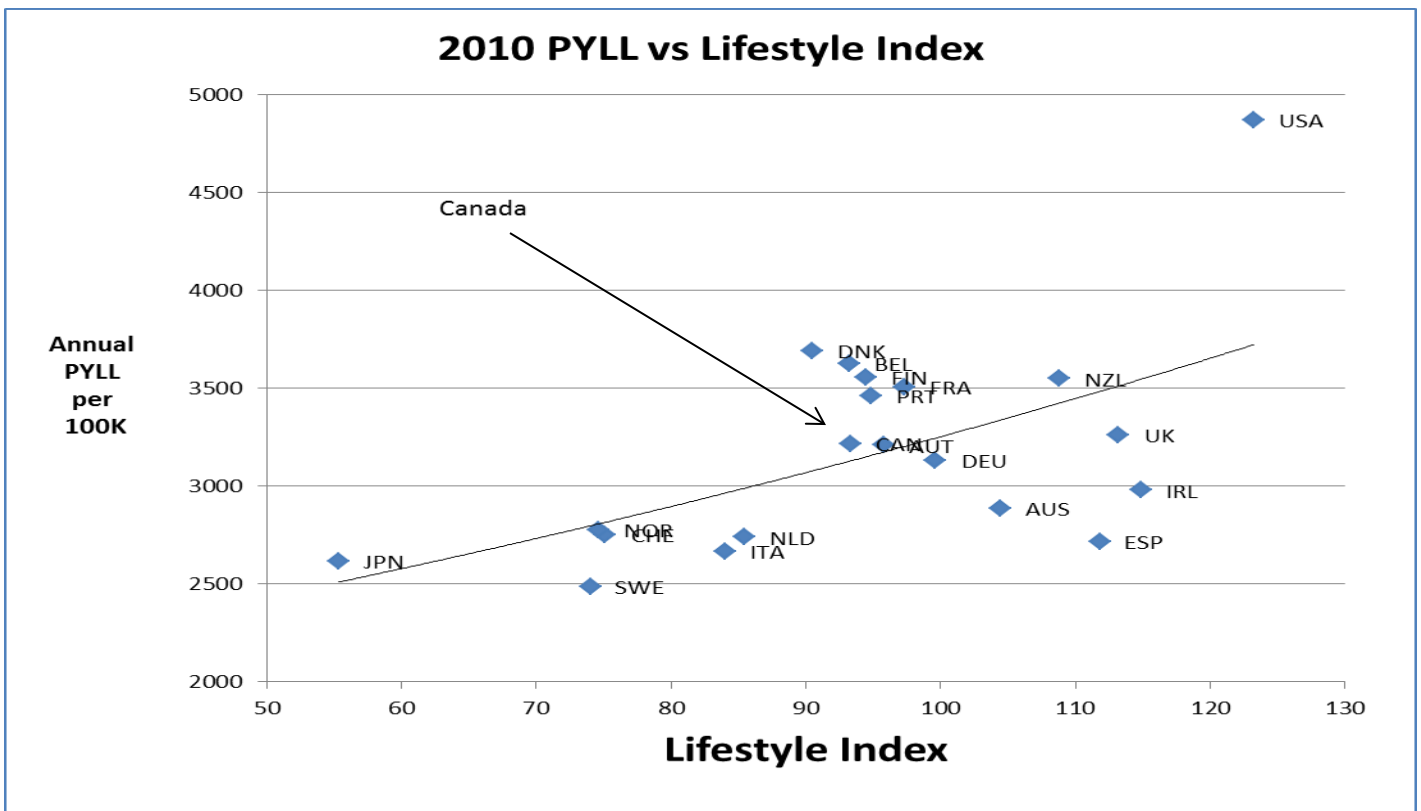
Canada has a Lifestyle Index of 93.3:

- Female life expectancy of 83.1 years
- Male life expectancy of 78.5 years
- Infant mortality rate of 5.1
- PYLL of 3,217

The Lifestyle Index has a high correlation with infant mortality and PYLL. See the charts below.



Correlation: Infant mortality versus Lifestyle Index = 0.62.



Correlation: All causes PYLL versus Lifestyle Index = 0.58.

See Appendix A for country abbreviation codes.

A low Lifestyle Index is then a reasonable predictor of favorable infant mortality and PYLL metrics.

Future studies using Lifestyle Indices by age group and socioeconomic classes should also include some measures of prevalence of chronic illnesses. Such a combination of information then allows for the development of many more metrics including the determination of economic values for healthy populations.

In actual application, for a specific country or region, additional analysis is required to produce an index that can predict actual increases in health care costs for each lifestyle measure or for future changes as a result of prevention programs leading to improved Lifestyle Indices.

Aside from direct health care costs there are many indirect costs with illness caused by poor lifestyles. Examples include lack of productivity and cost of disability benefits.

Correlations Related to Health Care Utilization and Outcomes

Determining the *correlations* of two metrics is a useful tool to study the tendencies of one metric to increase or decrease in relation to another. See Appendix B for more details on correlations.

Examples of the correlations of the Lifestyle Index versus other metrics for the OECD 20 countries are shown below:

Infant mortality	0.62
All causes PYLL	0.58
Circulatory system PYLL	0.55
Respiratory System PYLL	0.61
Female life expectancy	-0.50
Male life expectancy	-0.44

The negative correlation for life expectancy simply means that higher life expectancy tends to go along with a low Lifestyle Index.

Examples of the correlations factors of *health care costs as a percentage of GDP* versus other metrics are shown below:

Percentage of health care costs covered by private insurance	0.80
Health care costs per capita \$PPP*	0.84
MRI and CT exams	0.74 and 0.77
Infant mortality	0.63
All causes PYLL	0.71
Circulatory system PYLL	0.61
Respiratory system PYLL	0.48
Female life expectancy	-0.50
Male life expectancy	-0.51

*Purchasing Power Parity

Appendix A includes correlations of each data set with a number of other selected data sets.

Comparison of Metrics by Health Care Funding Model—OECD 7 Countries

Are there material differences in performance by funding model? This question is not necessarily easy to analyze and answer because each country's health care outcomes are also heavily influenced by many other factors, including access to health care, public sanitation, immunization programs, culture, socioeconomic status, and lifestyles. Also the population segments with higher income and better education do tend to enjoy better health care outcomes and health status in all countries.

The tables below show the lowest and highest health care metrics, from Appendix A, *among the OECD 7 countries only*.

Government Service Funding Model: Canada, Sweden, and the United Kingdom

	Lowest	Highest
Canada	<ul style="list-style-type: none"> • Inpatient care cost (\$PPP)* • Acute beds and hospital discharges • Physicians# • Coronary angioplasty# • Hip replacement# 	<ul style="list-style-type: none"> • Pharmaceuticals (%)
Sweden	<ul style="list-style-type: none"> • Health care cost (% of GDP) • Private insurance (%) • Administration costs (%) • Long-term care, medical goods, and other services (\$PPP) • Hospital beds# • Infant mortality • PYLL (all causes, cancer and digestive) • Lifestyle Index • Physician consultations 	<ul style="list-style-type: none"> • Physicians#
United Kingdom	<ul style="list-style-type: none"> • Health care as % of GDP and \$PPP • Pharmaceuticals \$PPP • MRI and CT units and their use# 	<ul style="list-style-type: none"> • Public insurance (%) • PYLL (digestive, e.g., liver)

Table Units:

*Per capita \$PPP: Purchasing Power Parity with costs restated in U.S. dollars using comparable cost of a basket of goods and services rather than using the normal market exchange rates.

% refers to percentage of each country's health care expenses.

in units per thousands or millions of population as per Appendix A.

Where metrics are tied for low or high in two or more countries, the metric is included in all such countries.

National Insurance Funding Model: France

	Lowest	Highest
France	<ul style="list-style-type: none"> • Proportion of population employed in health care • Out-of-pocket expenses (%) • Outpatient care (% and \$PPP) • Nurses • COPD hospitalization rates • Knee replacements 	<ul style="list-style-type: none"> • Inpatient care (%) • Tobacco and alcohol use • Age 65 female life expectancy

Mandated Insurance Funding Model: Germany and Switzerland

	Lowest	Highest
Germany		<ul style="list-style-type: none"> • Medical goods (\$PPP) • Knee and hip replacements • Coronary angioplasty • Physician consultations • Hospital beds and discharges
Switzerland	<ul style="list-style-type: none"> • Pharmaceuticals (%) • Obesity rate • PYLL (respiratory, circulatory, and endocrine) 	<ul style="list-style-type: none"> • Out-of-pocket (%) • Long-term care (\$PPP) • Physicians and nurses • Female and male life expectancy

Private Insurance Funding Model: United States

	Lowest	Highest
United States	<ul style="list-style-type: none"> • Public insurance (%) • Inpatient care, long-term care, and other services (%) • Female and male life expectancy • Physicians 	<ul style="list-style-type: none"> • % GDP and \$PPP • Private insurance (%) • Administration costs (%) • Outpatient care (% and \$PPP) • MRI and CT units and their use • Lifestyle score • PYLL (all causes, circulatory, respiratory, and endocrine) • Infant mortality • COPD hospitalization rate

Ranking of Metrics

Which metrics a country should seek to emulate is not always obvious. For example, Canada has the lowest rate of hip replacements. Is that because their needs are the lowest, or simply because the capacity to perform hip replacements is limited? Simply having low or high metrics does not always indicate the effectiveness of a country's health care system—hence, the need to choose metrics carefully when comparing health care systems.

Below are the above tables with the *best metrics only* for the OECD 7 countries.

Government Service Funding Model: Canada, Sweden, and the United Kingdom

	Lowest	Highest
Canada	<ul style="list-style-type: none"> • Inpatient care cost (\$PPP) • Acute beds and hospital discharges • Coronary angioplasty 	
Sweden	<ul style="list-style-type: none"> • Health care (% of GDP) • Long-term care, medical goods, and other services (\$PPP) • Infant mortality • PYLL (all causes, cancer and digestive) • Lifestyle Index 	<ul style="list-style-type: none"> • Physicians
United Kingdom	<ul style="list-style-type: none"> • Health care as % of GDP and \$PPP • Pharmaceuticals \$PPP 	

National Insurance Funding Model: France

	Lowest	Highest
France	<ul style="list-style-type: none"> • Out-of-pocket expenses (%) • COPD hospitalization rates 	<ul style="list-style-type: none"> • Age 65 female life expectancy

Mandated Insurance Funding Model: Germany and Switzerland

	Lowest	Highest
Germany		
Switzerland	<ul style="list-style-type: none"> • Pharmaceuticals (%) • Obesity rate • PYLL (respiratory, circulatory, and endocrine) 	<ul style="list-style-type: none"> • Female and male life expectancy • Age 65 male life expectancy

Private Insurance Funding Model: United States

	Lowest	Highest
United States	<ul style="list-style-type: none"> • Inpatient care, long-term care, and other services (%) 	<ul style="list-style-type: none"> • MRI and CT units and their use

Role of Private Insurance and Out-of-Pocket Funding

Much of the discussion so far has focused on the G, N, and M funding methods. For public health care funding to remain both fiscally and economically sustainable, more expenses may need to be covered by private insurance or paid out-of-pocket by patients. Also the population segment with higher incomes may want more extensive health care (beyond medically necessary) along with quicker access to health care than is normally available under the public plans, and they are prepared to pay for it.

For 2010 private insurance and OOP already accounts for an average of 24.7 percent of all health care expenses for the OECD 20 countries. See the table below.

Source of Funds (%)					
Funding Type	Gov't	N+M	Private	OOP	Private +OOP
G	73.0	3.5	6.8	16.7	23.5
N	17.2	59.5	9.3	14.0	23.3
M	11.2	63.2	7.9	15.8	23.7
P	13.4	39.7	35.1	11.8	46.9
OECD 20	49.3	25.7	8.8	15.9	24.7
Canada	69.2	1.3	14.9	14.7	29.5
France	7.4	70.5	14.8	7.3	22.2
Germany	8.9	68.1	10.0	13.0	22.9
Sweden	81.1	-	1.9	17.0	18.9
Switzerland	18.2	40.8	10.1	30.9	41.0
UK	83.9	-	6.1	10.0	16.1
USA	13.4	39.7	35.1	11.8	46.9
OECD 7	40.3	31.5	13.3	14.9	28.2

Among the OECD 20, the United Kingdom, Denmark, Norway, Sweden, Japan, the Netherlands, and New Zealand all have private insurance and OOP of less than 20 percent. Among the OECD 20, Japan is lowest at 13.6 percent.

Health care access and costs do not respond well to normal consumer market dynamics with the patient frequently disadvantaged by having too few choices of health care delivery and the health care provider deciding what services are required (and perhaps also prices); this is particularly true for serious illnesses. Also competitive markets normally require suppliers to have easy entry and exit into the market; however, entry of health care providers and delivery of health care services is highly regulated. Politically, it would not be easy to close a hospital that does not meet its profit or revenue targets.

What Is the Best Role for Private Insurance?

In most countries private insurance just provides supplemental additional insurance above the public plan. Examples include public plan deductibles and coinsurance, drugs, and dental.

For high-income earners, in some countries, private insurance can also be substitutive and replace the public plan by allowing patients to have more immediate access to health care services—perhaps even more extensive treatments than medically necessary or that normal practice would call for and that the public plan would cover. This has been discussed much in Canada and other countries in relation to access to elective surgery such as knee or hip replacements where the demand has increased significantly in the past few years as a result of aging population, rising obesity levels, and advancing technology.

For private insurance to work best it needs to be efficient, sustainable, affordable, and not subject to cancellations if the insured has had a serious illness.

Where private insurance is substitutive, it should not result in significantly reduced resources available for the public plan. For example: in Canada, core hospital and medical services can only be provided by the public plan with no private insurance allowed. This is believed to be necessary to make certain that sufficient resources available for the public plan to cover these core services. Other countries with sufficient physician and hospital resources will allow substitutive private insurance and those same resources to be used on a limited basis so as not to crowd out the needs of the public plan.

What Is the Role for Patient Out-of-Pocket (OOP) Payments?

Limited OOP can dampen demand for service as well as transfer some costs to the patient. However, it should be limited and not applied when a patient has a severe illness or a communicable disease. In other words, there must be real savings to the public or private health care system—not just a deferral of services that may end up costing substantially more or even result in unmet health care needs leading to more serious illness, disability, or death.

Among the OECD 20, Switzerland has the highest OOP at 30.9 percent of all health care expenses. Quality of care is considered to be high and is delivered consistently regardless of income. Generally the Swiss demand an optimal state of health care throughout life and are willing to pay for it. Their mandated insurance programs have many deductibles.

The Swiss enjoy the highest life expectancy among the OECD 7 countries along with the lowest circulatory, respiratory, and endocrine system PYLLs. They also have many high-income earners; hence, results may be partially socioeconomically driven.

Conclusions

Based on costs as a percentage of GDP and mortality results, life expectancy, and PYLL, it appears that reasonable results can come from any of the G, N, and M funding models as long as all their populations have adequate access to health care. On average, countries using the M funding model appear to have the best mortality results.

The P funding model is more costly and appears to deliver poorer results overall. However, this no doubt varies by socioeconomic class and their access to health care—hence, the suggestion, in this report, to look at health care metrics and Lifestyle Indices by socioeconomic status. According to the OECD's *Obesity Update 2012*,* obesity tends to be higher among low-income earners with less education and lower among high income earners and the well-educated.

Each country must seek out improvements in efficiencies and be responsive to any advantages available through new technology that fit with their standards of medical practice.

According to the World Health Organization's report "Global Health Risks: Mortality and Burden of Disease Attributable to Selected Major Risks"*** even in developing countries, disease patterns are changing just as in the rest of the world. Soon most of their illnesses and diseases will no longer be those you can catch from other people or insects. Hence, in developing countries, rates of noncommunicable diseases are rising—the usual chronic diseases, many caused by obesity. However, those with chronic diseases now require continuous treatment for them to lead healthy productive lives.

Public health care systems operate very much in political environments, which must be responsive to the needs of the population as a whole. A continuous flood of reports are produced by health care economists and medical experts every year, many using complex (and perhaps new) methodologies to develop ideas for changes to health care funding and policies with results and messages that are sometimes very complex and difficult to communicate in a political environment. This may result in misunderstanding of the outcomes and implications. Hence, not all health care policy decisions are optimal.

Most health care discussions focus on the costs, new technology, and obvious significant improvement in various health care metrics from a socially acceptable perspective. We also need reliable methods on how to translate those improvements into economic values, which ultimately drives the affordability of those improvements to health care.

Although medical experts can identify the obvious technical opportunities, actuaries can connect the costs with the population demographics and attach values to improved health status while looking at the longer term. We need longer-term analysis—not just simply figuring out who should pay the bill and next year's budget.

*<http://www.oecd.org/health/49716427.pdf>

**<http://apps.who.int/bookorders/anglais/detart1.jsp?sesslan=1&codlan=1&codcol=15&codcch=00772>

Actuaries can assist in the development of metrics that identify and quantify the core issues in simpler ways such that they can be more easily communicated and understood by senior politicians, health care managers, and the public in general—hence, leading to better health care policy decisions. An example is the Lifestyle Index: it is simple and easy to apply, yet readily understood by all stakeholders. One Canadian province has already used the Index in combination with their chronic illness prevalence rates by age groups to project future hospital resource needs for each of their seven Health Care Regions.

Actuaries can play a key role in policy setting for public health care going forward by assisting the program managers to take a longer-term view by connecting all the demographics, health status, trends in illnesses, and costs to assist in identifying not only opportunities but also the main costs drivers. Once detailed long-term actuarial models are in place, actuaries along with medical experts can test various scenarios related to new emerging trends in demographics, illnesses, and their treatments.

See the next section for health care needs that can benefit from analysis from an actuarial vantage point.

Role for Actuaries and Recommendations for Future Research

Public health care funding models and metrics vary significantly by level of government. At the federal level, finance ministers discuss percentage of GDP and tax points while local governments are talking health care resources and actual budgets, and actual health care providers discuss how to deliver on ever increasing demands. Actuarial models could be used to connect the metrics in use by all levels.

Below are a few suggestions for future research in which actuaries could contribute in analyzing the issues:

1. Are populations getting healthier over time?
 - How do we define a healthy population using objective health care metrics?
 - Are populations healthier from an economic vantage point?
2. Explore trends in mortality and major illnesses by generational cohorts of populations in relation to health care costs.
3. Are current health care systems and their costs sustainable over time—economically and fiscally? Each year health care costs are increasing—even as a percentage of GDP. Ultimately the growth in health care delivery costs must not exceed the growth in GDP. A healthier population, which is also well educated, will typically also have higher productivity; hence, a healthier population can lead to lower relative health care costs while also boosting GDP. But where are the breakeven points?
4. Goals of public health care systems are typically to provide reasonable access and quality of care at reasonable costs. But what do we mean by reasonable access, quality, and costs that are still affordable?
5. Development of dynamic scenario modeling techniques for projecting future health care costs for populations taking into account major illness and wellness metrics (i.e., life expectancy, life years lost, and disability-adjusted life years).
6. Compression of the mortality curve is widely studied. Can we also expect a morbidity compression with more chronic diseases and major health care costs being deferred to older ages? Or does reduced mortality in one decade simply lead to increased health care costs in the next and beyond? Are people healthier for those increased health care costs?
7. Most health care models focus on costs. There is also a need to model future health care resource needs for physicians and nurses, even hospital facilities in countries where many of the hospitals are publicly owned. It takes several years to train physicians and nurses, particularly specialists. Such health care resource models seem ideally suited to using actuarial population models.
8. Development of additional health care metrics showing the value and efficiency of given health care funding and delivery systems from a socially responsible vantage point as well as an economic value perspective that can also be readily understood and communicated.

9. What is an extra year or two of healthy living worth from a GDP productivity perspective?

Appendix A

Selected Health Care Metrics from 20 OECD Countries

2010 Data (or Earlier if No 2010 data)

The tables are split into two groups: the seven countries for which detail descriptions are provided plus 13 other countries of interest. The seven countries will be referred to as “the OECD 7 countries”; see their names below with codes assigned according to the funding method available for their main working population, not including seniors, disabled, or low-income populations.

This report relies on the OECD data as presented. No attempt has been made to verify results to each country’s own reported numbers, which may differ in terms of what is included as health care costs.

G - Canada
G - Sweden
G - UK
N - France
M - Germany
M - Switzerland
P - USA

G: Government Service Model

N: National Insurance Model

M: Mandated Insurance Model

P: Private Insurance Model

OECD sources:

<http://www.oecd-ilibrary.org/statistics>

<http://stats.oecd.org/Index.aspx?DataSetCode=SHA#>

CIHI source:

<https://secure.cihi.ca/estore/productFamily.htm?locale=en&pf=PFC1952>

Healthcare Growth

Public Ins Type	Country	1990 Healthcare as %GDP	2000 Healthcare as %GDP	2010 Healthcare as %GDP	1990-2010 Average Increment as %GDP
G	Canada	8.9	8.8	11.4	0.13
N	France	8.4	10.1	11.6	0.16
M	Germany	8.3	10.4	11.6	0.17
G	Sweden	8.2	8.2	9.6	0.07
M	Switzerland	8.2	10.2	11.4	0.16
G	UK	5.9	7.0	9.6	0.19
P	USA	12.4	13.7	17.6	0.26
G	Australia	6.7	8.0	9.1	0.12
N	Austria	8.4	10.0	11.0	0.13
N	Belgium	7.2	8.1	10.5	0.17
G	Denmark	8.3	8.7	11.1	0.14
G	Finland	7.7	7.2	8.9	0.06
G	Ireland	6.0	6.1	9.2	0.16
G	Italy	7.7	8.0	9.3	0.08
M	Japan	5.8	7.6	9.5	0.19
M	Netherlands	8.0	8.0	12.0	0.20
G	New Zealand	6.8	7.6	10.1	0.17
G	Norway	7.6	8.4	9.4	0.09
G	Portugal	5.7	9.3	10.7	0.25
G	Spain	6.5	7.2	9.6	0.16
	OECD 7	8.6	9.8	11.8	0.16
	OECD 13	7.1	8.0	10.0	0.15
	OECD 20	7.6	8.6	10.7	0.15
	Avg G	7.2	7.9	9.8	0.13
	Avg N	8.0	9.4	11.0	0.15
	Avg M	7.6	9.1	11.1	0.18
	Avg P	12.4	13.7	17.6	0.26
Correlations					
	Lifestyle	0.17	0.13	0.32	0.35
	%Employ	0.26	-0.05	0.03	-0.32
	%Public	0.24	0.38	0.38	0.35
	HC %GDP	0.83	0.88	1.00	0.62
	HC/Capita \$PPP	0.85	0.76	0.84	0.31
	InfantMortality	0.53	0.43	0.63	0.38
	PYLL	0.56	0.59	0.71	0.48

Correlation <-.70 or >.70

Real per Capita Annual % Growth in Healthcare

Public Ins Type	Country	1990-95	1995-00	2000-05	2005-10
G	Canada	1.0	2.7	3.7	3.1
N	France	-0.6	4.0	4.4	1.9
M	Germany	2.3	2.8	2.6	1.2
G	Sweden	5.2	1.7	2.9	1.0
M	Switzerland	4.4	4.5	5.7	3.0
G	UK	2.3	2.3	1.3	2.9
P	USA	3.3	3.1	4.5	2.0
G	Australia	3.5	5.0	3.2	2.6
N	Austria	4.1	3.9	1.9	2.1
N	Belgium	2.3	4.0	5.6	1.3
G	Denmark	1.4	3.9	3.3	2.0
G	Finland	-0.8	2.8	5.6	1.6
G	Ireland	6.0	6.3	7.7	2.3
G	Italy	0.0	4.0	2.5	0.0
M	Japan	4.3	3.0	2.5	2.8
M	Netherlands	2.4	2.5	5.2	5.2
G	New Zealand	2.2	3.5	4.4	4.0
G	Norway	2.7	7.3	3.7	1.1
G	Portugal	7.4	8.3	2.4	1.0
G	Spain	3.9	3.0	4.6	2.6
	Avg 7	2.6	3.0	3.6	2.1
	Avg 13	3.0	4.4	4.0	2.2
	Avg 20	2.9	3.9	3.9	2.2
	Avg G	2.9	4.2	3.8	2.0
	Avg N	1.9	4.0	4.0	1.7
	Avg M	3.4	3.2	4.0	3.0
	Avg P	3.3	3.1	4.5	2.0
	Correlations				
	Lifestyle	-0.03	-0.01	0.20	0.13
	%Employ	-0.22	-0.11	0.17	0.07
	%Public	-0.14	-0.24	0.11	0.20
	HC %GDP	-0.01	-0.17	0.07	0.13
	HC/Capita \$PPP	-0.02	-0.07	0.20	0.10
	InfantMortality	-0.14	-0.21	0.12	0.42
	PYLL	-0.20	-0.02	0.11	-0.05

Real Growth per Capita

Public Ins Type	Country	Real Ann Growth in HC per Capita 1990-2010	Real Growth Caused by Aging 1990-2010	Real Annual Growth Per Capita GDP 1990-2010	Excess Per Capita Growth in HC 1990-2010
G	Canada	2.6	0.5	1.3	0.7
N	France	2.4	0.2	1.6	0.6
M	Germany	2.2	0.5	0.6	1.2
G	Sweden	2.7	0.5	1.0	1.2
M	Switzerland	4.4	0.2	1.9	2.3
G	UK	2.2	0.4	0.1	1.7
P	USA	3.2	0.2	1.4	1.6
G	Australia	3.6	0.5	2.0	1.1
N	Austria	3.0	0.4	1.7	0.9
N	Belgium	3.3	0.4	1.3	1.5
G	Denmark	2.7	0.1	1.2	1.3
G	Finland	2.3	0.6	1.6	0.1
G	Ireland	5.6	0.2	3.3	2.1
G	Italy	1.6	0.8	0.7	0.1
M	Japan	3.1	1.5	0.8	0.9
M	Netherlands	3.8	0.4	1.7	1.7
G	New Zealand	3.5	0.4	1.5	1.6
G	Norway	3.6	0.0	1.9	1.7
G	Portugal	4.7	0.7	1.5	2.5
G	Spain	3.5	0.6	1.6	1.3
	OECD 7	2.8	0.4	1.1	1.3
	OECD 13	3.4	0.5	1.6	1.3
	OECD 20	3.2	0.5	1.4	1.3
	Avg G	3.2	0.5	1.5	1.3
	Avg N	2.9	0.3	1.5	1.0
	Avg M	3.4	0.6	1.2	1.5
	Avg P	3.2	0.2	1.4	1.6
	Correlations				
	Lifestyle	0.10	-0.42	0.21	0.15
	%Employ	-0.08	-0.50	0.06	0.06
	%Public	-0.08	0.13	-0.11	-0.07
	HC %GDP	-0.01	-0.29	-0.05	0.18
	HC/Capita \$PPP	0.07	-0.52	0.14	0.22
	InfantMortality	0.01	-0.39	0.09	0.12
	PYLL	-0.09	-0.32	-0.02	0.05

Real growth caused by aging calculated using CIHI costs by age group as described on page 17 of this report.

Healthcare Costs Split by Source of Funds

Public Ins Type	Country	Healthcare as %GDP	Healthcare PerCapita \$PPP	PerCapita Income \$PPP	% Govt Tax Revenue	% National + Mandated Insurance	% Public Insurance	% Private Insurance	% Out of Pocket
G	Canada	11.4	4,445	38,991	69.2	1.3	70.5	14.9	14.7
N	France	11.6	3,974	34,259	7.4	70.5	77.8	14.8	7.3
M	Germany	11.6	4,338	37,397	8.9	68.1	77.1	10.0	13.0
G	Sweden	9.6	3,758	39,146	81.1	0.0	81.1	1.9	17.0
M	Switzerland	11.4	5,270	46,228	18.2	40.8	59.0	10.1	30.9
G	UK	9.6	3,433	35,760	83.9	0.0	83.9	6.1	10.0
P	USA	17.6	8,233	46,778	13.4	39.7	53.1	35.1	11.8
G	Australia	9.1	3,670	40,330	68.0	0.0	68.0	11.5	20.5
N	Austria	11.0	4,395	39,955	33.0	44.5	77.5	7.9	14.6
N	Belgium	10.5	3,969	37,800	11.3	63.5	74.7	5.0	20.2
G	Denmark	11.1	4,464	40,216	85.1	0.0	85.1	1.8	13.1
G	Finland	8.9	3,251	36,528	60.3	14.8	75.1	6.2	18.8
G	Ireland	9.2	3,718	40,413	68.8	0.4	69.2	15.7	15.2
G	Italy	9.3	2,964	31,871	77.4	0.2	77.6	2.8	19.6
M	Japan	9.5	3,035	31,947	10.2	72.4	82.5	3.1	14.3
M	Netherlands	12.0	5,056	42,133	7.6	71.7	79.2	8.4	5.2
G	New Zealand	10.1	3,022	29,921	74.8	8.4	83.2	6.3	10.5
G	Norway	9.4	5,388	57,319	72.1	11.8	83.9	0.8	15.3
G	Portugal	10.7	2,728	25,495	67.0	1.2	68.1	7.1	24.8
G	Spain	9.6	3,076	32,042	68.4	4.4	72.8	6.5	20.7
	Avg 7	11.8	4,779	39,794	40.3	31.5	71.8	13.3	14.9
	Avg 13	10.0	3,749	37,382	54.1	22.5	76.7	6.4	16.4
	Avg 20	10.7	4,109	38,226	49.3	25.7	75.0	8.8	15.9
	Avg G	9.8	3,660	37,336	73.0	3.5	76.5	6.8	16.7
	Avg N	11.0	4,113	37,338	17.2	59.5	76.7	9.3	14.0
	Avg M	11.1	4,425	39,426	11.2	63.2	74.5	7.9	15.8
	Avg P	17.6	8,233	46,778	13.4	39.7	53.1	35.1	11.8
Correlations									
	Lifestyle	0.32	0.16	-0.12	0.16	-0.27	-0.36	0.59	-0.22
	%Employ	0.03	0.42	0.73	0.09	0.00	0.31	-0.17	-0.29
	%Public	-0.57	-0.51	-0.18	0.29	-0.02	1.00	-0.77	-0.47
	HC %GDP	1.00	0.84	0.27	-0.52	0.38	-0.57	0.80	-0.26
	HC/Capita \$PPP	0.84	1.00	0.75	-0.41	0.28	-0.51	0.68	-0.19
	InfantMortality	0.63	0.55	0.18	-0.09	-0.03	-0.43	0.72	-0.32
	PYLL	0.71	0.50	0.02	-0.19	0.08	-0.38	0.65	-0.24

\$PPP: Purchasing Power Parity with costs restated in U.S. dollars using comparable cost of a basket of goods and services rather than using the market exchange rates.

Healthcare Costs Split by Use of Funds

Public Ins Type	Country	% Inpatient Care	% Outpatient Care	% Long Term Care	% Pharma	% Medical Goods	% Other Services
G	Canada	19.8	33.3	14.6	16.7	4.1	11.5
N	France	35.7	22.6	11.5	16.0	5.0	9.2
M	Germany	28.6	29.4	12.3	14.8	5.7	9.1
G	Sweden	28.5	42.0	7.7	12.6	3.4	5.8
M	Switzerland	28.3	32.7	19.3	9.7	2.5	7.4
G	UK				11.8		
P	USA	18.9	50.6	5.9	11.9	2.2	10.6
G	Australia				14.7		
N	Austria				12		
N	Belgium	29.6	25.5	19.7	15.8	1.7	7.7
G	Denmark	29.3	31.2	24.5	7.4	4.1	3.5
G	Finland	27.9	34.2	12.3	13.9	4.1	7.6
G	Ireland				18.5		
G	Italy				17.2		
M	Japan	32.2	33.9	8.9	20.8	0.0	4.3
M	Netherlands	35.0	18.6	22.6	9.5	5.0	9.2
G	New Zealand	27.7	33.9	13.9	9.4	1.2	13.9
G	Norway	31.8	26.3	27.1	7.3	4.5	3.0
G	Portugal	25.3	44.2	1.0	18.6	7.2	3.6
G	Spain	25.6	37.8	9.0	18.9	2.8	5.8
	OECD 7	26.6	35.1	11.9	13.4	3.8	8.9
	OECD 13	29.4	31.7	15.5	14.2	3.4	6.5
	OECD 20	28.3	33.1	14.0	13.9	3.6	7.5
	Avg G	27.0	35.4	13.8	13.9	3.9	6.8
	Avg N	32.7	24.0	15.6	14.6	3.3	8.4
	Avg M	31.0	28.7	15.8	13.7	3.3	7.5
	Avg P	18.9	50.6	5.9	11.9	2.2	10.6
Correlations							
	Lifestyle	-0.53	0.32	-0.29	0.02	0.14	0.54
	%Employ	0.26	-0.34	0.74	-0.71	0.04	-0.20
	%Public	0.51	-0.50	0.09	0.05	-0.16	0.19
	HC %GDP	-0.45	0.33	-0.17	-0.23	0.00	0.40
	HC/Capita \$PPP	-0.31	0.15	0.23	-0.49	-0.05	0.20
	InfantMortality	-0.53	0.18	0.02	-0.26	-0.24	0.78
	PYLL	-0.48	0.37	-0.20	-0.18	-0.02	0.37

Healthcare Costs Split by Use of Funds

Public Ins Type	Country	Inpatient Care PerCapita \$PPP	Outpatient Care PerCapita \$PPP	Long Term Care PerCapita \$PPP	Pharma PerCapita \$PPP	Med Goods PerCapita \$PPP	Other Services PerCapita \$PPP
G	Canada	880	1,482	647	742	181	512
N	France	1,417	900	458	636	197	366
M	Germany	1,242	1,277	536	642	246	395
G	Sweden	1,070	1,577	290	474	129	218
M	Switzerland	1,493	1,724	1,019	511	130	392
G	UK				405		
P	USA	1,553	4,167	484	980	179	870
G	Australia				539		
N	Austria				527		
N	Belgium	1,176	1,010	783	627	67	304
G	Denmark	1,308	1,393	1,094	330	184	154
G	Finland	907	1,112	400	452	132	248
G	Ireland				688		
G	Italy				510		
M	Japan	976	1,029	269	631		130
M	Netherlands	1,772	941	1,145	480	253	464
G	New Zealand	838	1,025	419	284	37	419
G	Norway	1,711	1,416	1,463	393	242	163
G	Portugal	690	1,207	29	507	196	99
G	Spain	789	1,163	278	581	87	178
	OECD 7	1,276	1,855	572	627	177	459
	OECD 13	1,130	1,144	653	504	150	240
	OECD 20	1,188	1,428	621	547	162	328
	Avg G	1,024	1,297	577	492	149	249
	Avg N	1,297	955	621	597	132	335
	Avg M	1,371	1,243	742	566	210	345
	Avg P	1,553	4,167	484	980	179	870
	Correlations						
	Lifestyle	-0.14	0.41	-0.26	0.28	-0.25	0.55
	%Employ	0.61	0.08	0.76	-0.28	0.32	0.00
	%Public	0.47	-0.08	0.11	0.33	0.29	0.26
	HC %GDP	0.44	0.84	0.05	0.63	0.28	0.86
	HC/Capita \$PPP	0.74	0.84	0.48	0.51	0.39	0.76
	InfantMortality	0.20	0.59	0.11	0.39	-0.13	0.88
	PYLL	0.05	0.62	-0.13	0.38	-0.08	0.59

Healthcare Resources

Public Ins Type	Country	Healthcare & Social Services as % of All Emplmt	Physicians / 1000	Nurses / 1000	Physicians + 50% Nurse / 1000	Hosp Beds / 1000	Acute Hosp Beds / 1000	MRI Units / million	CT Units / million	
G	Canada	11.6	2.4	9.3	7.1	3.2	1.7	8.2	14.2	
N	France	9.5	3.3	8.5	7.6	6.4	3.5	7.0	11.8	
M	Germany	11.9	3.7	11.3	9.4	8.3	5.7	10.3	17.7	
G	Sweden	15.7	3.8	11.0	9.3	2.7	2.0			
M	Switzerland	11.8	3.8	16.0	11.8	5.0	3.1	17.8	32.6	
G	UK	12.9	2.7	9.6	7.5	3.0	2.4	5.9	8.2	
P	USA	12.5	2.4	11.0	7.9	3.1	2.6	31.6	40.7	
G	Australia	11.1	3.1	10.1	8.2	3.7	3.4	5.6	42.8	
N	Austria	9.7	4.8	7.7	8.7	7.6	5.5	18.6	29.8	
N	Belgium	13.2	2.9	15.1	10.5	6.4	4.1	10.7	13.2	
G	Denmark	18.4	3.5	15.4	11.2	3.5	2.9	15.4	27.6	
G	Finland	15.2	3.3	9.6	8.1	5.9	1.8	18.7	21.1	
G	Ireland	12.0	3.1	13.1	9.7	3.1	2.3	12.5	15.6	
G	Italy	7.3	3.7	6.3	6.9	3.5	2.8	22.4	31.6	
M	Japan	9.9	2.2	10.1	7.3	13.6	8.1	43.1	97.3	
M	Netherlands	15.9	2.9	8.4	7.1	4.7	3.0	12.2	12.3	
G	New Zealand	10.4	2.6	10.0	7.6	2.7	2.0	10.5	15.6	
G	Norway	20.0	4.1	14.4	11.3	3.3	2.4			
G	Portugal	5.9	3.8	5.7	6.7	3.4	2.8	9.2	27.4	
G	Spain	6.3	3.8	4.9	6.3	3.2	2.5	10.7	15.0	
	OECD 7	12.3	3.2	11.0	8.6	4.5	3.0	13.5	20.9	
	OECD 13	11.9	3.4	10.1	8.4	5.0	3.4	15.8	29.1	
	OECD 20	12.1	3.3	10.4	8.5	4.8	3.2	15.0	26.4	
	Avg G	12.2	3.3	10.0	8.3	3.4	2.4	11.9	21.9	
	Avg N	10.8	3.7	10.4	8.9	6.8	4.4	12.1	18.3	
	Avg M	12.4	3.2	11.5	8.9	7.9	5.0	20.9	40.0	
	Avg P	12.5	2.4	11.0	7.9	3.1	2.6	31.6	40.7	
	Correlations									
	Lifestyle	-0.24	-0.16	-0.21	-0.26	-0.50	-0.41	-0.47	-0.58	
	%Employ	1.00	-0.02	0.69	0.64	-0.14	-0.22	-0.01	-0.15	
	%Public	0.00	-0.13	0.12	0.06	0.74	0.68	0.32	0.23	
	HC %GDP	0.03	-0.24	0.08	-0.02	-0.06	0.01	0.26	0.01	
	HC/Capita \$PPP	0.42	-0.09	0.40	0.35	-0.14	-0.08	0.27	0.01	
	InfantMortality	-0.07	-0.44	0.05	-0.12	-0.37	-0.27	-0.12	-0.25	
	PYLL	0.05	-0.32	0.12	-0.02	-0.15	-0.17	0.08	-0.16	

Healthcare Utilization

Public Ins Type	Country	Physicians Consult /Capita	MRI Exams / 1000	CT Exams / 1000	Hosp Discharges (All Causes) / 1000	Average Hosp Stay (Acute Care) Days	COPD Hosp Rates / 1000	Coronary Angioplasty / 1000	Knee Replace / 1000	Hip Replace / 1000
G	Canada	5.5	46.7	126.9	82.6	7.7	1.8	1.0	1.4	1.2
N	France	6.7	60.2	145.4	168.6	5.7	0.8	1.9	1.2	2.2
M	Germany	8.9	95.2	117.1	239.8	9.5	2.0	5.8	2.1	3.0
G	Sweden	2.9	..	..	163.1	5.7	1.4	1.8	1.3	2.1
M	Switzerland	4.0	..	..	168.9	9.6	0.9	1.3	2.0	2.9
G	UK	5.0	40.8	76.4	136.0	7.7	2.1	1.8	1.4	1.9
P	USA	3.9	97.7	265.0	131.0	4.9	2.3	3.8	2.1	1.8
G	Australia	6.5	23	93	155.5	5.1	3.1	1.6	1.6	1.5
N	Austria	6.9	47.6	145.5	261.0	6.6	3.1	2.3	1.9	2.4
N	Belgium	7.7	52.8	179.3	178.4	8.1	2.3	4.3	1.7	2.4
G	Denmark	4.6	57.5	105.2	171.5	4.6	2.8	1.8	1.7	2.4
G	Finland	4.3	..	..	181.6	11.6	1.5	1.4	1.8	1.9
G	Ireland	3.8	17.3	75.4	131.6	6.1	3.6	0.8	0.4	1.2
G	Italy	7.0	..	..	127.5	6.7	1.3	1.3	1.0	1.5
M	Japan	13.1	..	..	107.1	18.2				
M	Netherlands	6.6	49.1	66.0	115.8	5.8	1.5	1.7	1.2	2.1
G	New Zealand	2.9	3.6	22.4	147.0	8.1	3.2	1.2	1.0	1.5
G	Norway	5.2	..	..	175.3	4.5	2.4	2.5	0.8	2.3
G	Portugal	4.1	..	..	112.5	5.9	0.7	1.2	0.6	0.9
G	Spain	7.5	45.6	82.8	102.5	6.8	1.4	1.3	1.0	0.9
	OECD 7	5.3	68.1	146.2	155.7	7.3	1.6	2.5	1.6	2.2
	OECD 13	6.2	37.1	96.2	151.3	7.5	2.2	1.8	1.2	1.7
	OECD 20	5.9	49.0	115.4	152.9	7.4	2.0	2.0	1.4	1.9
	Avg G	4.9	33.5	83.2	140.5	6.7	2.1	1.5	1.2	1.6
	Avg N	7.1	53.5	156.7	202.7	6.8	2.1	2.8	1.6	2.3
	Avg M	8.2	72.2	91.6	157.9	10.8	1.5	2.9	1.8	2.7
	Avg P	3.9	97.7	265.0	131.0	4.9	2.3	3.8	2.1	1.8
Correlations										
	Lifestyle	-0.39	-0.04	0.14	-0.02	-0.46	0.42	0.09	0.02	-0.44
	%Employ	-0.27	0.17	0.03	0.25	-0.19	0.27	0.18	0.18	0.52
	%Public	0.60	0.56	0.40	0.31	0.40	-0.20	0.62	0.46	0.64
	HC %GDP	-0.13	0.74	0.77	0.00	-0.24	-0.07	0.43	0.49	0.20
	HC/Capita \$PPP	-0.21	0.69	0.78	0.13	-0.32	0.11	0.42	0.49	0.40
	InfantMortality	-0.31	0.04	0.33	-0.14	-0.33	0.40	0.09	0.28	-0.10
	PYLL	-0.31	0.49	0.74	0.09	-0.21	0.17	0.34	0.38	0.00

Lifestyle Risk Factors

	Weight	1	2	3		
Public Ins Type	Country	Litres/Yr Alcohol Age 15+	% Tobacco Age 15+	Self Report % Obese BMI>30	Measured % Obese BMI>30	Weighted Lifestyle Aggregate
G	Canada	8.2	16.3	17.5	24.2	93.3
N	France	12.0	23.3	12.9	..	97.3
M	Germany	11.7	21.9	14.7	..	99.6
G	Sweden	7.3	14.0	12.9	..	74.0
M	Switzerland	10.0	20.4	8.1	..	75.1
G	UK	10.2	21.5	20.0	26.1	113.2
P	USA	8.7	15.1	28.1	35.9	123.2
G	Australia	10.3	15.1	21.3	24.6	104.4
N	Austria	12.2	23.2	12.4	..	95.8
N	Belgium	10.8	20.5	13.8	..	93.2
G	Denmark	10.3	20.0	13.4	..	90.5
G	Finland	9.7	19.0	15.6	20.2	94.5
G	Ireland	11.9	29.0	15.0	23.0	114.9
G	Italy	6.9	23.1	10.3	..	84.0
M	Japan	7.3	19.5	3.0	3.5	55.3
M	Netherlands	9.4	20.9	11.4	..	85.4
G	New Zealand	9.6	18.1	21.0	27.8	108.8
G	Norway	6.6	19.0	10.0	..	74.6
G	Portugal	11.4	18.6	15.4	..	94.8
G	Spain	11.4	26.2	16.0	..	111.8
	Avg 7	9.7	18.9	16.3	28.7	96.5
	Avg 13	9.8	20.9	13.7	19.8	92.9
	Avg 20	9.8	20.2	14.6	23.2	94.2
	Avg G	9.5	20.0	15.7	24.3	96.6
	Avg N	11.7	22.3	13.0		95.4
	Avg M	9.6	20.7	9.3	3.5	78.9
	Avg P	8.7	15.1	28.1	35.9	123.2
	Correlations					
	Lifestyle	0.55	0.21	0.86	0.94	1.00
	%Employ	-0.35	-0.30	-0.07	0.30	-0.24
	%Public	0.18	0.12	-0.35	-0.55	-0.27
	HC %GDP	0.05	-0.27	0.45	0.59	0.32
	HC/Capita \$PPP	-0.15	-0.29	0.32	0.62	0.16
	InfantMortality	0.07	-0.18	0.71	0.84	0.62
	PYLL	0.24	-0.23	0.68	0.75	0.58

Estimated

Mortality

Public Ins Type	Country	Infant Mortality /1000 1990	Infant Mortality /1000 2010	All Causes PYLL/100K 1990	All Causes PYLL/100K 2010	All Cancer PYLL/100K	Circulatory Systems PYLL/100K	Respiratory Systems PYLL/100K	Endocrine Sytems (ie:Diabetes) PYLL/100K	Digestive Systems (ie:Liver) PYLL/100K
G	Canada	6.8	5.1	4,817	3,217	876	433	122	102	119
N	France	7.3	3.6	5,323	3,508	1,130	396	76	77	175
M	Germany	7.0	3.4	5,379	3,129	936	522	102	79	205
G	Sweden	6.0	2.5	4,129	2,487	702	375	66	61	83
M	Switzerland	6.8	3.8	4,671	2,749	833	350	57	56	103
G	UK	7.9	4.2	4,912	3,259	914	543	171	69	254
P	USA	9.2	6.1	6,382	4,870	966	860	197	177	219
G	Australia	8.2	4.1	4,707	2,884	821	398	92	70	100
N	Austria	7.8	3.9	5,290	3,208	903	464	70	136	195
N	Belgium	8.0	3.5	5,147	3,625	1,077	554	157	77	179
G	Denmark	7.5	3.4	5,566	3,689	1,120	503	121	134	282
G	Finland	5.6	2.3	5,755	3,557	770	625	70	83	319
G	Ireland	8.2	3.8	5,116	2,978	865	465	98	68	142
G	Italy	8.1	3.4	4,579	2,666	927	392	67	78	110
M	Japan	4.6	2.3	3,653	2,616	768	443	101	43	111
M	Netherlands	7.1	3.8	4,324	2,738	1,016	392	95	73	90
G	New Zealand	8.4	5.2	5,803	3,548	971	550	141	141	65
G	Norway	6.9	2.8	4,647	2,775	800	366	75	75	66
G	Portugal	10.9	2.5	6,617	3,462	1,065	384	120	73	200
G	Spain	7.6	3.2	5,052	2,716	986	406	134	54	149
	OECD 7	7.3	4.1	5,088	3,317	908	497	113	89	165
	OECD 13	7.6	3.4	5,096	3,112	930	457	103	85	154
	OECD 20	7.5	3.6	5,093	3,184	922	471	107	86	158
	Avg G	7.7	3.5	5,142	3,103	901	453	106	84	157
	Avg N	7.7	3.7	5,253	3,447	1,036	472	101	97	183
	Avg M	6.4	3.3	4,507	2,808	888	427	89	63	127
	Avg P	9.2	6.1	6,382	4,870	966	860	197	177	219
Correlations										
Lifestyle		0.62	0.62	0.65	0.58	0.38	0.55	0.61	0.47	0.37
%Employ		-0.39	-0.07	-0.19	0.05	-0.21	0.13	-0.09	0.12	0.08
%Public		-0.30	-0.03	-0.16	0.08	0.22	0.11	-0.05	-0.06	-0.01
HC %GDP		0.31	0.63	0.44	0.71	0.36	0.61	0.48	0.65	0.19
HC/Capita \$PPP		0.09	0.55	0.18	0.50	0.05	0.49	0.26	0.53	0.04
InfantMortality		0.39	1.00	0.31	0.56	0.24	0.51	0.57	0.68	-0.08
PYLL		0.46	0.56	0.80	1.00	0.48	0.85	0.66	0.78	0.58

Female Life Expectancy

Public Ins Type	Country	Life Expectancy at Birth Female	Increase Last 20 Years	Increase Last 40 Years	Life Expectancy at 65 Female	Increase Last 20 Years	Increase Last 40 Years
G	Canada	83.1	2.3	7.0	21.5	1.6	4.2
N	France	84.7	3.8	9.2	22.6	2.8	5.8
M	Germany	83.0	4.5	9.4	20.9	3.2	6.0
G	Sweden	83.5	3.1	6.4	21.1	2.1	4.3
M	Switzerland	84.9	4.0	8.7	22.5	2.8	6.2
G	UK	82.6	4.1	7.6	20.9	3.0	4.9
P	USA	81.1	2.3	6.4	20.3	1.4	3.3
G	Australia	84.0	3.9	9.8	21.8	2.8	6.2
N	Austria	83.5	4.5	10.0	21.4	3.3	6.5
N	Belgium	83.0	3.5	8.7	21.3	2.5	5.9
G	Denmark	81.4	3.6	5.5	19.7	1.8	3.0
G	Finland	83.5	4.5	8.5	21.5	3.7	7.1
G	Ireland	83.2	5.5	9.7	21.1	4.1	6.1
G	Italy	84.6	4.3	9.7	22.1	3.2	5.9
M	Japan	86.4	4.5	11.7	23.9	3.9	8.6
M	Netherlands	82.7	2.6	6.2	21.2	2.3	5.1
G	New Zealand	82.8	4.4	8.3	21.2	2.9	5.3
G	Norway	83.3	3.4	5.8	21.2	2.5	4.4
G	Portugal	82.8	5.3	13.1	20.6	3.5	6.0
G	Spain	85.3	4.7	10.5	22.7	3.4	6.7
	OECD 7	83.3	3.4	7.8	21.4	2.4	5.0
	OECD 13	83.6	4.2	9.0	21.5	3.1	5.9
	OECD 20	83.5	3.9	8.6	21.5	2.8	5.6
	Avg G	83.3	4.1	8.5	21.3	2.9	5.3
	Avg N	83.7	3.9	9.3	21.8	2.9	6.1
	Avg M	84.3	3.9	9.0	22.1	3.1	6.5
	Avg P	81.1	2.3	6.4	20.3	1.4	3.3
	Correlations						
	Lifestyle	-0.50	0.10	-0.01	-0.44	-0.05	-0.27
	%Employ	-0.46	-0.50	-0.83	-0.45	-0.46	-0.53
	%Public	0.21	-0.17	0.09	0.34	0.03	0.32
	HC %GDP	-0.50	-0.55	-0.31	-0.34	-0.60	-0.48
	HC/Capita \$PPP	-0.48	-0.67	-0.58	-0.35	-0.66	-0.57
	InfantMortality	-0.47	-0.45	-0.34	-0.29	-0.52	-0.49
	PYLL	-0.67	-0.25	-0.20	-0.53	-0.39	-0.43

Male Life Expectancy

Public Ins Type	Country	Life Expectancy at Birth Male	Increase Last 20 Years	Increase Last 40 Years	Life Expectancy at 65 Male	Increase Last 20 Years	Increase Last 40 Years
G	Canada	78.5	4.1	9.4	18.3	2.6	4.6
N	France	78.0	5.2	10.0	18.4	2.9	5.5
M	Germany	78.0	6.0	10.5	17.8	3.8	5.9
G	Sweden	79.5	4.7	7.5	18.2	2.9	4.2
M	Switzerland	80.3	6.3	10.3	19.0	3.7	5.9
G	UK	78.6	5.7	9.9	18.3	4.3	6.3
P	USA	76.2	4.4	9.1	17.7	2.6	4.6
G	Australia	79.5	5.6	12.1	18.7	3.7	6.5
N	Austria	77.9	5.6	11.4	17.7	3.5	6.1
N	Belgium	77.6	4.9	9.8	17.5	3.3	5.5
G	Denmark	77.2	5.2	6.5	16.8	3.0	3.2
G	Finland	76.9	5.9	10.4	17.3	3.7	6.0
G	Ireland	78.7	6.6	9.9	17.2	4.8	4.8
G	Italy	79.4	5.6	10.4	18.2	3.1	4.9
M	Japan	79.6	3.7	10.3	18.9	2.7	6.4
M	Netherlands	78.8	5.0	8.0	17.4	3.5	4.1
G	New Zealand	79.1	6.6	10.7	18.6	4.2	6.0
G	Norway	79.0	5.5	7.8	18.0	3.4	4.4
G	Portugal	76.7	6.1	13.1	17.1	3.1	5.8
G	Spain	79.1	5.7	9.9	18.3	3.1	5.0
	OECD 7	78.4	5.2	9.5	18.2	3.3	5.3
	OECD 13	78.4	5.5	10.0	17.8	3.5	5.3
	OECD 20	78.4	5.4	9.9	18.0	3.4	5.3
	Avg G	78.5	5.6	9.8	17.9	3.5	5.1
	Avg N	77.8	5.2	10.4	17.9	3.2	5.7
	Avg M	79.2	5.3	9.8	18.3	3.4	5.6
	Avg P	76.2	4.4	9.1	17.7	2.6	4.6
Correlations							
	Lifestyle	-0.44	0.39	0.23	-0.25	0.38	0.07
	%Employ	-0.07	-0.16	-0.77	-0.30	0.08	-0.51
	%Public	-0.07	-0.32	0.00	0.09	-0.19	0.21
	HC %GDP	-0.51	-0.33	-0.16	-0.16	-0.39	-0.25
	HC/Capita \$PPP	-0.29	-0.29	-0.41	-0.11	-0.25	-0.38
	InfantMortality	-0.13	-0.04	0.00	0.15	0.07	-0.05
	PYLL	-0.83	-0.08	0.02	-0.39	-0.15	-0.05

Percentage of Population who Feel Healthy

Public Ins Type	Country	Ages 15-24	Ages 25-44	Ages 45-64	Ages 65+	All Ages	Low Income	High Income
G	Canada	95.0	93.5	85.6	75.6	88.1	77.6	94.1
N	France	91.0	82.2	62.8	41.6	68.4	57.2	78.0
M	Germany	90.6	81.5	58.4	38.1	64.7	51.5	78.1
G	Sweden	90.0	87.3	76.4	62.7	79.2	77.8	88.4
M	Switzerland	95.9	92.7	84.3	71.8	86.7		
G	UK	88.9	84.1	70.2	56.9	76.1		
P	USA	96.5	92.7	83.8	75.4	89.8	75.6	96.2
G	Australia	93.2	90.7	82.0	68.4	84.9	75.3	92.5
N	Austria	93.8	84.9	64.3	38.8	69.6	53.9	82.2
N	Belgium	93.5	86.3	72.4	56.5	76.7		
G	Denmark	94.6	79.5	68.1	56.5	71.2	65.0	82.2
G	Finland	82.9	72.9	60.5		68.0		
G	Ireland	95.6	90.2	78.2	65.0	83.3	82.1	92.2
G	Italy	94.8	86.5	64.9	26.1	66.5	66.1	75.2
M	Japan	45.5	38.6	26.7	18.4	30.0	23.6	34.5
M	Netherlands	89.3	85.7	73.0	58.9	77.1		
G	New Zealand	92.2	91.2	89.7	83.2	89.7	89.7	93.2
G	Norway	90.0	87.0	75.0	68.0	80.0	80.0	90.0
G	Portugal	84.4	70.9	38.9	11.5	49.3	34.9	66.1
G	Spain	94.1	88.1	69.7	40.5	74.0		
	OECD 7	92.6	87.7	74.5	60.3	79.0	67.9	87.0
	OECD 13	88.0	81.0	66.4	49.3	70.8	63.4	78.7
	OECD 20	89.6	83.3	69.2	53.4	73.7	65.0	81.6
	Avg G	91.3	85.2	71.6	55.9	75.9	72.1	86.0
	Avg N	92.8	84.5	66.5	45.6	71.6	55.6	80.1
	Avg M	80.3	74.6	60.6	46.8	64.6	37.6	56.3
	Avg P	96.5	92.7	83.8	75.4	89.8	75.6	96.2
	Correlations							
	Lifestyle	0.57	0.54	0.43	0.30	0.50	0.47	0.67
	%Employ	0.09	0.12	0.31	0.54	0.31	0.45	0.37
	%Public	-0.35	-0.33	-0.32	-0.23	-0.32	-0.57	-0.50
	HC %GDP	0.24	0.23	0.21	0.23	0.25	0.03	0.24
	HC/Capita \$PPP	0.32	0.37	0.43	0.50	0.46	0.31	0.45
	InfantMortality	0.49	0.60	0.68	0.66	0.67	0.56	0.63
	PYLL	0.25	0.15	0.16	0.23	0.22	0.12	0.32

Appendix B

Brief Discussion of Correlations

Determination of the correlation coefficient between two or more health care metrics is used extensively in health care research.

This appendix will illustrate briefly its actual determination and how to interpret correlation results as it applies to this report.

Correlations

The correlation of two data sets is a method to test if one data set might behave similarly to the other. More specifically, does the increase in the values of one data set *correlate* with an increase or decrease in the value of the other data set?

In this report the Lifestyle Index has been introduced. Does it *correlate* with other health care metrics? For example below, the values of the Lifestyle Index are tested against the Infant Mortality rates.

Public Ins Type	Country	Lifestyle Index	Infant Mortality /1000 2010
G	Canada	93.3	5.1
N	France	97.3	3.6
M	Germany	99.6	3.4
G	Sweden	74.0	2.5
M	Switzerland	75.1	3.8
G	UK	113.2	4.2
P	USA	123.2	6.1
G	Australia	104.4	4.1
N	Austria	95.8	3.9
N	Belgium	93.2	3.5
G	Denmark	90.5	3.4
G	Finland	94.5	2.3
G	Ireland	114.9	3.8
G	Italy	84.0	3.4
M	Japan	55.3	2.3
M	Netherlands	85.4	3.8
G	New Zealand	108.8	5.2
G	Norway	74.6	2.8
G	Portugal	94.8	2.5
G	Spain	111.8	3.2

A visual review of the two data sets seems to indicate that low infant mortality rates go with the low Lifestyle Indices, for example, Sweden and Japan.

On the other hand, high Lifestyle Indices go with high infant mortality rates. Examples include the United States, Australia, and New Zealand.

Canada has a high infant mortality rate but a slightly less than average Lifestyle Index.

Hence, it appears that the values of the Lifestyle Index correlate at some level with the infant mortality rates.

Mathematically we can determine how well they correlate by the following formulas for the value of correlation coefficient r where L is the Lifestyle Index value and Q is the infant mortality rate, and for each value of L and Q :

$$x = L - (\text{Average } L)$$

$$y = Q - (\text{Average } Q)$$

$$r = \sum xy / \sqrt{(\sum x^2)(\sum y^2)}$$

See an example of the actual calculation of the correlation coefficient for L and Q later in this appendix.

Average	94.2	3.6
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Correlation with		
Lifestyle	1.00	0.62

The correlation coefficient r will have values between -1 and 1 .

A value close to zero indicates no correlation exists between the two data sets. A value close to 1 indicates high correlation with high values of one data set tending to go with high values of the other data set. A value close to -1 indicates high correlation with high values of one data set tending to go with low values of the other data set.

Typically, values less than -0.50 or higher than $+0.50$ indicate some level of correlation of the two data sets. However, it does not necessarily indicate that one data set is dependent on the other data values since there may be many other factors that might influence the results.

Examples of correlations less than -0.50 or greater than $+0.50$:

- Lifestyle Index versus infant mortality at 0.62 . The lower Lifestyle Index values tend to go with the lower infant mortality rates, and higher Lifestyle Index values go with higher infant mortality rates.
- Lifestyle index versus male life expectancy at -0.51 . The lower Lifestyle Index values tend to go with the higher life expectancies, and higher Lifestyle Index values go with lower life expectancies.

Calculation of Correlation Coefficient of L vs Q Values

L	Q	y	y			
		L-Avg(L)	Q-Avg(Q)	x * y	x ^2	y^2
93.3	5.1	-0.9	1.5	-1.288	0.78	2.12
97.3	3.6	3.1	0.0	-0.140	9.70	0.00
99.6	3.4	5.4	-0.2	-1.327	29.32	0.06
74.0	2.5	-20.2	-1.1	23.112	407.43	1.31
75.1	3.8	-19.1	0.2	-2.958	364.24	0.02
113.2	4.2	19.0	0.6	10.553	361.57	0.31
123.2	6.1	29.0	2.5	71.232	841.87	6.03
104.4	4.1	10.2	0.5	4.648	104.35	0.21
95.8	3.9	1.6	0.3	0.412	2.61	0.07
93.2	3.5	-1.0	-0.1	0.143	0.97	0.02
90.5	3.4	-3.7	-0.2	0.903	13.58	0.06
94.5	2.3	0.3	-1.3	-0.424	0.10	1.81
114.9	3.8	20.7	0.2	3.211	429.11	0.02
84.0	3.4	-10.2	-0.2	2.495	103.73	0.06
55.3	2.3	-38.9	-1.3	52.300	1512.04	1.81
85.4	3.8	-8.8	0.2	-1.362	77.18	0.02
108.8	5.2	14.6	1.6	22.726	213.60	2.42
74.6	2.8	-19.6	-0.8	16.549	383.57	0.71
94.8	2.5	0.6	-1.1	-0.704	0.38	1.31
111.8	3.2	17.6	-0.4	-7.839	310.29	0.20

	L	Q
Total	1,883.7	72.9
Average	94.2	3.6

A	B	C
192.2	5,166.4	18.6

Correlation L versus Q	=	A / (B x C)^.5	=	0.62
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Appendix C

Examples of Seven Public Health Care Funding Models

This section briefly describes the actual funding models in use for seven countries:

- Canada, France, Germany, Sweden, Switzerland, the United Kingdom, and the United States.

These countries were selected because they are frequently cited in any comparisons with the Canadian health care system. They also represent examples of all three funding methods.

The brief outlines show the main and unique characteristics of each country's public health care model without being overly detailed.

The description includes only health care programs that have been in place for a few years. Thus, it excludes any provisions of the U.S. Affordable Care Act.

HEALTH CARE PROFILE: CANADA

Coverage

Canada's national health insurance program, often referred to as "Medicare," provides coverage to all legal residents of Canada. Each province administers its own plan with some funding from the federal government.

In order to get federal funding each province must also adhere to the fundamental principles of the Canada Health Act (CHA), briefly outlined as follows:

- Publicly administered with ability to contract out specific administrative services
- Comprehensive and must cover all medically necessary core hospital, physician, and diagnostic services plus in-hospital drugs
- Universal and cover all residents after 90-day waiting period
- Portable to allow resident to move to another province—temporarily or permanently without interruption of coverage
- Have reasonable access for all beneficiaries—with allowances for remote locations
- Reasonable compensation to providers
- Not allow extra billings for core services.

Provinces may add some additional benefits (e.g., paramedical services and drugs). All provinces provide drug coverage for seniors age 65+.

Copayments usually exist for drug coverage.

Separate programs exist for the armed forces and First Nations and Inuit people.

Private insurance is not allowed for core medically necessary hospital, physician, and diagnostic services. Other expenses such as drugs and dental are either paid OOP or covered by supplemental private insurance through employer or individual plans.

The provinces provide the supplemental coverage for those on social assistance.

Funding

Funding follows the Government Service Model. Source of funds includes federal and provincial value-added and general income taxes plus health payroll taxes for some provinces with limited earmarking of taxes. The federal government provides annual health transfers to the provinces under the Canada Health Transfer (CHT) program.

A few provinces also collect additional funds through monthly premiums.

Provider Reimbursement

Hospitals: Most hospitals are publicly owned or not-for-profit. Each receives annual budgets according to provincial service and accountability agreements with each hospital based on the services they provide and their academic training facilities plus research activities. There are limited incentives based on performance targets (e.g., emergency room waiting times).

Physicians and Specialists: About 70 percent are fee-for-service based on fee schedules each province negotiates with its provincial medical association. Other physicians are paid by salaries from hospitals, sessional arrangements, or capitation formulas.

Diagnostics outside Hospitals: Fee-for-service based on fee schedules each province negotiates with provincial associations.

Drugs outside Hospitals: Coverage according to provincial formulary with guidelines for maximum cost of generics related to the brand drug price. As indicated above, this drug coverage is mostly for seniors.

Ambulance: Run by each province except for a few large municipalities where ambulance service is part of their emergency response teams.

Public Nursing Homes: Annual budgets according to provincial service and accountability agreements with each hospital based on the services they provide. Residents pay a monthly fee depending on their income.

Private Nursing Homes: Residents will be subsidized, by province, monthly depending on their income.

Reference for Canada Health Act:

<http://www.hc-sc.gc.ca/hcs-sss/pubs/cha-lcs/2011-cha-lcs-ar-ra/Index-eng.php>

Reference for Province of Ontario on Eligibility:

http://www.health.gov.on.ca/en/public/publications/ohip/ohip_eligibility.aspx

Reference for Canadian Federal Budget:

<http://www.fin.gc.ca/fedprov/mtp-eng.asp>

HEALTH CARE PROFILE: UNITED STATES

The Medicare and Medicaid profiles do not reflect the implementation of the Affordable Care Act.

MEDICARE: FEDERAL PLAN

Coverage

Medicare provides coverage for seniors (age 65+), those receiving monthly Social Disability benefits, and those who have end-stage renal disease.

Medicare Part A pays for inpatient hospital, home health agency, skilled nursing facility, and hospice care. Part A is provided free of premiums to most eligible people (receiving Social Security or have been); other seniors may voluntarily pay a monthly premium for coverage.

Part B helps pay for physician, outpatient hospital, home health agencies, and other services. To be covered by Part B, all eligible beneficiaries must pay a monthly premium.

Part D is optional and helps to pay for prescription drugs not otherwise covered by Parts A or B. Part D provides subsidized access to prescription drug insurance coverage on a voluntary basis for all beneficiaries upon payment of a monthly premium.

Beneficiaries pay for deductibles and coinsurance and items not covered under A, B, or D.

Part C (Medicare Advantage program) expands beneficiaries' options for Part A, B, and D by allowing them to acquire their Medicare coverage through private-sector health care plans with the private plan being reimbursed by Medicare for their components. This allows the beneficiary to purchase additional insurance and cover some deductibles and items not covered by Medicare.

Low-income enrollees may qualify for premium and/or cost-sharing subsidies through Medicaid.

The Medicare program covers 95 percent of the over age 65 population plus those receiving Social Security disability benefits. Part A covers 47 million, Part B covers 44 million, and Part D covers 34 million enrollees.

Funding

Medicare funding follows the National Insurance Model in combination with Government Service Model whenever premiums exceed limits set out below.

All financial operations for Medicare are handled through two trust funds, one for Hospital Insurance (Part A) and one for Supplemental Medical Insurance (split by Parts B and D). These trust funds, which are special accounts in the U.S. Treasury, are credited with all receipts and charged with all expenditures for benefits and administrative costs. The trust funds cannot be used for any other purpose, nor can one fund be used to finance the other funds.

Part A is funded through payroll taxes (currently 1.45 percent for the employee and 1.45 percent for the employer) with the goal to keep the fund liquid for at least the next 10 years.

Parts B and D are funded by premiums paid by eligible beneficiaries plus general tax revenues. Beneficiary premiums are limited to 25 percent of the projected annual costs.

Provider Reimbursement

Part A: Most inpatient hospital services are paid under a reimbursement mechanism known as the prospective payment system (PPS) using diagnosis-related groups (DRGs). Each DRG has a specific predetermined amount associated with it, which serves as the basis for payment. A number of adjustments are applied to the DRG's specific predetermined amount to calculate the payment for each patient stay. Certain payment adjustments exist for extraordinarily costly inpatient hospital stays and other situations.

Part A payments for skilled nursing care, home health care, inpatient rehabilitation hospital care, long-term-care hospitals, inpatient psychiatric hospitals, and hospice are made under separate PPS.

Part B participating physicians are paid up to the Medicare scale with no extra billing to beneficiaries allowed. Beneficiaries who choose to use nonparticipating physicians must first pay the bill and then be reimbursed by Medicare based on the Medicare scale.

Part B nonphysician services such as home health care are reimbursed under the same PPS as Part A above.

Part B hospital outpatient services are reimbursed on a separate PPS, and most payments for clinical laboratory and ambulance services are based on fee schedules.

Part B durable medical equipment charges were paid on a fee schedule in recent years but are now paid based on a competitive bidding process in some areas beginning January 1, 2011. This competitive bidding process will be expanded to all areas within the next several years.

Medicare Advantage plans have generally been paid on a capitation basis, meaning that a fixed, predetermined amount per month per member is paid to the plan, without regard to the actual number and nature of services used by the members. The specific mechanisms to determine the payment amounts have changed over the years. In 2006 Medicare began paying to plans capitated payment rates based on a competitive bidding process. For Part D, each month for each plan member, Medicare pays Part D drug plans (stand-alone PDPs and the prescription drug portions of Medicare Advantage plans) their risk-adjusted bid, minus the enrollee premium. Plans also receive payments representing premiums and cost-sharing amounts for certain low-income beneficiaries for whom these items are reduced or waived. Under the reinsurance provision, plans receive payments for 80 percent of costs in the catastrophic coverage category.

MEDICAID: FEDERAL/STATE PLAN

Coverage

Medicaid pays for medical assistance for certain individuals and families with low incomes and resources.

Within broad national guidelines established by federal statutes, regulations, and policies, each state establishes its own eligibility standards; determines the type, amount, duration, and scope of services; sets the rate of payment for services; and administers its own program. Medicaid policies for eligibility, services, and payment are complex and vary considerably, even among states of similar size or geographic proximity. Thus, a person who is eligible for Medicaid in one state may not be eligible in another state, and the services provided by one state may differ considerably in amount, duration, or scope from services provided in a similar or neighboring state. In addition, state legislatures may change Medicaid eligibility, services, and/or reimbursement at any time.

In order to receive federal funds, a state must cover at least a specified list of beneficiary categories (e.g., children of low-income families).

A state may also choose to add other categories and receive federal funds (e.g., medically needy persons whose income less their medical expenses falls below that state's medically needy income standard).

Each state may impose nominal deductibles, coinsurance, or copayments on some Medicaid beneficiaries for certain services. However, no cost sharing is allowed for emergency services and family planning services, pregnant women, children under age 18, and hospital or nursing home patients who are expected to contribute most of their income to institutional care.

Funding

Funding uses the Government Service Model with the federal government paying at least 50 percent of the Medicaid cost for qualified beneficiaries and services. The states may pay providers on a fee-for-service basis or through various prepayment arrangements, such as health maintenance organizations (HMOs).

Provider payment rates must be sufficient to enlist enough providers so that covered services are available at least to the extent that comparable care and services are available to the general population within that geographic area. Providers participating in Medicaid must accept Medicaid payment rates as payment in full.

Individual states must make additional payments to qualified hospitals that provide inpatient services to a disproportionate number of Medicaid beneficiaries and/or to other low-income or uninsured.

Medicare and Medicaid reference:

<http://www.cms.gov/Research-Statistics-Data-and-Systems/Statistics-Trends-and-Reports/MedicareProgramRatesStats/downloads/MedicareMedicaidSummaries2011.pdf>

HEALTH CARE PROFILE: GERMANY

Who Is Covered?

All citizens and residents of Germany are required to have health insurance under the Statutory Health Insurance Act.

What Is Covered?

Medical and dental treatment; hospital treatment; drugs, dressings, complementary treatment such as massages and aids such as hearing aids and wheelchairs; home help if the insured person has a child under 12 living in their home and must go into a hospital and is thus unable to look after the household; home nursing care if this helps to avoid or shorten a hospital stay; orthodontic treatment up to the age of 18; preventive measures and rehabilitation; long-term care for elderly.

Some health costs and medical bills have coinsurance and deductibles.

What Is the Cost and How Is It Paid?

Funding follows a combination of National Insurance and Mandated Private Insurance Models. There are three options for the mandatory coverage: (1) statutory (state-provided) health insurance mandatory for employees making less than €48,600 gross per year (as of January 2010), (2) private health insurance for those with higher incomes, and (3) a combination of state and private insurance.

Employers and employees each pay half the premiums as a percentage of payroll. Those who choose the private options can ask the employer for the employer's share of premiums they would have paid to the mandatory state plan to be paid toward their private plan.

The state health insurance scheme is administered by local health insurance funds using funds allocated on a per capita basis for those insured with their fund. Each fund contracts with the regional physicians' associations for services on a per capita basis. Hospitals are funded using a DRG basis.

Is Private Insurance Available?

Additional private insurance is available to supplement mandatory coverage.

Other Observations

Even though providers are mostly paid on a capitation basis, Germany has high utilization of physician and hospital services.

Sources:

OECD (2011), *Health at a Glance 2011: OECD Indicators*, OECD Publishing.

http://dx.doi.org/10.1787/health_glance-2011-en

http://www.euro.who.int/_data/assets/pdf_file/0018/80703/E85472.pdf

HEALTH CARE PROFILE: FRANCE

Who Is Covered?

French citizens are covered once they are affiliated with the social security system, which includes the provision of public health care. Workers are associated with one of seven funds that are responsible for care delivery. The largest fund covers over 80 percent of the population. Self-employed and agricultural workers each have separate funds.

What Is Covered?

Most physician, specialist, hospital, and medical services are covered. Insured individuals have free choice of provider, without going through a physician, although the reimbursement percentage may be reduced depending on how services are accessed. There is a significant mix of public and private health provision. Quality, access, and cost vary little between public and private provision.

What Is the Cost and How Is It Paid?

Funding follows a National Insurance Model. In 2009 total health expenditures represented 11.8 percent of GDP. The public portion of the system is paid from the social security contributions, paid by the working population including the self-employed, and from general tax revenues. The aggregate social security contribution for an employee is approximately 20 percent of gross salary, of which at least 25 percent is in respect of health care. Moreover, care is not free at the point of delivery. Individuals pay for services rendered and receive reimbursement at a rate of 60 percent to 70 percent of standard tariff fees, less a small administrative reimbursement-processing fee. Fees in excess of the tariff are common, especially in certain areas, such as Paris and the Côte d'Azur.

Is Private Insurance Available?

Private insurance is available and is commonly sought to cover the copayments associated with public health care. Supplementary insurance may also be purchased.

Other Observations

The French system was rated the best in the world by the World Health Organization in 2000. There are short, if any, waiting times. The diversity of public and private provision is noteworthy. There are reported to be differences of geographic distribution of health resources and inequality of health outcomes by social class across France.

Sources:

Health care in France: <http://www.frenchentree.com/fe-health/>

The French health care system: <http://www.medicalnewstoday.com/articles/9994.php>

The Health Care System under French National Health Insurance: Lessons for Health Reform in the United States: <http://www.ncbi.nlm.nih.gov/pmc/articles/PMC1447687/>

HEALTH CARE PROFILE: UNITED KINGDOM

There are some slight differences among England, Scotland, Wales, and Northern Ireland. This description is accurate for England, which is where the vast majority of the population lives.

Who Is Covered?

All residents are covered by the National Health Service (NHS) plan.

What Is Covered?

The NHS covers preventative services; inpatient and outpatient hospital specialist care; physician services; inpatient and outpatient drugs; dental care; mental health care; learning disabilities and rehabilitation.

What Is the Cost and How Is It Paid?

Funding follows the Government Service Model. The budget is financed by general tax revenues. In 2010 total health expenditures represented 9.6 percent of GDP. An important principle of the system is that there is no charge at point of service delivery for most services. There may be copayments required in certain situations, for example, many dental services and some prescription charges. Low-income individuals may receive financial support to help with these charges.

Physicians are paid by a combination of salary, capitation, and fee-for-service. Hospitals are reimbursed based on DRG models.

Is Private Insurance Available?

Private insurance may substitute for the NHS plan and is offered by a mix of for-profit and not-for-profit insurers. They offer the choice of specialists, avoidance of waiting for elective surgery, and higher standards of comfort and privacy than provided by the NHS. It represents only 7.9 percent of total health care expenses.

Other Observations

Measured by employees, the NHS is the world's largest health service and one of the world's largest employers. It is organized into trusts. Primary care trusts are local organizations that control approximately 83.2 percent of the total NHS budget. They oversee general practitioners and NHS dentists.

Source:

<http://www.nhs.uk/NHSEngland/Pages/NHSEngland.aspx>

HEALTH CARE PROFILE: SWEDEN

Who Are Covered?

All Swedish residents are covered by the public health care plan.

What Is Covered?

The public plan provides coverage for medical treatment, hospital treatment, transportation, supplementary treatment, medicines, and dental treatment. User fees and copayments, subject to annual maximums, apply to all residents age 20 and over.

What Is the Cost and How Is It Paid?

Health care is primarily the responsibility of the 21 councils/regions in Sweden. Funding follows a Government Service Model funded by general taxation.

The detailed mechanisms for paying providers vary by county. Primary care facilities are generally paid based on capitation formulas for their registered patients, complemented with fee-for-service and performance-based payments. Health care workers, such physicians, nurses, and other categories of staff, both publicly and privately employed, are predominantly salaried employees.

Is Private Insurance Available?

Private individual insurance is limited and used mainly to get quick access to a specialist in ambulatory care and to avoid waiting lists for elective treatment. It represents only 1.8 percent of total health care expenses and is mostly employer paid for so their employees can have quicker access to medical services.

However, in 2010 Sweden legislated service guarantees that require instant contact (zero delay) with the health care system for consultation; seeing a general practitioner within seven days; consulting a specialist within 90 days; and waiting no more than 90 days after being diagnosed to receive treatment.

Other Observations

In 2010 total health expenditures represented 9.6 percent of GDP, and 81.0 percent of health expenses are publicly funded. Private insurance is minimal at 2.2 percent of health care costs. The other 16.8 percent represents mostly user charges for medical professionals and hospitals with graduated coinsurance for prescription drugs and dental services.

Health care and social services employment is high, at 15.7 percent of all Swedish employment.

Source:

<http://www.euro.who.int/en/who-we-are/partners/observatory/news/news/2012/05/new-hit-health-system-review-on-sweden>

HEALTH CARE PROFILE: SWITZERLAND

Who Is Covered?

It is compulsory for all residents to be covered for basic health insurance; however, it is necessary to register with an insurance provider within three months of arrival in Switzerland. Each individual has his or her own insurance.

What Is Covered?

Basic compulsory insurance provides coverage for medical treatment, hospital treatment, transportation, supplementary treatment, medicines, and dental treatment, although restrictions and limitations apply to the services in these categories, especially to supplementary treatment, medicines, and dental treatment. There is not a list of covered medical treatments, but the payment of any such treatment is assessed on the basis of effectiveness, appropriateness, and efficiency. Hospital stays are covered for ward accommodation. Transportation is subject to copayment charges and an annual maximum.

What Is the Cost and How Is It Paid?

Funding follows a Mandated Insurance Model. In 2009 total health expenditures represented 11.4 percent of GDP. Insurers use a community rating system for basic insurance, without any risk adjustment. All policies are subject to deductible, and different deductibles are available in order to reduce premiums. If the premium rate for basic compulsory insurance exceeds 8 percent of a family's income, the state may provide financial assistance to pay these premiums. Also, there are copayments and limits when certain services are received. Tax revenues pay for some health services.

Is Private Insurance Available?

Private insurance is available for supplementary coverage and must be paid for in full by the individual.

Other Observations

Quality of care is considered to be high and is delivered consistently regardless of income. Generally the Swiss demand an optimal state of health provision throughout life and are willing to pay for it. Insurers offer the basic compulsory insurance on a not-for-profit basis. There is considerable competition among insurers and providers. Responsibility for health care rests at the canton (i.e., province or state) level, so there are some slight differences by region.

Sources:

http://www.euro.who.int/_data/assets/pdf_file/0003/96411/E68670.pdf

The Swiss Health Care System (2002): www.civitas.org.uk/pdf/Switzerland.pdf