

**Aging Population Impact On Health Care Expenditures In Canada**

**By**

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**Major Paper presented to the Department of Economics of the  
University of Ottawa**

**In partial fulfillment of the requirements of the M.A. Degree**

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**Ottawa, Ontario**

**April 2003**

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## Chapter 1 Introduction

Over the past twenty years, debates about the provision of social programs have been an important theme in the political realm in Canada. Concerned by the presence of large budget deficits, the federal and provincial governments have had to find ways to reduce public expenditures. As explained in Robson (2001), total government debts reached 100 percent of the nominal GDP in the 1990s, and this prompted all governments to respond with unprecedented spending reductions. As a result, the overall public spending as a share of the nominal GDP declined by more than 10 percentage points in 1999 from a peak of 52.4 percent in 1992. Among the measures put in place, the federal government froze the per capita transfer payments to provinces at the 1989 level, and then reduced the per capita transfer payments in 1995. Therefore, the growth of the federal transfers dramatically decreased in the mid-1990s (LeBreton and Kirby, 2001).

As the proportion of seniors within the population is increasing, and that of youths is declining, a reduction of the proportion of the working age population is to be expected. Obviously, the aging population reduces labour supply, which may have negative effects on economic growth. According to Antunes, Brimacombe, and McIntyre (2001), the real growth of GDP will fall from an average 3.5 percent annually in 2000-2004 to 2.5 percent in 2010-2020. Similarly, Robson (2001) claims that the growth of the economy in the next 10 years is expected to be slower than that in the 1990s, so health care spending as a share of GDP is projected to rise even faster than it did in the last decade.

An increasing share of the elderly within the population will require more health care services. Many analysts worry that given the previous cuts of the federal transfers, the provincial budget allocations will not be enough to maintain the health care services at the current level. Finding ways to reduce fiscal pressures on health care became one of the priorities of the political agenda. As stated in Romanow (2002),

*Sustainability means ensuring that sufficient resources are available over the long term, to provide timely access to quality services that address Canadians' evolving health needs (Romanow, 2002, p.2).*

Following Romanow, it seems that any analysis of the health care policy in the context of an aging population must focus on the overall sustainability of the health care system to meet the health care needs of the population.

The purpose of this paper is to project and analyze future health care expenditures in the context of an aging population in Canada. Numerous studies have examined the degree of sustainability of health care expenditures. The opinions and assumptions differ, however, regarding the growth rate of GDP and government revenue, the inflation rate, the relevant demographics, and the increase in the expected real consumption of health care due to technology innovations. I investigate in this paper to what extent the projection of health care expenditures is sensitive to these various factors. To this end, I adapt a model developed first by Fougère and Mérette (2000) to project the health care expenditures between 2000 and 2026. Unlike other models, this model breaks down the age groups into smaller age intervals. I experiment with various scenarios regarding health care spending share for each age group. I also simulate the incorporation of an additional aging effects similar to the “age-adjusted servicing intensity of health spending” used by Robson (2001).

This paper is organized as follows: in chapter two, I describe the evolution of health care expenditures between 1981 and 2001. Chapter three reviews the literature on the studies on the fiscal capacity of Canadian government to deal with a dramatic rise in health care costs. Chapter four discusses the role of governments to improve the fiscal capacity. Chapter five introduces the methodology of my health care expenditures projection model in detail. Finally, chapter six presents the interpretations of the projection results.



## Chapter 2 Health Care Expenditure Evolution Between 1981 and 2001

### 2.1 International Comparison

Rising health care expenditures problems have been attracting a great deal of attention in Organization for Economic Co-operation and Development (OECD) countries over the last two decades. The ratio of health care expenditures to Gross Domestic Product (GDP) is most frequently used statistic for comparing health care expenditures with other countries. The ratio measures how much of the aggregate spending of the total economy in each country is devoted to health care. On an international basis, Canada spent more on health care with respect to GDP than the OECD average in 1998. Table 1 presents the health care expenditure indicators for 30 OECD countries:

**Table 1: Health Care Expenditures in OECD Countries in 1998**

Country	Expenditures as a % of GDP	Rank	Per Capita Expenditures In US\$	Rank	Per Capita Expenditures In \$PPP	Rank
Australia	8.5	9	1691	17	2036	12
Austria	8.2	15	2164	11	1968	13
Belgium	8.8	6	2169	10	2081	9
<b>Canada</b>	<b>9.5</b>	<b>4</b>	<b>1828</b>	<b>14</b>	<b>2312</b>	<b>5</b>
Czech Republic	7.2	19	393	24	930	24
Denmark	8.3	12	2736	5	2133	7
Finland	6.9	21	1724	15	1502	17
France	9.5	5	2333	8	2055	11
Germany	10.6	2	2769	4	2424	3
Greece	8.3	13	957	22	1167	23
Hungary	6.8	22	319	26	705	26
Iceland	8.3	14	2468	7	2103	8
Ireland	6.4	24	1436	19	1436	19
Italy	8.4	10	1720	16	1783	15
Japan	7.6	18	2283	9	1822	14
Korea	5	27	351	25	730	25
Luxembourg	5.9	26	2473	6	2215	6
Mexico	4.7	28	202	28	356	28
Netherlands	8.6	7	2143	13	2070	10

New Zealand	8.1	16	1127	20	1424	20
Norway	8.6	8	2836	3	2330	4
Poland	6.4	25	263	27	496	27
Portugal	7.8	17	859	23	1237	21
Spain	7.1	20	1044	21	1218	22
Sweden	8.4	11	2146	12	1746	16
Switzerland	10.4	3	3834	2	2794	2
Turkey	4	29	122	29	255	29
United Kingdom	6.7	23	1607	18	1461	18
United States	13.6	1	4178	1	4178	1
OECD Average	7.9		1730		1689	

Source: LeBreton and Kirby 2001, Vol. 1

As shown in Table 1, Canada ranks fourth (9.5 percent) among OECD countries after the United States (13.6 percent), Germany (10.6 percent) and Switzerland (10.4 percent), in terms of the ratio of total health care expenditures to GDP. Comparing this indicator with other OECD countries, Canada's spending on health care is greater than the OECD average of 7.9 percent.

Comparing health care expenditures per capita in terms of US dollars among the 30 OECD countries, Canada is not considered to have a high ranking. Table 1 shows that Canada ranks fourteenth; and its health care spending per capita is \$1,828, which is much smaller than that of the United States. The United States' health care expenditures per capita is \$4,178, which is by far the highest among OECD countries. Switzerland and Germany rank second and fourth respectively among other OCED countries.

However, comparing Purchasing Power Parity (PPP) per capita terms with the other OCED countries, Canada ranks fifth.<sup>1</sup> It means in the real value terms, Canada spent a great deal in health care in 1998.

## 2.2 Current Health Care Expenditures in Canada

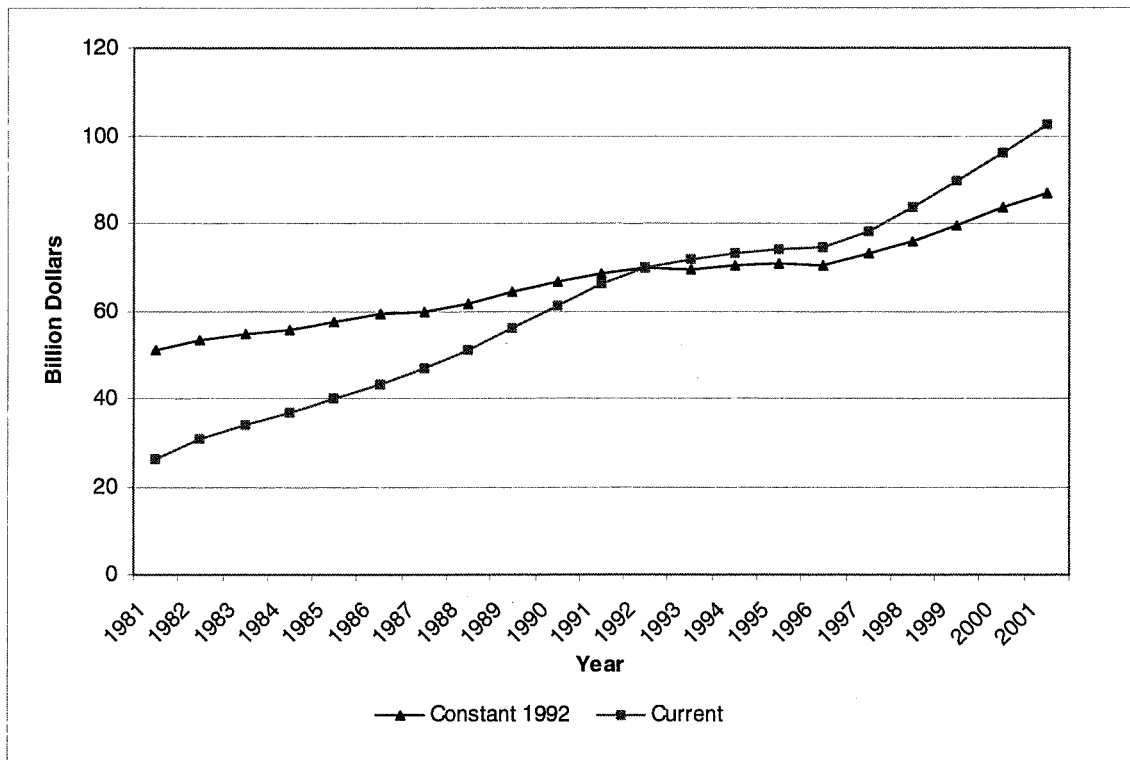
Health care expenditures have increased in Canada partly because of a rising proportion of people over 65 years of age. Between 1981 and 2001, the number of people aged 65 and over increased by 10 percentage points. According to Health Canada (2001), the health care expenditures per capita at the national level is \$2,987 in Canadian dollars, whereas the expenditures for seniors aged 65+ and 85+ are \$10,834 and \$27,135 respectively in per capita terms. Therefore, the senior age groups' health care expenditures in per capita terms are much greater than the national average. The 65 and over age group represented about 42.7 percent of total health care expenditures, whereas they represented only 12.5 percent of total population in 2001.

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<sup>1</sup> PPP is an international price index calculated by comparing the prices of identical goods in various countries. It indicates the rate at which at one currency must be converted into another currency to be able to purchase an equivalent basket of goods and services in other countries.

## 2.3 Evolution of Canadian Health Care Expenditures

Figure 1: Total Health Care Expenditures in Canada Between 1981 and 2001

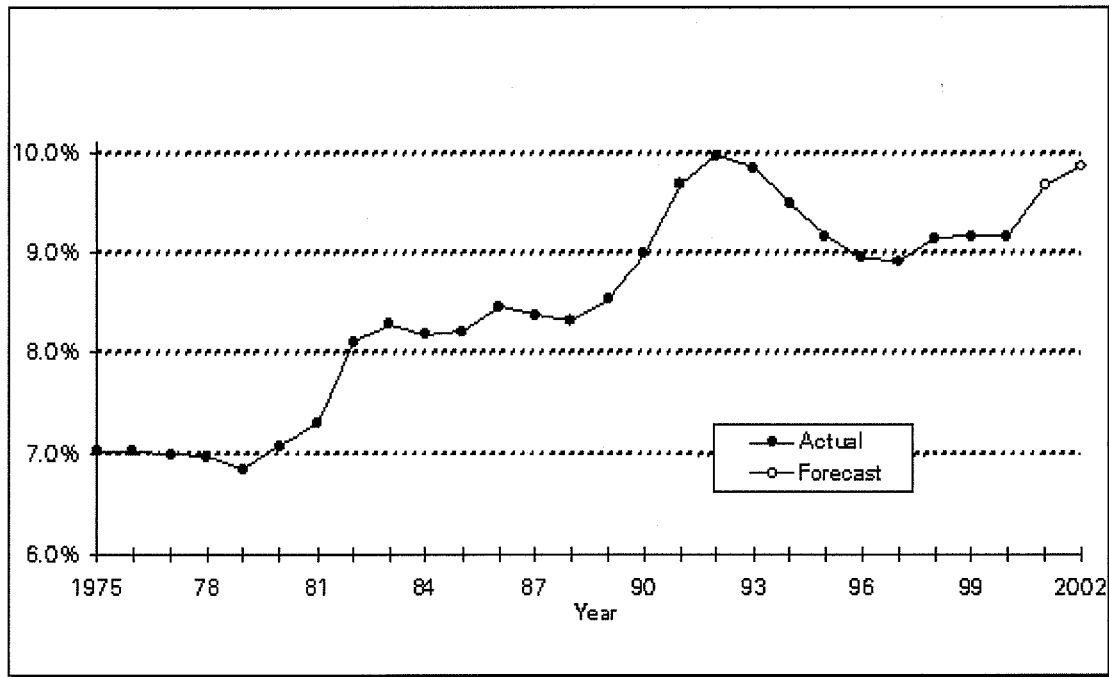


Source: Canadian Institute For Health Information 2001

As shown in Figure 1, Canada experienced a rapidly rising health care costs for the period between 1981 and 2001. In current dollars terms, total health care spending increased from \$26.3 to \$102.5 billion. This represented an average annual rate of growth of 9.6 percent during the 1981 to 1992 period. After 1992, the rate of growth fell substantially to an average annual rate of growth at 2.5 percent until 1996, because provincial and federal governments implemented a policy of fiscal restraint that affected spending for health care and social programs after the 1990-1992 recession. Thereafter, health care expenditures grew at a rate of 6 percent in the early 2000s. Similar patterns apply in the real total health care expenditures expressed in constant 1992 dollars.

However, the real growth of total health care expenditures is slower than the nominal growth of total health care expenditures because of the high price inflation rate in the medical field.

**Figure 2: Total Health Care Expenditures as a Share of GDP Between 1975 and 2002**



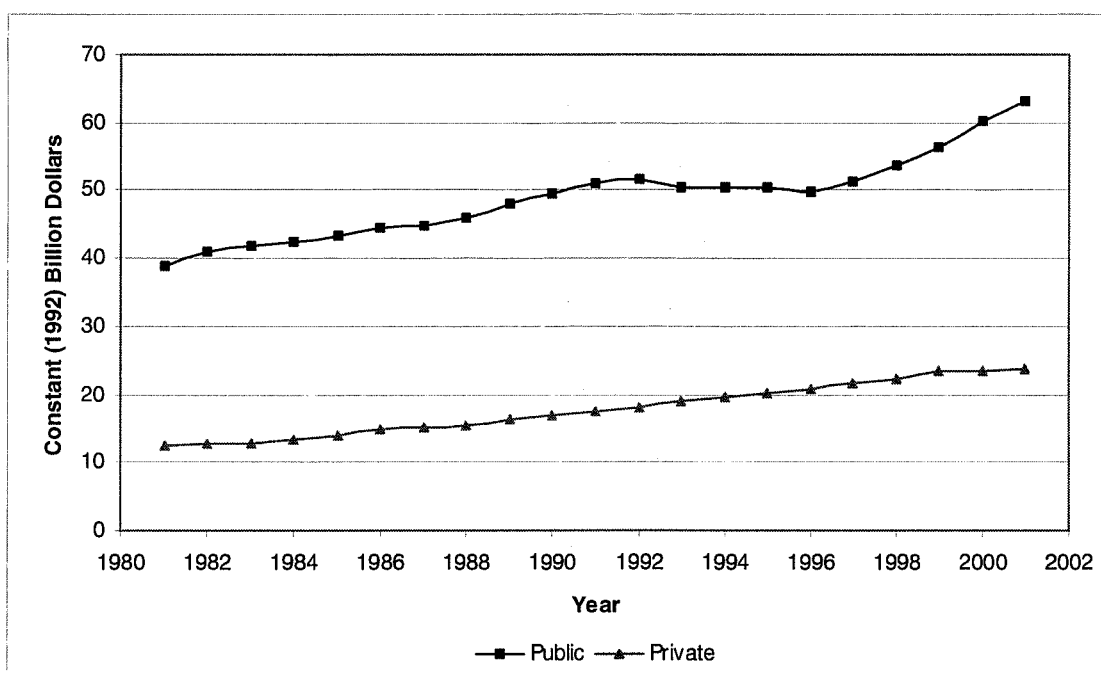
Source: Canadian Institute For Health Information 2002

The health care spending to GDP ratio steadily increased between 1981 and 1988. It then increased even more significantly from 1989 to reach a peak of 10.2 percent level in 1992. Thereafter, there was a turning point as the ratio of GDP decreased until 1998. The downward trend ratio was reversed in 1998, and then remained at a nearly steady level between 1999 and 2000.

## 2.4 Overview of Health Care Expenditures by Source of Finance

Public and private sectors play important roles in sharing the health care costs and providing health care services to all Canadians. The public sector refers to provincial/territorial, federal and municipal governments, and the social security funds. Private sector spending primarily consists of direct out-of-pocket cost and health care expenditures covered by private health insurances. In addition, private sector also involves expenditures on drugs, certain medical procedures, and treatments that are not covered by provincial governments.

**Figure 3: Total Health Care Expenditures by Source of Finance Between 1981 and 2001**



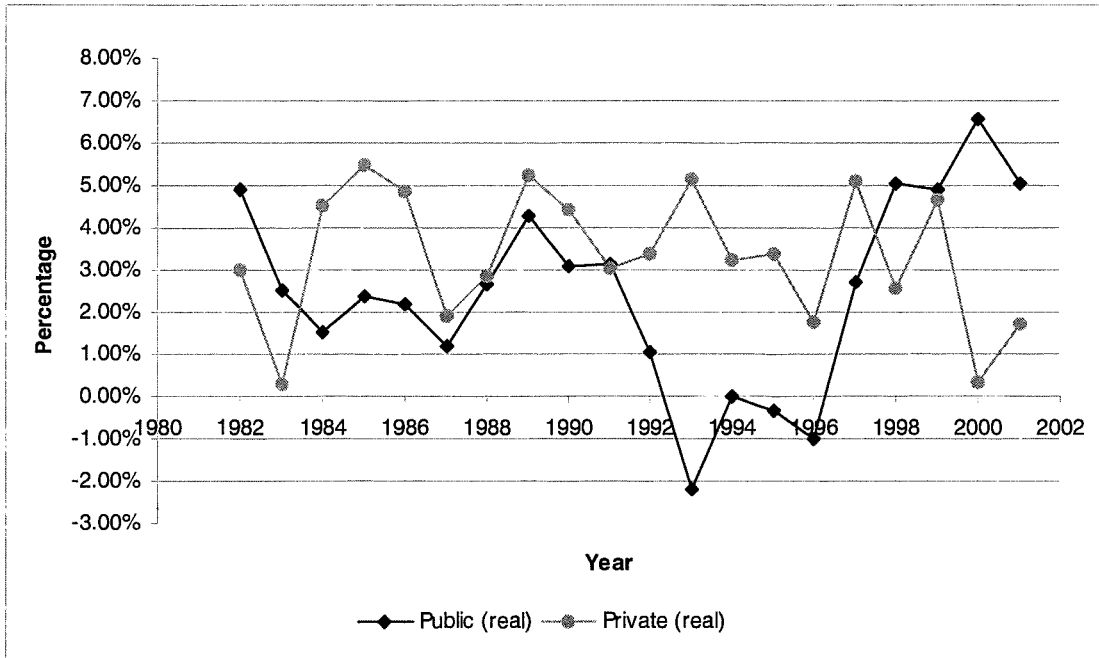
Source: Canadian Institute For Health Information 2001

The growth of health care expenditures was steadier in the private sector than that in the public sector for the period between 1981 and 2001. As it can be seen in Figure 3, the public health care expenditures gradually increased in the 1980s and declined slightly from

1992 to 1997. After 1997, public health care expenditures grew faster than private health care expenditures. In contrast, the private health care expenditures increased at a more steady annual rate. By 2001, the public and private health care expenditures increased by 23 and 9 percentage points respectively with respect to 1997.

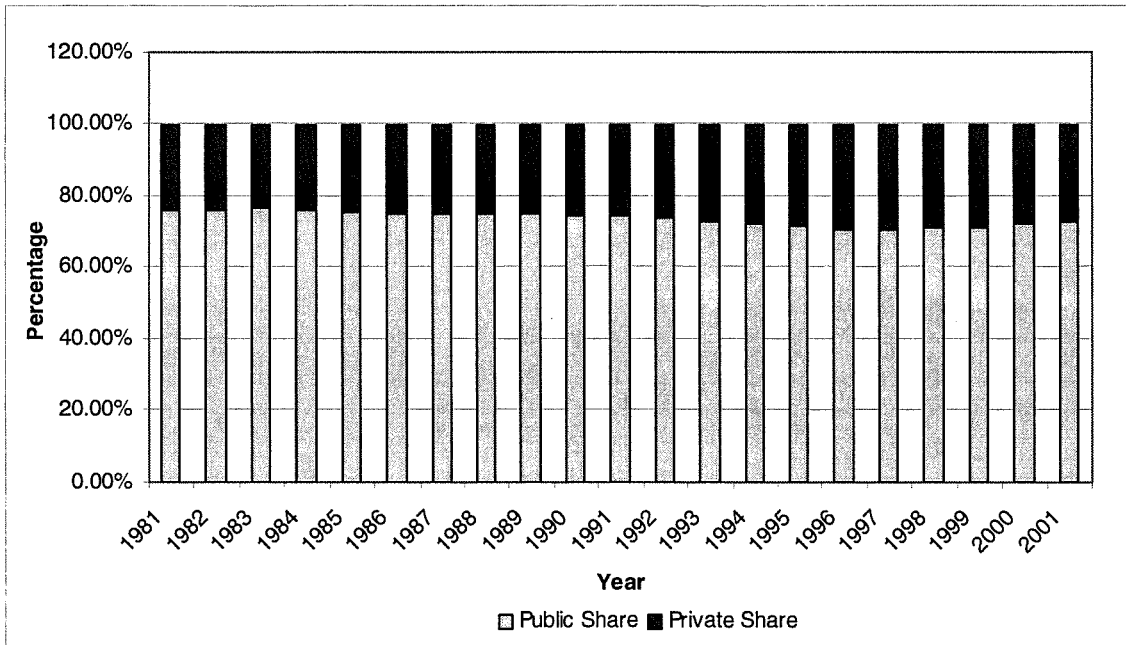
As shown in Figure 4 and 5, the growth of the health care expenditures in public sector was lower than that in the private sector during the mid-1980s to the early 1990s. However, the public share of total health care expenditures remained at a steady level of 75 percent (See Figure 5). The growth of public health care expenditures declined rapidly during the mid-1990s, because total government initiated restraints in funding for hospitals and physicians services. The private health care share of total health care expenditures increased in the late 1990s due to a rapid growth in drug expenditures and a high demand of other professional services (See detail in Section 2.6).

**Figure 4: Real Annual Growth Rate of Health Care Expenditures by Source of Finance Between 1981 and 2001**



Source: Canadian Institute For Health Information 2001

**Figure 5: Share of Public and Private Health Care Expenditures Between 1981 and 2001**



Source: Canadian Institute For Health Information 2001



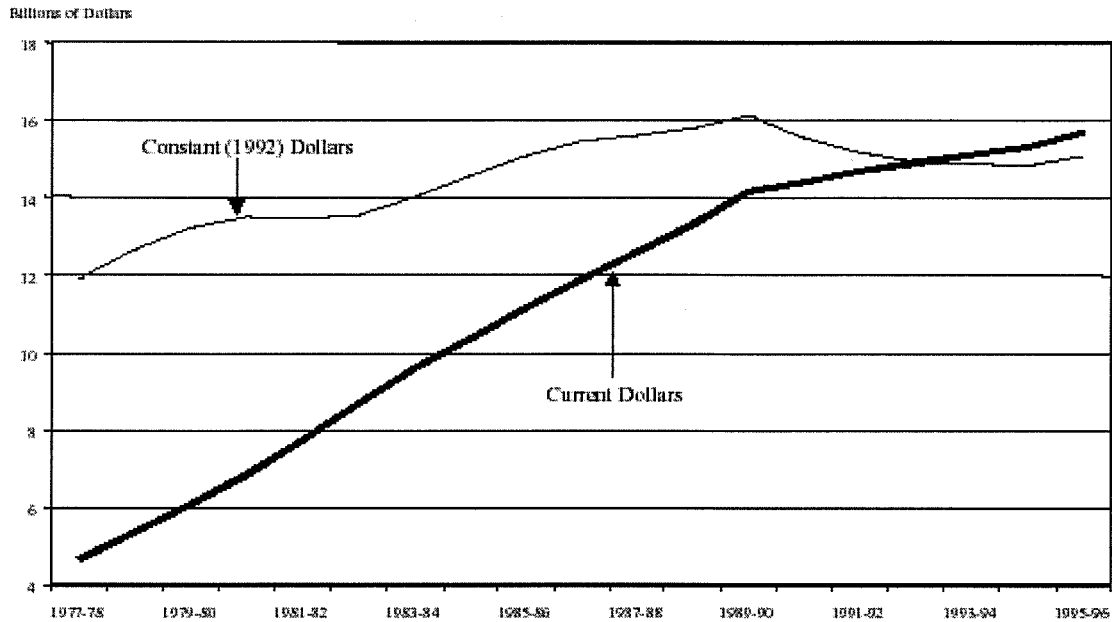
## 2.5 Evolution of Health Care Funding From Federal Government

Federal, provincial, and municipal governments share responsibility for providing health care funding. This partnership has changed over time as the benchmark for determining an appropriate scheme among governments. The federal government implemented three major programs, which are Established Program Financing (EPF), Canada Health and Social Transfer (CHST), and Equalization Program, to provide federal transfers to provincial governments. Since the transfer payments cover a lot of social programs, it is difficult to determine what the specific amount is allocated to each program.

According to LeBreton et al. (2001), before 1995 the federal government operated with the Established Program Financing (EPF) to transfer funding to different services: hospital services, medical care, and post-secondary education to provinces. Under the EPF, each province received an equal per capita transfer for health care and post-secondary education.

Figure 6 presents the total EPF entitlements for health care, which is expressed in constant 1992 dollars. In order to fight public deficits, the federal government froze the per capita transfer at the 1989 level, and then increased the transfer payments based on population growth of each province. In 1995, the federal government reduced the amount of per capita transfers. Hence, the growth rate of the federal transfers dramatically decreased during the mid-1990s.

**Figure 6: Total EPF Entitlement for Health Care Between 1977-78 and 1995-96**

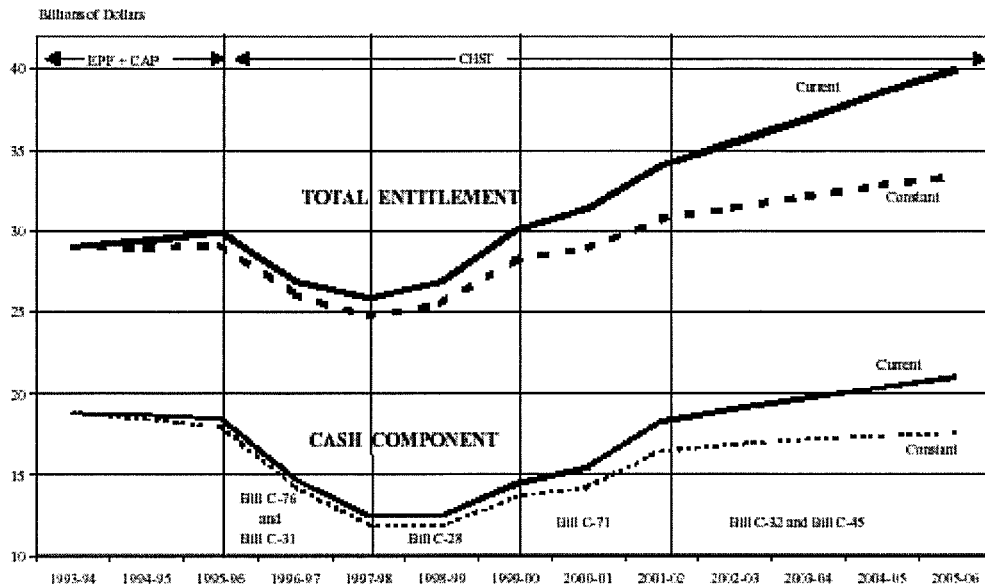


Source: LeBreton and Kirby 2001, Vol. 1

After the establishment of the Canada Health and Social Transfer (CHST) in 1996, the federal share of public health care expenditures increased significantly until 2001. CHST was combined with EPF and the Canada Assistance Plan (CAP) into a new block funding and provided to all provinces. CAP was established in 1966, and it was a funding mechanism, which the federal government provided funding to social assistance and social services of provinces and territories. It also covers the cost of certain health care services, which are not covered by Medicare or supplementary provincial health insurance plans. The structure of CHST is similar to EPF, as the federal transfer has involved both cash and tax point transfers. The cash component is allocated on an equal per capita basis, so that the provinces with larger population can receive more cash transfer payments than those with smaller population.

Figure 7 shows the Department of Finance's projection for CHST over the period between 1996 and 2006 in terms of current dollars (LeBreton et al., 2001). While the federal government was implementing Bill C-76 during the mid-1990s, the total CHST entitlement decreased from \$30 billion in 1995-96 to \$26 billion in 1997-98. The Bill-76 was announced as the follows: for 95-96, the EPF annual growth rate was set at -3 percent; CAP was frozen at 1994-95 levels to all provinces; CHST entitlements were set at \$26.9 billion for 1996-97, and \$25.1 billion for 1997-98; the CHST entitlement for 1996-97 was the same proportion as combined EPF and CAP entitlements in 1995-96 (Documented in Department of Finance, 2002). Thereafter, the downward trends of both total CHST entitlement and cash component have been reversed, because the federal government projects to increase CHST funding by \$11.5 billion between 1999 and 2004, and this amount is specifically earmarked for health care. In addition, the federal government provided an additional \$2.3 billion health care transfer for health information technology, a medical equipment fund, and health transition fund in 2000. Hence, the share of federal government in total health care expenditures is expected to increase in the future.

**Figure 7: Total CHST Entitlement and Cash Component Between 1993-94 and 2005-06**



Source: LeBreton and Kirby 2001, Vol. 1

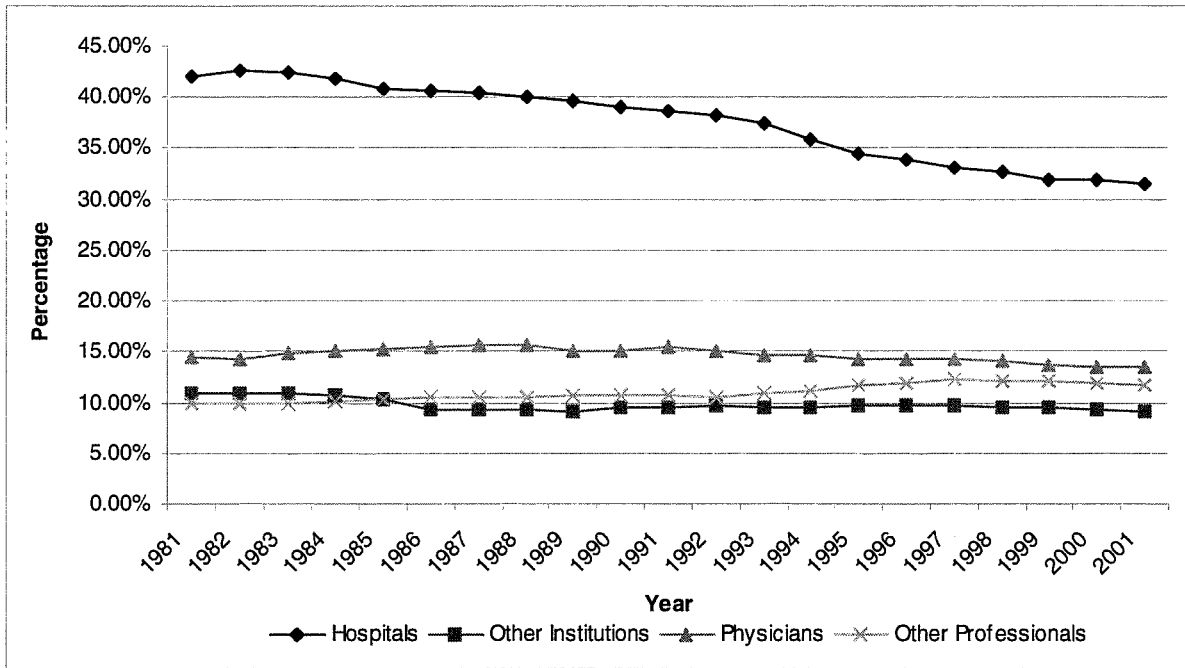
Equalization Program is another federal transfer program that can reduce the fiscal disparities among provinces. The Equalization payments are designed to provide residents with public services of similar quality across the country for lessening fiscal capacities of provincial governments, at reasonably comparable levels of taxation. In addition, these are unconditional payments, in which provinces can spend them on the public services regarding their priorities. As announced by the Department of Finance in February 2002, the federal government committed itself to maintaining growth of the equalization payments ceiling that is linked to the growth of GDP. In 2003-04, the federal government will allocate about \$10.5 billion to the equalization program (Documented in Department of Finance, 2002).

## 2.6 Evolution of Health Care Expenditures by Use of Funds

Both public and private sectors allocate funding to health related goods and services for Canadians. This funding is allocated into 8 categories: hospitals, physicians, drugs, other institutions, other professionals, capital, public health & administration, and other health spending.

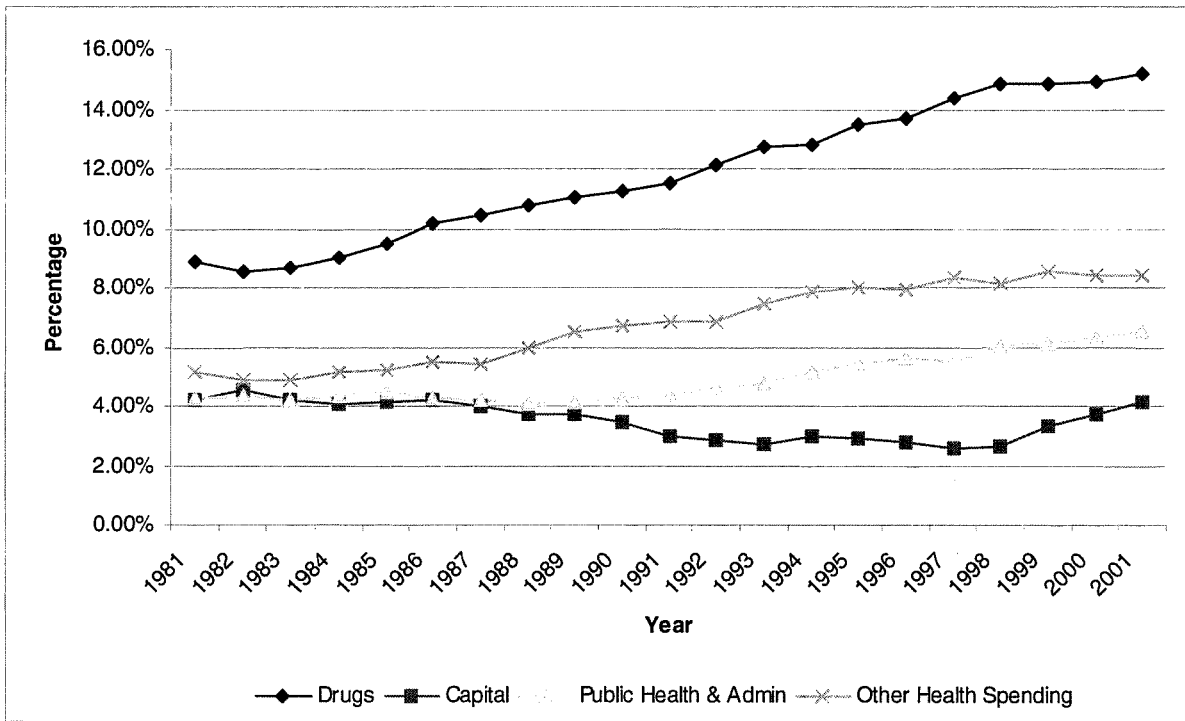
Figure 8 and Figure 9 show the substantial differences in the pattern among use of funds in the total health care expenditures for the period between 1981 and 2001. The proportion of health care funds allocated to hospitals declined sharply, while the share of total health care expenditures devoted to drugs, other professionals, and other institutions increased. Public administration, physicians, and capital investments remained at a nearly steady level. To be more precise, the evolution of those funds between public and private sectors will be explained in the following paragraphs.

Figure 8: Share of Total Health Care Expenditures by Use of Funds Between 1981 and 2001 (a)



Source: Canadian Institute For Health Information 2001

Figure 9: Share of Total Health Care Expenditures by Use of Funds Between 1981 and 2001 (b)



Source: Canadian Institute For Health Information 2001

### 2.6.1. Hospitals

Although hospitals have been the largest category of total health care expenditures, its share of total health care expenditures has declined since 1981. The public sector has significantly impacted upon the hospitals expenditures, because it reduced the hospitals' cost per capita from \$948 to \$803 in constant 1992 dollars between 1992 and 1997. As a result, total health care expenditures declined by 5 percentage points during that period.

At the same time, the private sector hospital expenditures fell in per capita terms, because of a lot of hospitals were closed. Some hospital related services, including the uses of accommodation, private clinic, and auxiliary services, which were delivered by the private sector, were declined. Thus, the private sector decreased by 5 percentage points in hospitals expenditures. In 1992 constant dollars terms, by 1997, the hospitals expenditures in public sector decreased to its lowest level since 1988. Even though the downward trends were reversed in the late 1990s, total expenditures of hospitals nearly met the 1992 level.

According to Ontario Health Coalition (1999), in 1997-98, the provincial government cut hospitals' budgets by \$365 million in 1996-97 and \$435 million in current dollars terms. Hospitals responded by discharging their patients more quickly than that in the past. In 1993-94, the average lengths of stay for acute care and chronic care were 7.0 days and 211 days respectively. By 1997-98, these numbers were cut to 6.4 and 141 days respectively. Since 1994, 5780 acute care beds and 2445 chronic beds have been cut off from the health care system. Thus, patients sometimes lie on stretchers in emergency and

wait for the health care services. Overall, the hospitals' share of total health care expenditures decreased from 42 to 32 percent between 1981 and 2001.

### 2.6.2 Drugs

Drugs (prescribed drugs and non-prescribed products) expenditures increased rapidly over the last 2 decades. As illustrated in Figure 8, drugs' share of total health care expenditures increased steadily from 9 to 16 percent for the period between 1981 and 1998. Then it remained at a steady level until 2001. In per capita terms, drugs expenditures increased by 133 percentage points in constant 1992 dollars terms between 1981 and 2001. This increase was greater than that of the national health care expenditures per capita in the same period.<sup>2</sup>

Rising drugs expenditures are the main source driving up health care expenditures. There are three factors behind the increase in drugs expenditures. First, rising patent costs and mark-up represented about 17 percent of increases in drug expenditures in 1999 (LeBreton et al., 2002, Vol. 2). The patent cost increased by 19 percentage points between 1995 and 2000. The average annual growth rates of both wholesale's mark-up and the retail's mark-up were 15 percent during the same period.

Second, the high demand uses of prescription and new drugs represented about 80 percent of increases in drugs expenditures, because some prescription drugs and new drugs substitute other treatments and medical intervention, including surgery (LeBreton et al.,

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<sup>2</sup> National health care expenditures per capita increased by 40 percentage points between 1981 and 2001.



2002, Vol. 2). In addition, comparing with old drugs, new drugs are more effective, are easier to use, and have fewer side effects to patients (Health Care In Canada, 2002). Furthermore, as showed in Romanow (2002), drugs' therapies lead to a reduction in the number of in-patients. However, it is still unknown to what extent the decline in hospitals expenditures is due to greater spending on prescription drugs.

Inappropriate drug uses are the third factor that drives up expenditures on drugs. Inappropriate drug uses are defined as instances when patients fail to take the medication, stop taking their medication too soon, and neglect to refill prescriptions. According to LeBreton et al. (2002, Vol. 2), the total cost of inappropriate prescription drug uses was \$9 billion in 1995. In order to prevent the inappropriate drug uses, provincial governments allocated \$11 billion to an information system and the integration of prescription drug care for the period between 2000 and 2004.

Since the Canada Health Act has not insured prescription drugs used outside the hospital setting, the private sector has become a major source of finance for prescribed drugs. Private sector allocated a 66 percent share of the prescribed drugs expenditures in 1981. The private share of the prescribed drug expenditures declined to 53 percent in 1992, and then increased steadily to reach 58.5 percent by 1997.

The public share of the prescribed drugs expenditures increased from 40 to 49 percent between 1997 and 2000, because the public sector implemented various drug programs in the early 2000s. Federal government provides drug coverage to the registered

Indians, eligible Inuit and Innu, the members of the armed forces and their families. Pharmacare program covers the social recipients, seniors, and the individuals with high-cost disease in all provinces and territories. In Ontario, the Ontario Drugs Benefit (ODB) Program covers most of the prescription drugs for Ontario residents aged 65+ or the people with long-term care treatments. Single seniors (people aged 65 or older) who have an annual income of \$16,018+, and seniors in couples with a combined annual income of \$24,175+ are required to pay the deductible. As shown in the Report Card for Ontario Drug Plan Program (2002), the cost of the ODB program increased from \$1.8 to \$2.1 billion between 2000-01 and 2001-02. About 68 percent of claimants were aged 65 and over in 2001-02, and the number of claims increased by 11 percentage points from 2000-01 to 2001-02. The annual growth rate of the ODB program cost is expected to be 14 percent over the next 15 years.

### 2.6.3 Other Health Spending

The share of other health spending share among total health care expenditures, which includes medical transportation, hearing aids and appliances, occupational health and voluntary health associations, and explicitly identified home care, rapidly increased between 1981 and 2001. The public sector was responsible for about a 70 percent share of total other health care expenditures, and it increased the funding from \$2 to \$5.6 billion in constant 1992 dollars between 1981 and 2001. In addition, the private sector increased the funding by 200 percentage points in other health spending over the same period.

### 2.6.4 Other Professionals, Other Institutions, and Public Health and Administration

The share accounted for by other professionals, other institutions, and public health and administration increased by 2 percentage points between 1981 and 2001. Other professionals constituted the fourth largest category of total health care expenditures in 2001 at \$13 billion. These services, including dental, vision care and other professional care, represent the highest percentage of private health care expenditures, because Canada Health Act does not insure dental and vision care outside hospital settings. Hence, in constant 1992 dollars, the private sector increased its share of other professional expenditures gradually from 81 to 90 percent during 1981 to 2001 period as a result of the increases in demand of dental and vision care services.

In contrast, other institutions that include nursing homes and residential care facilities are financed mostly by the public sector. Public share of total other institutions' expenditures fluctuated between 72 and 75 percent between 1981 and 1993, and then reached its highest level of 76 percent in 2001.

Likewise, public health and administration, which include disease prevention and health promotion activities, and infrastructure costs to operate health care departments, are financed by the public sector. The expenditure growth of this category has been higher than those in other categories among use of funds. As a result, public health and administration increased the share of total health care expenditures by 2 percentage points between 1981 and 2001.

#### 2.6.5 Physicians

The trends in the physicians' share of total health care expenditures remained at a steady level for the period between 1981 and 2001. About 99 percent of the physicians expenditures were financed by the public sector, because the Canada Health Act insured all physician services in hospitals as well as services delivered elsewhere. In per capita terms, the public physicians expenditures were \$404, but the private physician spending was \$5 on average in 2001. The public physicians are paid by provincial/territorial medical plans, but the private physicians are paid by both public and private health insurance plans.

Physicians expenditures constituted the third largest category of the total health care expenditures. The physicians' share of the total health care expenditures increased from 14.5 percent in 1981 and reached 15.5 percent in 1991. During the 1990s, the low growth rate of physicians expenditures tended to decrease their share of total health care expenditures, because the number of hospitals and the federal transfer payments to physicians services were reduced. Furthermore, a lot of physicians in their provinces had opted out of their provinces' health care insurance plans, so that they requested facility fees from their patients. As a result, the private physician share of total health care expenditures increased slightly during the late 1990s. Consequently, the physicians' share of total health care expenditures decreased by 1 percentage point over the last 20 years.

In summary, the proportion of health care funds allocated to hospitals declined sharply in the past twenty years, while the share of health care expenditures devoted to drugs and to payment of other professionals increased. This can be explained by the fact that hospitals discharge their patients more quickly than that in the past, and a lot of

hospitals have been closed. In addition, the increased use of drugs, day surgery, and medical technology also can reduce the demand for hospitals, but these may cause greater uses of drugs, other professionals, and other institutions in the private sector. Moreover, governments introduced the fiscal restraint policies during 1990s. Consequently, the private share of total health care expenditures increased slightly by 4 percentage points from 1981 to 2001.

## Chapter 3 Literature Review

### 3.1 Health Care Expenditures in Relation to the Gross Domestic Product (GDP)

As I explained in Chapter 2, total health care expenditures as a share of GDP is much higher in Canada than in some other OECD countries. In addressing the matter of how an aging population affects health care expenditures, one can see the effect of an aging in projections of the health care spending of Canada as a share of GDP.

Ruggeri (2002) investigates the degree of sustainability of health care spending in the context of an aging population. He identifies three different degrees of sustainability. First, he looks at the ability of the economy to sustain current and projected levels of health care spending. Second, he investigates the capacity of the fiscal system to withstand the pressures of rising health care expenditures. Third, the ability of provincial and territorial governments to fulfill the constitutional commitments for the provision of health care is estimated. His model incorporates four components: the projected growth of total population; the changes in age structures of population, which is based on the “medium” projection by Statistics Canada (2001); the growth of health care expenditures in per capita terms due to the expected rate of inflation; and the escalation of real cost, which depends on factors such as diagnostic treatments, pharmaceutical technology and efficiency in the utilization of human and non-human resources. According to his projections, without an aging population, the health care expenditures as a share of GDP are expected to decrease from 9.1 percent in 2000-2001 to 8.4 percent in 2026-2027. In contrast, with an aging population, the increase in the health care expenditures with respect to GDP will be significant, from 9.1 percent in 2000 to 10.8 percent in 2026.

While other studies have demonstrated projection analyses of future health care expenditures in relation to overall economic activity as measured by GDP, Antunes et al. (2001) illustrate the similar projection from the provincial-territorial perspective. This health care expenditures model incorporates the same components as Ruggeri's model with different figures, but Antunes et al. introduce the public and private shares of health care expenditures, and the price index in the health sector. There are two assumptions that enter into the projection. First, historical trends in the real growth of public and private health care expenditures per capita are assumed to continue in the forecast period. Second, these trends are assumed to capture both changes in overall health care services due to demographic changes and increases in real consumption due to technology changes.

According to this study, the provincial-territorial governments will have to raise health care expenditures as a share of GDP from 8.7 to 10.2 percent for the period between 2000 and 2020. If one looks at public and private health care expenditures in relation to GDP, public health care expenditures as a share of GDP is expected to increase from 6.0 to 7.1 percent, whereas private health spending will increase from 2.7 to 3.1 percent of GDP between 2000 and 2020.

Similarly, Robson (2001) also analyzes provincial health care expenditures by determining health care costs as a share of GDP. His forecasting model, constructed to project provincial and territorial health care expenditures, incorporate three components: demographic changes, the price index in health care, and real growth of provincial health

care expenditures. The model is based on a number of assumptions on key demographic parameters. For instance, the fertility rate of each province and territory is assumed to remain at 1997 levels; the mortality rate is assumed to decline at the same rate observed between 1971 and 1991; both immigration rates and emigration rate in and out of Canada, as well as the distribution of immigrants and emigrants in each province, are assumed to be equal to the average observed between 1991 and 1999; and net inter-provincial migration is based on the figures of 1999. Currently, since there is no reliable price index for health care, it is difficult to estimate the inflation rate in the health care sector (Antunes et al., 2001 and Robson, 2001). In fact, health care spending increases have exceeded the rise in the general price level since 1980. In his projections, Robson (2001) assumes that the inflation in the health care sector will be at the same rate as general inflation, which is expected to increase by 2 percentage points on average annually. In addition, in per capita terms, real growth of provincial health care expenditures, without demographic shift, is assumed to rise at the same rate as real productivity of labour. The expected annual growth rate is 1.6 percent.

Robson (2001) claims that the provincial health care share of GDP is projected to increase from 6 to 7.5 percent on average from 2000 to 2020. Since the aging population will not be equally distributed across Canada, those provinces with a higher aging population will need more funding to improve health care services and facilities. For example, Newfoundland, New Brunswick and Yukon Territory will experience a higher proportion of seniors; so their health care shares of GDP are expected to increase by 3 percentage points between 2000 and 2020. In contrast, those provinces with a smaller



proportion of seniors, such as in Ontario and Manitoba, are projected to have that health care shares of GDP will increase by 1.5 percentage points in the same period.

According to the projections above, the health care share of GDP will increase substantially with population aging. This means that the economy may encounter more difficulties in sustaining future health care expenditures. Notice, however, that the degree of sustainability will depend positively on overall economic activity, but negatively on relative growth of health care expenditures. Robson (2001) claims that the growth of the economy in the next 10 years is expected to be slower than that in the 1990s, so health care spending as a share of GDP is projected to rise even faster than it was in the last decade.

The real GDP growth in the Canadian economy was 3.5 percent in 2000. Antunes et al. (2001) expect this rate to remain constant until 2004. However, an aging population will contribute to slow labour growth in the labour force and reduce consumer spending. The slow labour force growth will decrease the production activity of the economy, and this downward pressure will become worse after 2005 as baby boomers reach the age of 55. In addition, an increasing share of the elderly within the population tends to decrease the demand for new housing and purchases, such as furniture and other durable consumer goods. As a result, the annual real growth of GDP is expected to fall from an average 3.2 percent in 2005-09 to 2.5 percent in 2010-2020.

The second additional factor refers to relative real growth in health care expenditures. The real growth in health care expenditures is expected to be greater than that

of other expenditures in the economy. Robson (2001) defines the “age-servicing intensity of health spending” as an increase in real health expenditures per capita. Robson observes the past trends in real health care expenditures, and predicts future growth of health care spending. He assumes that the age-adjusted servicing intensity will push the real growth rate of health care expenditures up by 0.5 percentage points above the rate projected for the economy between 2000 and 2020. As a result, the provincial health care spending with respect to GDP is projected to reach 9 percent by 2020 (7.5 percent in the base projection).

### 3.2 Health Care Expenditures in Relation to the Government Revenue

One way to measure the fiscal pressure of health care on government budgets is to examine future health care expenditures in relation to government revenue. Various studies show that the capacity of the fiscal system to withstand the pressure of rising health care expenditures is not going to be sustainable over the next 20 years.

Similarly, Ruggeri (2001) evaluates the issue of fiscal sustainability for governments by linking health care expenditures to total government revenue. He concludes that future health care expenditures at the current quality of health care will be fiscally unsustainable. In terms of each dollar of total government revenue, it finds that about 14.6 cents were allocated to health care in 2000-01. With population aging, this amount is expected to increase by 3.2 cents in 2026-27. Without an aging population, health costs with respect to government revenue will decline steadily by 1.2 cents in 2026-27.

Given that the delivery of health care services is a major responsibility of provincial-territorial governments, according to the Antunes et al. (2001), it is estimated that the health care expenditures as a share of provincial-territorial revenue is projected to increase from 31.1 to 42 percent between 2000 and 2020. In each dollar of provincial-territorial revenue, the provincial-territorial governments will allocate 11 cents more to health care in 2020.

Ruggeri (2002) also investigates fiscal sustainability by relating health care expenditures and provincial-territorial revenue, including federal transfers. Ruggeri uses a provincial-territorial revenue model developed in a previous study (Ruggeri, 2001). Unsurprisingly, an aging population increases substantially health care expenditures as a share of the provincial revenue from 30.5 to 43.2 percent between 2000-01 and 2026-27. This result is similar with the result of Antunes et al. (2001), because they assume the annual growth rate of provincial revenue at the range between 3.5 and 4 percent during 2000-2027. However, without an aging population, the increase of health care expenditures would be very small. As a result, Ruggeri (2002) states that under the current fiscal structure of provincial-territorial governments, the ability of provincial-territorial governments to fulfill their constitutional commitments for the provision of health care is not sustainable.

Robson (2001) shows how federal transfers can improve the ability of provincial governments to maintain the health care system. The health care expenditures as a share of the total provincial revenue (including federal transfers) is projected to increase by 3.5

percentage points between 2000 and 2020. However, the increase in the health care cost with respect to own-source revenue (excluding federal transfers) will be substantial, from 35 percent in 2000 to 42 percent in 2020, and to 57 percent in 2040. If the provinces that are relatively low-recipients of federal transfers, for instance Quebec, the health care expenditures will represent between 50 percent and 60 percent of their own-source revenue in 2040. The case in Newfoundland and Territories can become dramatic as with a rapidly aging population, the health care expenditures are expected to exceed their own-source of revenue by 2040.

In addition, the overall share of total government revenue relative to GDP is expected to decline over the next 40 years because of a decline in tax revenue (Jackson and King, 2000). In fact, the dramatic and persistent demographic shift influences total government revenue yields through the effects of lifetime earnings and consumption patterns. Lifetime earnings patterns are such that income tends to rise through an individual's early working years, and then reach a peak in the middle-to-late working period. Finally, the income declines toward the retirement years. Likewise, similar patterns apply to individuals' consumption patterns. Jackson et al. (2000) state that consumption levels increase from the early to the mid-life years, and then decrease toward retirement age. If this consumption pattern is maintained, the consumption tax yields will fall as the population matures. It is called consumption and saving over the life-cycle.

Furthermore, Jackson et al. (2000) claim that the revenue from Personal Income Tax (PIT) will decrease rapidly relative to GDP in the future. To support this claim, they

project a Personal Income Tax model that incorporates four components: inflation, population growth, population compositional changes, and labour productivity. Assuming this tax yield remains relatively stable between 2000 and 2040, the most significant slowdown in PIT revenue growth is expected to occur during the period between 2010 and 2030, because baby boomers leave the labour market, and their incomes start to decline substantially. Although the subsequent generations will move into their highest earning years, their PIT cannot offset completely the decline in tax revenue.

Although new technology and human capital investments are assumed to increase the labour productivity, we do not have enough information to estimate how much labour productivity growth can offset the decline in labour force participation over the next 40 years. Productivity is a measure of how efficiently an economy transforms its labour, capital, and raw materials into goods and services. If there is a higher growth rate of productivity in the broader economy relative to growth in health care expenditures, this will lead to lightening fiscal pressure on the government. Otherwise, this in turn will augment the fiscal pressure on the government budgets coming from health care spending. In addressing the issue of how labour productivity affects government revenue and the resulting impact on health care, it is helpful to examine the relation between consumption of health care and the labour productivity in the economy.

Given the expected high growth in health care spending in per capita terms, Robson (2001) assumes that the “age-servicing intensity of health spending” will be 0.5 percentage points greater than the labour productivity growth over the next 20 years. Not surprisingly,

provincial health care expenditures as a share of own-resource revenue is expected to increase by 12 percentage points on average for the period between 2000 and 2020. Consequently, health care expenditures will increase faster than the government revenue.

In conclusion, Table 2 suggests that the capacity of the fiscal system to withstand the pressure of rising health care expenditures will not be sustainable over the next 20 years for the provinces and territories. Since decreasing labour force tends to reduce the personal income tax and consumption levels, the growth of government revenue will decline between 2010 and 2030. In addition, a high-expected growth of health care expenditures will apply greater fiscal pressure to the government budgets. Furthermore, the delivery of health care services is a major responsibility of provincial governments, thus, federal government has to increase transfer payments to the provinces and increase funding to the health care system. Consequently, the ability of provincial governments to fulfill their constitutional commitments for the provision of health care will be sustainable given funding from the federal government.

**Table 2: Summary of Health Care Expenditures Projections**

Total Health Care Expenditures in Relation to the GDP				
	Aging Population		Without An Aging Population	
	2000-01	2026-27	2000-01	2026-27
Ruggeri (2002)	9.10%	8.40%	9.10%	10.80%
Provincial Health Care Expenditures in Relation to the GDP				
	Aging Population			
	2000	2020		
Antunes, Brimacombe, and McIntyre (2001)	8.70%	10.20%		
Robson (2001)	6%	7.50%		
	6%	9.00%	*	
Total Health Care Expenditures in Relation to the Total Governments Revenue				
	Aging Population		Without An Aging Population	
	2000-01	2026-27	2000-01	2026-27
Ruggeri (2002)	14.60%	17.80%	14.60%	13.40%
Provincial Health Care Expenditures in Relation to the Provincial Revenue				
	With Federal Transfers		Without Federal Transfers	
	2000	2020	2000	2020
Robson (2001)	35%	38.50%	35%	42%
			35%	47%
Provincial Health Care Expenditures in Relation to the Provincial Revenue (continued)				
	With Federal Transfers			
	2000	2020		
Antunes, Brimacombe, and McIntyre (2001)	31.10%	42.00%		
Total Health Care Expenditures in Relation to the Total Governments Revenue (continued)				
	Aging Population			
	2000-01	2026-27		
Ruggeri (2002)	30.50%	43.20%		

\*With "age-serving intensity of health spending" effect

### 3.3 Health Implicit Liability

In order to evaluate the forecasted health care expenditures, it may be helpful to calculate the present value of future health care spending. Robson (2001) measures what he calls the implicit health care liability, which is the amount of public health care received by the person during his/her life. He estimates the average remaining of life expectancy of living Canadians at 50 years of life. Moreover, the current health care costs as a share of provincial GDP is assumed to be equivalent to those of provincial own-source revenue.

Robson shows that if the health care share in GDP or in provincial own-source revenue stays at a constant level, the implicit liability will equal zero. Any increased share of health care costs that rises beyond the constant level is called an implicit health care liability.

**Table 3: Implicit Health Care Liability and Other Public Liability**

	Health Care Liability	Provincial Debt	Federal Debt	Unfunded CPP/QPP Liability	Total
Current Dollars Per Capita					
Canada	17300	8400	18400	19900	64000
Newfoundland	21800	16100	18400	19900	76200
Prince Edward Island	13800	7400	18400	19900	59500
Nova Scotia	15900	11100	18400	19900	65300
New Brunswick	17100	9300	18400	19900	64700
Quebec	18700	12400	18400	19900	69400
Ontario	16300	9800	18400	19900	64400
Manitoba	11700	7700	18400	19900	57700
Saskatchewan	7700	9900	18400	19900	55900
Alberta	20000	-800	18400	19900	57500
British Columbia	18500	1800	18400	19900	58600
Northwest Territories	35700	1500	18400	19900	75500
Yukon	33500	-7000	18400	19900	64800

Source: Robson 2001

Robson calculates that the implicit health care liability, which the provinces will have to pay for in delivering medical services to retiring boomers, is substantial (\$530 billion) over the period between 2000 and 2040. This amount represents about 50 percent of GDP in 2001. As illustrated in Table 3, it shows all figures (in per capita terms) of implicit health care liability, the provincial net debt, the federal net debt, the unfounded liabilities of the Canadian Pension Plan (CPP), and the Quebec Pension Plan (QPP) in each province. The implicit health care liabilities are much higher than the provincial and the federal debts, which is the case in Newfoundland, Quebec, Alberta, British Columbia, and all territories. Particularly, Newfoundland experiences the highest total deficits. By adding



up together with its provincial debt and the implicit health care liability, this amount represented about 160 percent of GDP in 2001.

Robson (2001) shows that the degree of implicit health care liability is unevenly distributed across Canada, in part because of inter-provincial flows of population. He demonstrates an alternative health care expenditures projection, which is affected by inter-provincial flows of population. For example, Newfoundland lost one percent of its young population annually with inter-provincial flows over the 1990s. Thus, the seniors' share of the total population will increase by 25 percentage points in 2020, because seniors are less mobile (about 20 percentage points in the base projection). As a result, its health care spending will represent greater than 80 percent of the provincial own-revenue by 2020. In contrast, since a lot of young inter-provincial immigrants went to Alberta and British Columbia during the 1990s, the share of their populations represented by the elderly are expected to decrease from 17 to 15 percent between 2000 and 2020. As a result, the increases in health care spending with respect to their own-source revenue will be much smaller than those in Newfoundland by 2020. The implicit health care liabilities as the shares of provincial GDP are projected to decrease by 4 percentage points in Alberta and British Columbia between 2000 and 2020.

Thus, demographic changes will put massive pressure on many provinces' health care budgets in the decades ahead. The uneven weight of implicit health care liability across Canada may put fiscal pressure on the federal government to increase health care transfers to provinces. It has to be seen that if the new money injected by the federal

government in its last budget (Documented in Department Of Finance, 2003) will be sufficient to make sustainable the fiscal pressure of health care on provincial governments.

## Chapter 4 Government Role in Canada

Increased federal transfers to provincial-territorial governments can reduce fiscal pressure from population aging and can maintain the health care system. As stated in Romanow (2002), the “medicare bargain” means that the federal and provincial governments share all the eligible expenditures on hospitals and physicians on a 50:50 basis. In fact, the federal share of provincial hospitals and physicians expenditures decreased from 60 percent in the 1970s to 47 percent in the early 2000s. In addition, the federal share of total provincial health care expenditures decreased significantly from 43 percent in 1979-80 to 27.5 percent in 2001-02 (Romanow, 2002). As a result, the federal government has successfully shifted the burden of rising health care expenditures to provinces through its reductions in federal transfers and the elimination of the CHST escalator in the 1990s.

As examined in Ruggeri (2002), the fiscal health care pressure on the provincial budgets can be reduced by high growth of CHST. Ruggeri selects two different scenarios for CHST: under the first scenario, the standard growth of cash payments is assumed to be equal to the rate determined in the CHST agreement of September 2000. The agreement states that federal government increases \$21.1 billion CHST cash between 2000 and 2005. In addition, the funding grows at the same rate as the nominal GDP. Under the second scenario, CHST increases to about \$7 billion for the fiscal year 2002-2003, and then cash transfers grow at the same rate as the growth of the federal personal tax revenue. Not surprisingly, with high growth of CHST cash payments, the share of health care expenditures with respect to provincial revenue is much smaller than that with the standard

CHST. For example, by the fiscal year 2026-2027, the provincial-territorial governments could save a 2.5 percent share of provincial revenue devoted to health care by receiving high growth CHST payments.

According to the Romanow Final Report, the amount of federal cash transfers is far below the needs of provincial governments. If future federal expenditures are based on the previous cash commitments, that is only 25 percent of provincial health care costs for services that are covered by the Canada Health Act (Romanow, 2002). In fact, provincial governments will require federal cash transfers of \$60 billion for the fiscal years between 2001-02 and 2005-06. This amount only takes hospitals and physicians' services into account. However, as announced by the Department of Finance in September 2000, the federal government committed to invest only \$42 billion of additional CHST cash and Medical Equipment Fund during 2000-01 to 2004-05. Therefore, province governments still need more health care transfer payments from the federal government in the future.

In addition, in order to provide the long term stability of the health care system, the commission suggests that the formula for the growth of the CHST escalator should be the growth rate of the economy, which is measured by a five-year historic average of GDP, times a multiplier of 1.25 that is based on the long term trend in the relationship (1960 to 2000) between the total health care expenditures growth and the economic growth (Romanow, 2002). As a result, the escalator could ensure that the growth of CHST be linked to the growth of the economy.

Robson (2001) suggests that the establishment of the senior health grant and pre-funding program in CHST will increase financial resources for the health care system. The senior health grant, which would be a part of CHST, would address the challenge posed by an aging population. The provincial governments will receive a \$3000 grant as behalf of each senior, and this amount would be indexed to the growth of the nominal GDP. Robson (2001) shows that, by 2040, the senior health grant will represent about 2 to 3 percent of GDP, and about 12 to 17 percent of the own-source revenue in the Atlantic Provinces. Furthermore, the grant can reduce the implicit health care liability of GDP by 25 to 30 percentage points. Since the senior health grant will be provided on per capita (age over 65) bass, the provinces with higher population of their aging will receive more grants.

Robson shows that the pre-funding program can reduce the health care cost of baby boomers, and can provide extra revenue for the federal government to constrain Ottawa's ability to increase other social programs' spending or to cut taxes. Ottawa can make annual payments index to the growth of the nominal GDP into a trust fund – Senior Health Grant Account, and then it withdraws the amount that equals the difference between payments from the senior health grant and the CHST transfers. The investment earning will be accumulated in the trust fund over the long period of time. The amount of contributions is determined regarding the implicit health care liability, demographic changes, and the inflation in the medical field. In addition, the Senior Health Grant Account aims for a funding ratio relative to total senior health grant payments. For instance the total grant will be twice as large as the incremental cost of senior health grant between 2000 and 2050. Since the pre-funding program is the long-term investment, the additional annual

contribution to achieve the higher funding ratio would be proportionately smaller than without the pre-funding program. If the program were implemented in 2000, the investment earning would cover about one-sixth of the projected provincial health care expenditures for seniors between 2000 and 2050. Robson (2002) suggests that a part of the pre-funding would be collected from personal income tax and consumption tax, because they are the dominant sources of total government revenue, and the consumption expenditure is intimately linked to ability to pay. This proposal is similar to the Canadian Pension Plan and Quebec Pension Plan.

According to Romanow Final Report (Romanow, 2002), the tax-based co-payment is one of the proposals to increase the health care funding. It suggests that the tax can raise the government revenue from the health care services' recipients. One would receive the T4-H, which lists the cost of the health services that he received in each year. This amount would be added to his taxable income, and he would pay additional taxes to cover a portion of the cost of his received health care services. Some policy makers suggest that low-income group could be exempted from the co-payment tax. In fact, if the government implements the tax-based co-payment for health care, it will implement other specific-use taxes in the future.

In conclusion, the CHST escalator, the senior health grant, pre-funding program, and the tax-based co-payments will provide extra revenue for the health care system. CHST escalator could ensure that the federal government could provide the long-term stable and predictable cash transfer payments to provinces. Furthermore, the senior health grant is

allocated on per senior basis in provinces, and the pre-funding program can be reserved aside in order to payout the incremental cost of senior health grant over the next 50 years. Under the pre-funding program, Ottawa and taxpayers contribute to the senior health grant fund. However, under the tax-based co-payment system, only the health care service consumers pay the co-payment tax, which is tied to their income level. In both cases, the burden of health care expenditures will partially shift from the public purse to individuals eventually. Consequently, finding the optimum ways to allocate extra revenue to the health care system is an appropriate method to provide a future financial suitability on health care.

## Chapter 5 Methodology

This section presents the methodology used in determining future health care expenditures for the period between 2000 and 2026. The methodology used here has been adapted from papers written by Fougère et al. (2000) and Mercenier and Mérette (2002). My model is a simplification of the model developed by Fougère et al. (2002). Their model has a general equilibrium framework, so my model has a partial equilibrium flavor. To be more precise, I borrow the calibration and the projection procedures for the health care sector from Fougère et al., but I neglect the potential adjustment of relative prices, and the interaction between the health care sector and the rest of the economy. The first section discusses the various data that were used. Next, the health care expenditures model is presented as well as the critical assumptions used in the analysis. Finally, I explain the procedures of the model in detail.

### 5.1 Data

Data are obtained from 3 principal sources:

- Statistics Canada.
- The Canadian Institute for Health Information (CIHI).
- Health Policy and Communication Branch, Health Canada.

For this study, Statistics Canada provides historical data on the public accounts of federal and provincial governments, and various demographics indicators. The population and demographic projections are based on the “medium” projection by Statistics Canada. The Canadian Institute for Health Information (CIHI) provides the historical data of total health care expenditures in the public and private sectors, and the use of funds. In addition,



the Health Policy and Communication Branch is the data source of health care expenditures per capita by age group.

The objective of my base-case projection is to examine health care expenditures by changing “health care spending distribution for each age group” (DH)<sup>3</sup>. There are two different age groups distributions in my data sources. One needs to ensure that there is a concordance between the age groups of the health care expenditures per capita data and the age groups used in the demographic data. A linear trend is imposed between age groups of the data set. This is an interpolation procedure to determine the health care expenditures per capita of various age groups.

## 5.2 Health Care Expenditures Model Assumptions

- There are 19 age groups in the model; Age 0-4, 5-9, 10-14, 15-19, 20-24, 25-29, 30-34, 35-39, 40-44, 45-49, 50-54, 55-59, 60-64, 65-69, 70-74, 75-79, 80-84, 85-89, 90+.
- The projection of health care expenditures is modeled at the constant 2000 dollars.
- To ensure consistency between the age group categories of the model and those available in the data, a linear trend was imposed between age groups of the data set.

## 5.3 Health Care Expenditures Model

The results of the projected public, private, and total health care expenditures are obtained by multiplying the health care expenditures per capita of the 19 age groups at the

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<sup>3</sup> DH represents **D**istribution parameter of **H**ealth care services by age group.

constant 2000 dollars, and the projected population between 2000 and 2026. In the following, I describe the model more precisely.

The projections are done in 2 steps. In the first step, I determine the per capita spending on health care by age group. This step is represented by equations (1), (2), (3) and (4). The second step is represented by equations (5) and (6).

$$\sum_{i=1}^{19} DH(i) = 1 \quad (1)$$

$$\sum_{i=1}^{19} DH(i) = \frac{HEAC(i)}{\sum_{i=1}^{19} HEAC(i)} \quad (2)$$

In equation (1), the vector  $DH$  is exogenous, and takes the value observed in 2000 for health care expenditures per capita by age group in 2000. It represents the distribution of health care services to the different age groups ( $i$ ), assuming that age groups have equal weight with respect to population. In other words, it corresponds to the life-cycle evolution of the share  $DH(i)$  of health care services benefiting any individual in Canada. The sum of the shares over the life-cycle equals to one. Each  $DH$  parameter is between 0 and 1.  $HEAC(i)$  is endogenous, and is determined by the base-case projection. It represents the health care spending per capita in each age group.  $i$  denotes the age group. As seen in equation (2),  $HEAC(i)$  can be interpreted as being the value of health care choices received by an individual member of age group  $i$ .

$$HEAC(j, i+1) = \frac{DH(i+1)}{DH(i)} * HEAC(j, i) \quad (3)$$

Equation (3) states the health care spending ratio of each age group.  $j$  denotes as the public sector, and private sectors, and the use of funds (public and private sectors): hospitals, other institutions, physicians, other professionals, drugs, capital, public health & administration and other health expenditures. There are 18 indices in total.

$$GHEA(j) = \sum_{i=1}^{19} (NCI(i) * HEAC(j, i)) \quad (4)$$

$NCI(i)$  is exogenous, and represents the total population of each age group in year 2000. In equation (4),  $GHEA(j)$  is exogenous, as total health care expenditures in each sector or the use of funds in 2000. Once all equations above are solved, the health care expenditures per capita  $HEAC(j, i)$  is determined.

### Projection

Public, private, and total health care expenditures are obtained by multiplying the results of the previous model and the population projected for years 2000 to 2026.

$$HEA(j, i) = HEAC(j, i) \quad (5)$$

$$TEXP(j, t) = \sum_{i=1}^{19} (POP(i, t) * HEA(j, i)) \quad (6)$$

In equation (5),  $HEA(j, i)$  is the health care expenditures per capita of each  $j$ , which is now exogenous, and assumed to be the value of  $HEAC(j, i)$  obtained in the first step. In equation (6),  $TEXP(j, t)$  is endogenous, and presents total health care expenditures of each  $j$  in the specific year  $t$  of the forecast period.  $POP(i, t)$ , which is exogenous, represents the population by age group in the specific year between 2000 and 2026.

## Chapter 6 Simulation Results Interpretation

### 6.1 Base Scenario of Health Care Expenditures Model

In this section, I report and explain the base-case projection in four different experiments. The base-case experiment incorporates the demographic shifts only with the different value of DH parameters in each scenario. Then, I estimate the health care expenditures of the alternative scenarios, incorporating an additional aging effect that is similar to the “age-adjusted servicing intensity of health spending” used by Robson (2001). Finally, I compare my results with previous literature, and I examine the health care expenditures in relation to GDP and government revenue. The major assumptions of the base-case scenario are summarized in the following:

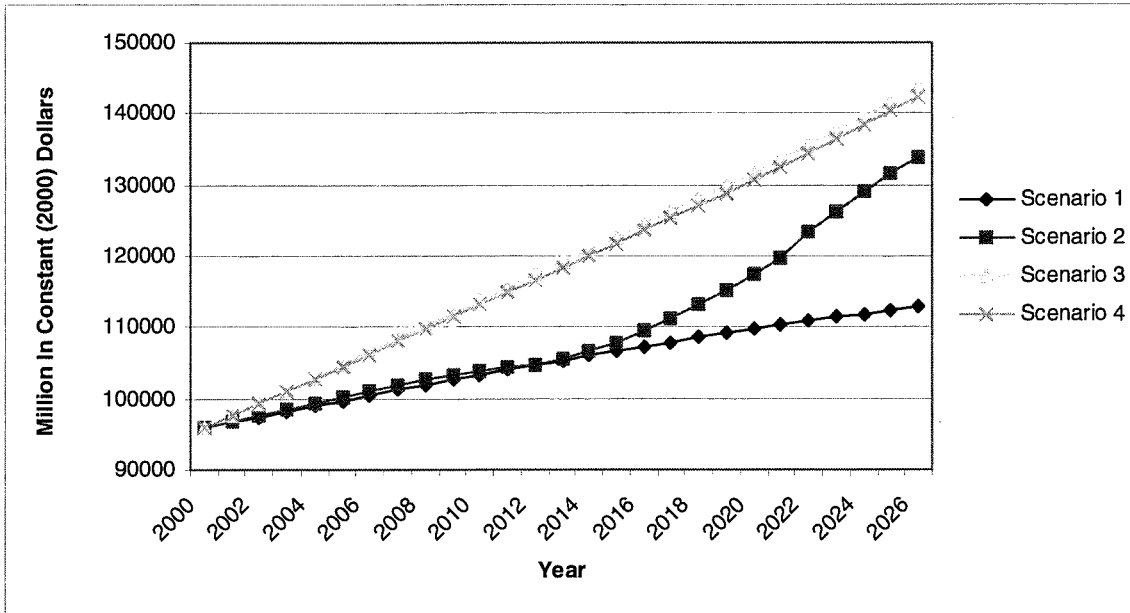
Scenario 1: Same DH parameters in all age groups.

Scenario 2: Individuals receive 50 percent of lifetime health care services during their last 5 years of life (between the age of 75 and 79).

Scenario 3: Different DH parameters in each 5 year age group, as observed in year 2000.

Scenario 4: Each use of funds is assumed to have different DH parameters in each age group.

**Figure 10: Total Health Care Expenditures Between 2000 and 2026**

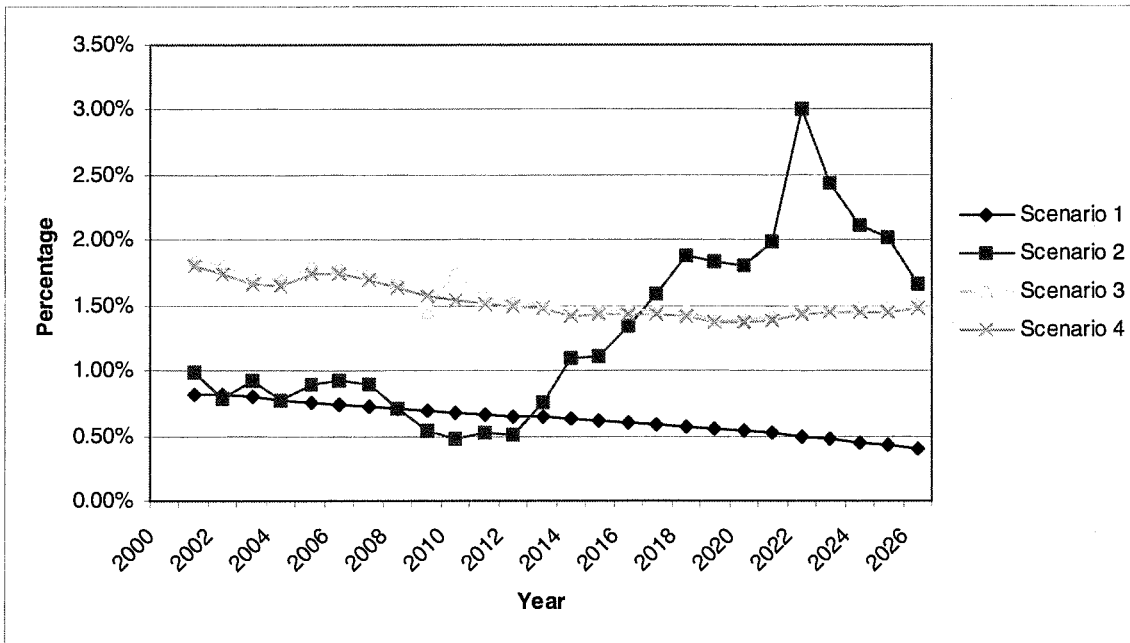


**Scenario 1:**

The total (private & public) health care expenditures are expected to increase by 17.7 percentage points, from \$95.8 to \$112.8 billion between 2000 and 2026. In per capita terms, the national health care expenditure is \$3118 in 2000.

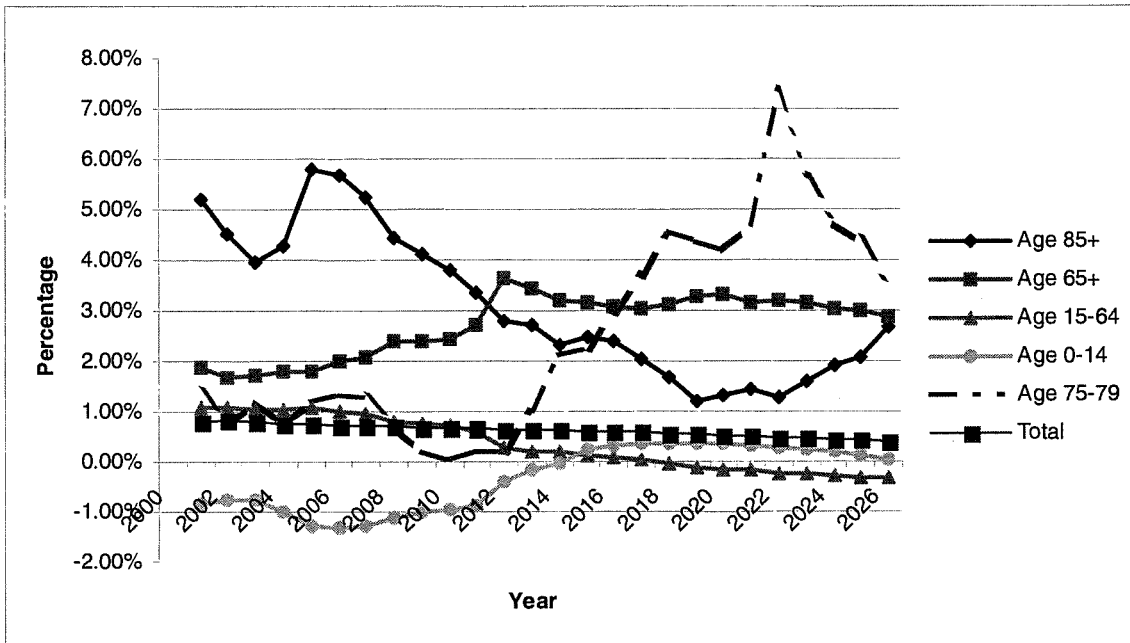
Not surprisingly, with an equally proportionate DH share over the life cycle, total health care expenditures grow at the same rate as the growth of total population. In other words, the total health care expenditures are directly associated with the evolution of the total population. The growth rate of total health care expenditures thus decreases in such a scenario from 0.79 to 0.41 percent between 2000 and 2026. Across aging groups, about 12.65 percent of total health expenditures is devoted to the people 65 or over in 2000. This amount increases by 9 percentage points to \$329 billion in constant 2000 dollars in 2026, as the relative size of this age group is projected to rise by the same percentage.

**Figure 11: Annual Growth of Total Health Care Expenditures Between 2000 and 2026**



The total health care expenditures under scenario 1 in 2026 are the smallest among the four scenarios in part, because the working age and child-dependent populations are projected to decline by 4 and 5 percentage points respectively between 2000 and 2026 (See Figure 12). This helps to restrain the growth rate of total health care expenditures as the sum of both age groups represent about 78 percent of the total population.

Figure 12: Annual Population Growth by Age Cohort Between 2000 and 2026



Scenario 2:

Under the scenario 2, 50 percent of health care benefits occur at the end of life. As illustrated in Figure 10, total health care expenditures under scenario 2 move in line with those in scenario 1 between 2000 and 2013. After that, total health care expenditures are projected to increase substantially from \$105.6 to \$133.7 billions between 2013 and 2026, because year 2020 corresponds to the time that most baby boomers move into the 75-79 age group. Indeed, 75-79 age group is projected to represent 4.19 percent of the total population in 2026 rather than only 2.64 percent in 2013.

In per capita terms, total health care expenditures allocated to the people 75-79 of age equal \$38,853 over the forecast period; a substantial increase with respect to the \$3,118



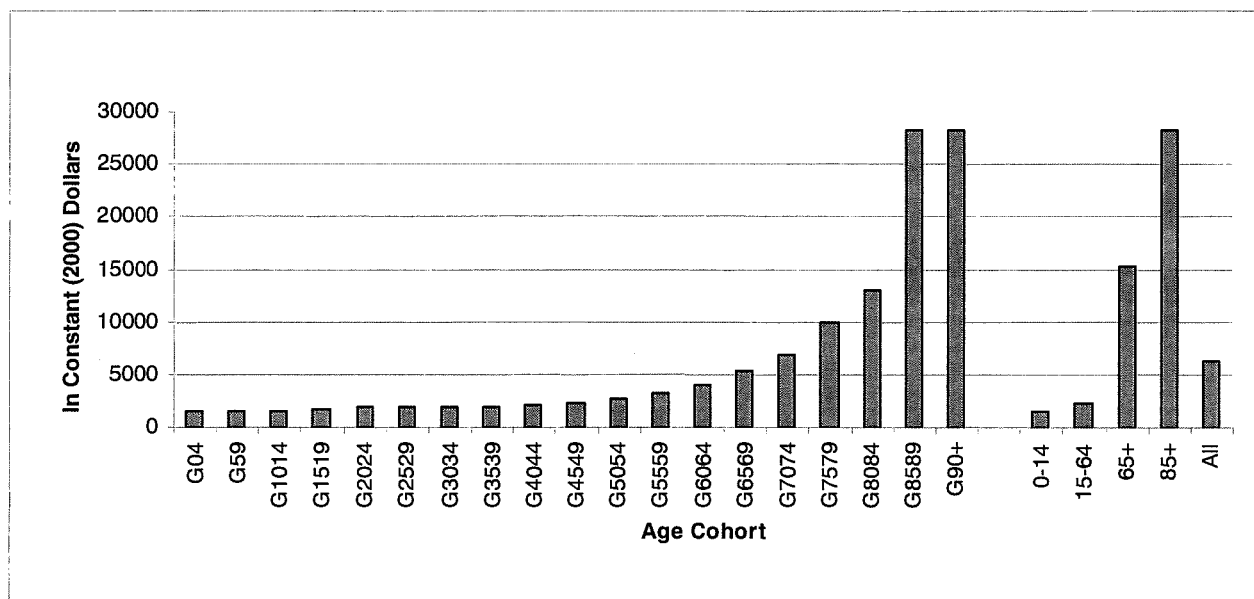
found in scenario 1. For other age groups the spending decline to \$2,159 in the same time frame.

As shown in Figure 11, scenario 2 has a very unique pattern of the total health care expenditures growth among other scenarios. The growth of the total health care expenditures increased at the rate of 1 percent in 2001. After that, it will drop to its lowest level of 0.47 percent by 2010, and then could remain at a steady level until 2013. Afterwards, the growth rate rapidly will increase to a peak of 3 percent level in 2022. Thereafter, the pressure coming from the people 75-79 age group diminishes. Consequently, the growth rate of the total health care expenditures is expected to decrease to 1.66 percent in 2026.

#### Scenario 3:

In scenario 3, I assume that DH value of each age group is equal to that of 2000 observation. According to the results of scenario 3, total health care expenditures is \$96 billion in 2000, and they are expected to reach \$144 billion in 2026 in constant (2000) dollars. The share of total health care expenditures allocates to the age 65+group is expected to increase from 41 to 56 percent for the period between 2000 and 2026. The dramatic rise of future health care expenditures is a result of the aging population process.

**Figure 13: Per Capita Health Care Expenditures by Age Cohort**



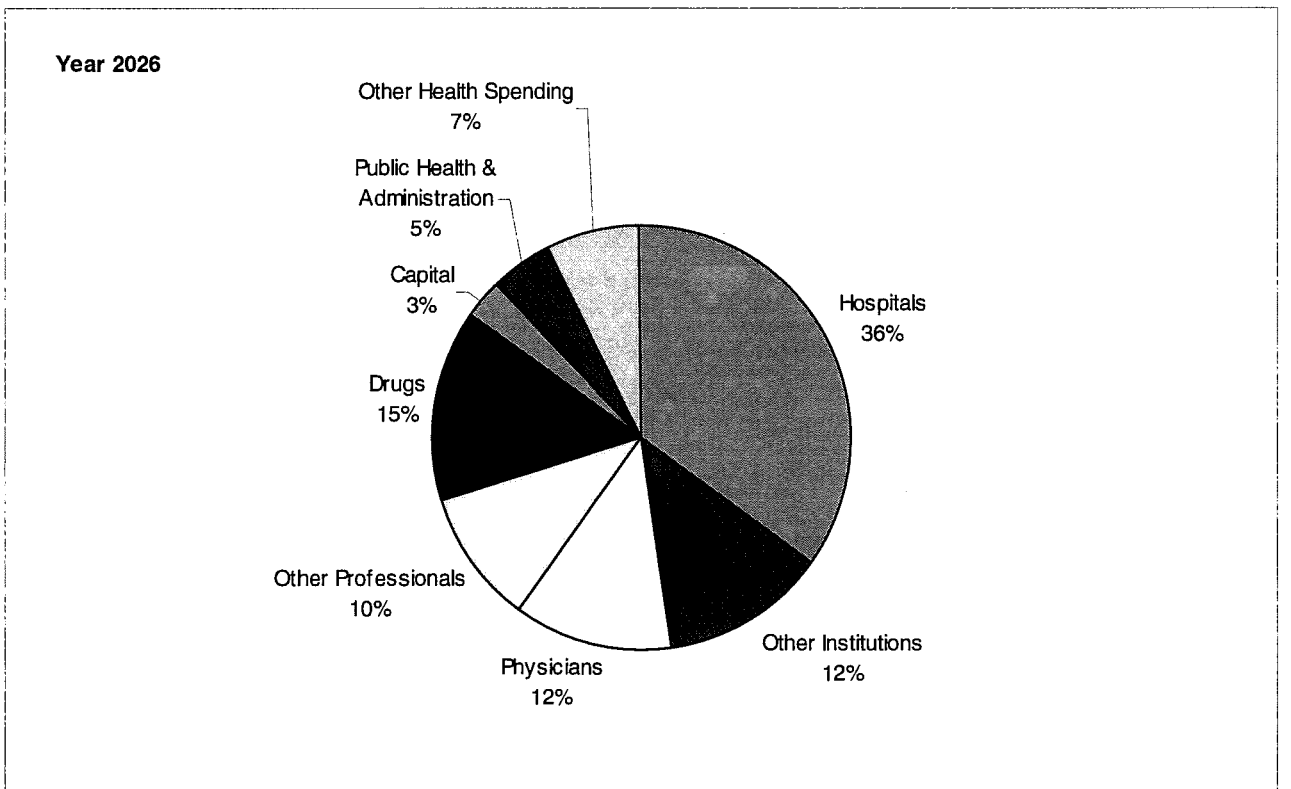
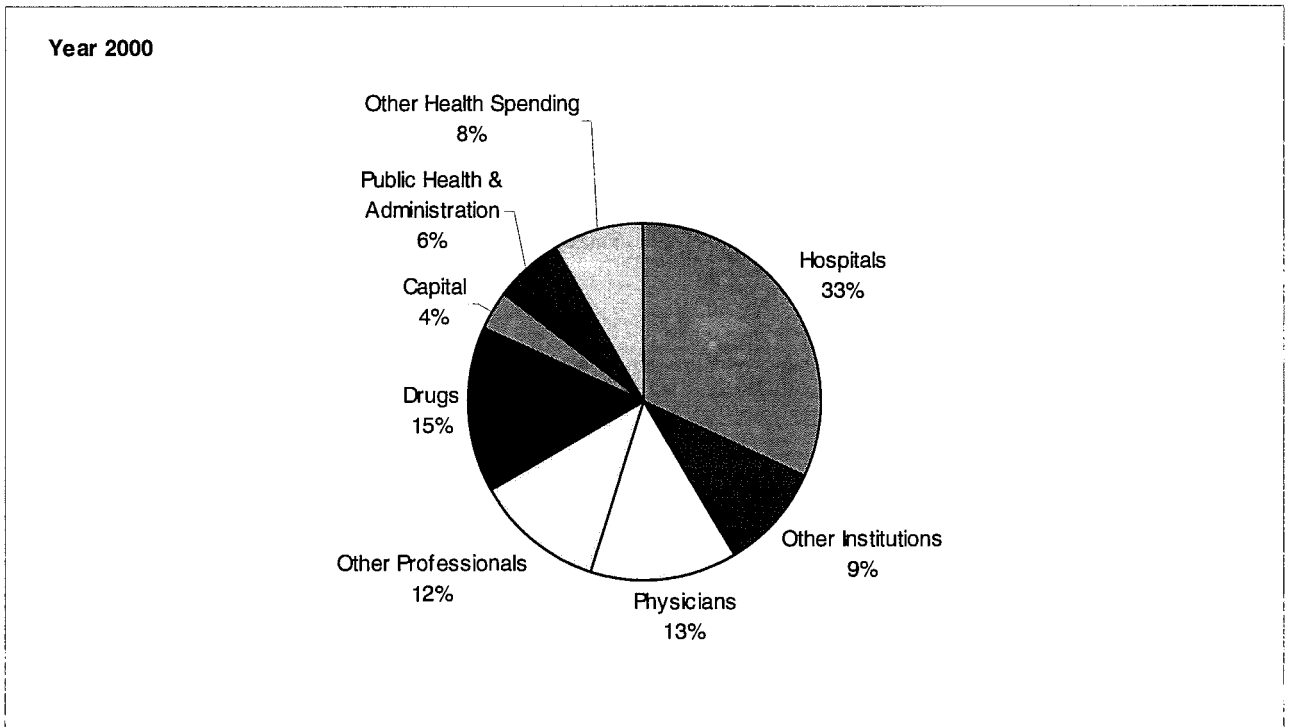
Under scenario 3, about 76 percent of individual’s health care spending occurs after age 65, which is caused by the greater probability illnesses at old age.

During the 2000-2026 period, in per capita terms, the average health care costs for people aged 65 are \$15,292.2, which is 4.78 times more than the national average. Moreover, the average health care expenditures for people aged 85 or over are \$28,218, which is 7 times more than the national average. In contrast, the health care expenditures of both 15-64 age and 0-14 age groups are less than the national average (See Figure 13).

As illustrated in Figure 11, the growth of total health care expenditures decreases from the highest rate at 1.85 percent in 2001, and then drops to the lowest rate at 1.39 percent by 2020. Since the health cost is directly associated with the demographic changes, a negative growth in the working age and the child-dependent populations can offset a

positive growth of the aging population between 2000 and 2019. Therefore, the 0-64 age group offsets somewhat the increasing pressure on health care expenditures opening from the 65+ age group. Then the annual growth of total health care expenditures is projected to increase significantly to reach 1.51 percent level in 2026. Since public and private sectors allocate most health care funding to the 85+age group, this put significant financial pressure on the health care system.

Figure 14: Evolution of Use of Funds Between 2000 and 2026



#### Scenario 4:

Under scenario 4, DH parameters of each age group in each use of funds are assumed to have different value. The value of DH parameters depends on how much the age groups receive the health care services in each use of funds. For instance, percentage of hospitals, drugs and other institutions' services received by an individual of the 65+ age group are about 85, 65 and 87 percent respectively. Distribution of physicians' services more concentrates on working age group. Distribution of other professionals' services that received by an individual of the 65+ age group is 48 percent. Public health and administration, other health spending, and capital are assumed to have the same distribution to all people. According to the simulation result, Figure 14 shows the use of funds in health care expenditures for the year 2000 and 2026. As can easily be noticed, the proportional of health care funds allocates to other institutions and hospitals will increase by 2026, whereas the share of total health care expenditures devotes to other professionals is expected to decrease rapidly.

There is about 90 percent share of the total other institutions expenditures, in per capita terms, allocate to the people age of 75 and over. The annual growth of other institutions expenditures decrease between 2000 and 2019, because the growth of people aged 75+ population decreases. Afterwards, the elder baby boomers will reach age 75 in 2020, this will tend to increase the annual growth rate of the other institutions expenditures.

In fact, the hospital costs for people 65 and over are 10 times more than working age population, and about 17 times more than the child-dependent population in per capita

terms. As the proportion, seniors will increase to 22 percent of total population in 2026, hospitals shares of total health care expenditures are projected to increase substantially.

Other professionals' shares of total health care expenditures are expected to decline slightly by 2026, because the declines in working age and child-dependent population will offset a part of the growth rate of other professionals expenditures. For instance, each senior receives about 48 percent distribution of other professionals' services, and about 18 percent for the other age groups. Hence, other professionals' shares of total health care expenditures are projected to decrease by 2 percentage points between 2000 and 2026.

Drugs remain the same share of total health care expenditures in these two periods. Other factors such as physicians, capital, public health and administration, and others health care spending have experienced in declining share of the total health care expenditures by 2026. And also, their annual growth rates of health care expenditures would decrease over the period between 2000 and 2026.

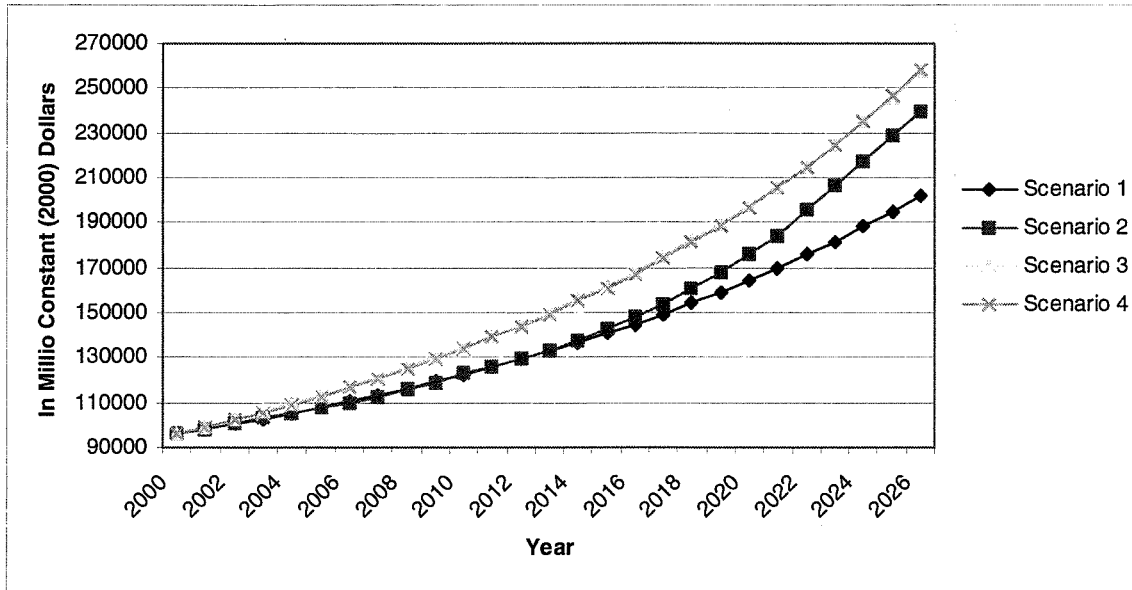
## 6.2 Additional Aging Effects to Health Care Expenditures

It is well known that seniors increase the demand of drugs, other institutions and other professionals' services. During the last two decades, the real growth rates of those services were even higher than the economic growth. I assume that the additional aging effects correspond to the real expenditures increases in drugs, other institutions and other professionals. This assumption is similar to the "age servicing intensity of health spending" used by Robson (2001). The expected real average annual growth rates of drugs, other institutions, and other professionals expenditures are assumed to be equal to real average annual growth rates observed between 1980 and 2000. I used the following assumptions for the expected growth rates of the expenditures: 8.1 and 4.38 percent for drugs in public and private sectors respectively; 0.83 and 3.94 percent for other professionals in public and private sectors respectively; 1.95 and 1.5 percent for other institutions in public and private sectors respectively. Figure 15 shows the health care expenditures with the additional aging effects. Under scenario 1, the increase of total health care expenditures is the smallest among the others scenarios from 2000 to 2026; under scenario 3 and 4, their health care expenditures are projected to increase by 170 percentage points in the same period.

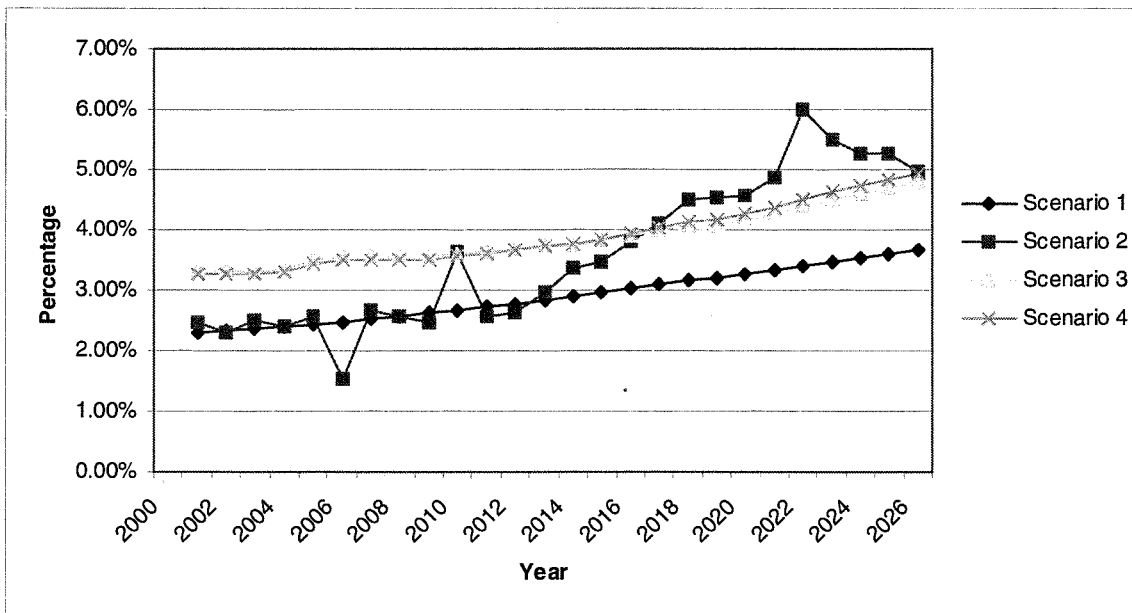
With the additional aging effects, total health care expenditures rise at a greater rate than the base care projections. Figure 16 reports the growth of health care expenditures with additional aging effects. Scenario 2 has a unique pattern among other scenarios. It moves in line with the growth rate of scenario 1 until 2012, and then increases substantially to its peak at 6 percent level by 2022. In comparison with its base-case, both have the same

growth patterns of total health care expenditures. However, the growth rate of total health care expenditures with additional aging effects is higher than that in the base model

**Figure 15: Total Health Care Expenditures with Additional Aging Effects**



**Figure 16: Growth of Total Health Care Expenditures with Additional Aging Effects**





### 6.3 Health Care Expenditures in Relation to the Gross Domestic Product

In this section, I will analyze future health care expenditures by determining health care costs as a share of GDP. I assume that future real annual growth rate of GDP will be equal to the real average annual growth rate observed between 1980 and 2000. Thus, I project a rate is equal to 2.55 percent between 2000 and 2026. As reported in Table 4, which depends on demographic shifts only, the share to GDP under scenarios 2, 3 and 4 is expected to decrease from 9 to 7 percent between 2000 and 2026 when health care expenditures depend on the demographic shift only. However, with the additional aging effects, the health care share of GDP is expected to increase substantially. For instance, in scenarios 3 and 4, their health care shares of GDP are projected to increase by 4 percentage points and reach 12.5 percent of GDP by 2026. In scenario 2, the health care share of GDP slightly decreases to 8.97 percent between 2000 and 2010, because the population growth of the 75-79 age group will decline. After that, the health care share of GDP increases to 12 percent by 2026.

**Table 4: Health Care Expenditures as a Share of GDP Between 2000 and 2026**

Year	Without Additional Aging Effects				With Additional Aging Effects			
	Scenario 1	Scenario 2	Scenario 3	Scenario 4	Scenario 1	Scenario 2	Scenario 3	Scenario 4
2000	9.00%	9.00%	9.00%	9.00%	9.00%	9.00%	9.00%	9.00%
2010	7.54%	7.57%	8.31%	8.27%	8.93%	8.97%	9.84%	9.79%
2020	6.23%	6.66%	7.47%	7.41%	9.33%	9.98%	11.19%	11.17%
2025	5.62%	6.58%	7.08%	7.02%	9.76%	11.43%	12.29%	12.34%
2026	5.51%	6.53%	7.01%	6.94%	9.87%	11.70%	12.57%	12.63%

According to the projection above, the health care share of GDP is estimated to decrease if future health care expenditures depend only on demographic shift. My results are contrast with the previous projection results, because the growth of the economy is greater than the growth of future health care expenditures. In this case, the economy should

be capable of sustaining future health expenditures. However, with additional aging effects, the growth rate in health care expenditures is 1.5 percent greater than economic growth for the period between 2000 and 2026. Obviously, health care expenditures relation to GDP increases substantially as presented in Table 4.

#### 6.4 Health Care Expenditures in Relation to the Provincial Revenue

As shown in Table 5, federal transfers play an important role in improving the ability of provincial-territorial governments to maintain the health care system with the additional aging effects. The real annual growth rate of provincial revenue and own-source revenue are assumed to be 2 and 2.5 percent respectively between 2000 and 2026, which are the observed real average growth rate between 1990 and 2000. With federal transfer payments, health care share of provincial revenue in scenarios 3 and 4 increase from 48 to 78 percent between 2000 and 2026. In each dollar of provincial revenue terms, provincial governments will contribute 78 cents to the health care sector in 2026. Without federal transfer payments, health care share of provincial own-source revenue is expected to increase more; for instance, in scenarios 3 and 4, their health shares of provincial own-source revenue are expected to increase from 58 to 82 percent between 2000 and 2026. As a result, without federal transfers, provincial governments are projected to allocate 4 cents more to health care spending than that with federal transfers in 2026.

**Table 5: Health Care Expenditures as a Share of Provincial Revenue Between 2000 and 2026**

Year	With Federal Transfer				Without Federal Transfers			
	Scenario 1	Scenario 2	Scenario 3	Scenario 4	Scenario 1	Scenario 2	Scenario 3	Scenario 4
2000	48.84%	48.84%	48.84%	48.84%	57.85%	57.85%	57.85%	57.85%
2005	49.70%	49.89%	52.16%	52.02%	57.39%	57.62%	60.23%	60.07%
2010	51.08%	51.29%	56.27%	55.97%	57.50%	57.74%	63.35%	63.01%
2015	53.19%	53.83%	61.15%	60.82%	58.38%	59.08%	67.12%	66.75%
2020	56.24%	60.15%	67.48%	67.32%	60.17%	64.36%	72.20%	72.04%
2026	61.39%	72.78%	78.19%	78.56%	63.71%	75.53%	81.15%	81.54%

Comparing my results with Robson (2001), the increase of health care expenditures without federal transfer payments is somewhat smaller. Robson states that without federal transfer payments, health care share of own-resource revenue is expected to increase by 13 percent between 2000 and 2020. His model incorporates different demographic changes assumptions, a price index in health care, and a real productivity growth rate for labour. Thus, Robson's projection is based on different assumptions and his age groups are more aggregated than mine. Table 5 suggests clearly that in order to reduce fiscal pressure on provincial governments, federal government has to transfers enough funds to the provinces.

## Chapter 7 Conclusion

In this paper, I present the evolution of health care expenditures for the last two decades, and I examine the degree of sustainability of future health care expenditures in the context of an aging population. According to my simulations, the economy is capable of sustaining the current and projected levels of health care spending. Health care spending with respect to GDP will increase, but not to an unsustainable ratio. The capacity of provincial fiscal system to withstand the pressure of rising health care expenditures is, however, not going to be sustainable under the current federal transfers system. Seniors receive about 70 percent of the total health care services, and the proportion of seniors will increase to 25 percent of total population in 2026. Therefore, given a high-expected growth rate of health care expenditures, fiscal pressure will be high on provincial government budgets.

My model as any other projection models has some limitations and sources of uncertainty. For instance, it does not incorporate technology innovations, changes in health services' consumption habits, and the likely improved status of future services. As Chen and Millar claim:

*The baby boomer generation has a lower prevalence of heart disease, hypertension, arthritis and functional limitations compared with the previous cohorts at the same age (Hebert, 2002, p.4).*

In order to reduce fiscal pressure on health care system due to an aging population, it is possible to reform the health care services, which focus on the special needs of the aging population, such as a large demand of long term health care services, drugs, home

care services, the promotions that emphasize on the “healthy aging”, and the increases in social and health care services. Those services can help seniors to maintain independence and improve their quality of life. Furthermore, federal government needs to increase transfer payments by associating directly to the number of seniors in province. These strategies can reduce the fiscal pressure on the health care system.

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