

The Canadian Health Care System  
and the Effects of Public and Private  
Health Care Systems on Health  
Outcomes

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## **Chapter 1- Health Care Economics**

### ***1.1 Introduction***

The health care system in Canada has come under much scrutiny and criticism since the introduction of public health care midway through the twentieth century. Many feel that the public health care system in Canada does not provide the services that are guaranteed for all Canadians at a sufficient level. For example, there has been a rising concern over the length of time one must wait in order to receive certain medical procedures. Some feel that having a strict public system of health care is inefficient because there are many people who would be willing to pay directly for medical services rather than wait. Further complicating matters, the current Canadian system may be unsustainable in the future as a large portion of the Canadian population (the baby-boomers) are soon to become elderly and will require increasing levels of health services while contributing less to the growth of the economy. These problems have caused some to examine the structure and overall quality of the provision of health care in Canada and many possible solutions have been put forward.

As problems with the Canadian health care system seem to escalate, reformists argue that a change in health care policy is needed in order to maximize the benefit of health care to Canadians. Most agree that a change is in order; however, it is difficult to determine what kind of reforms would improve the efficiency and overall delivery of

health care to Canadians. Every developed country in the world has a unique method of financing and delivering health care services, and many of these techniques have been suggested as alternatives to the current Canadian system. Although; in theory, some of these techniques seem to offer increased efficiency and possibly greater equity as compared to the Canadian system, much of the evidence of superiority is lacking.

Some argue that the adoption of a more privatized style of health care should be available for those who would rather pay out-of-pocket for health services (or through private insurance markets), rather than wait extended periods of time for publicly financed health procedures. The issue of private insurance has been growing in Canada and has even made its way into the Supreme Court, as an example, in the Chaoulli case. In this case, the Supreme Court of Canada ruled that Chaoulli was subjected to an unacceptable waiting period in order to receive a surgical procedure. They concluded that, under the constitution, Quebec should not support the prohibition of private insurance as extended waiting periods affect the right to life and to personal inviolability.

However, the incorporation of private health care has shown varying levels of success in other countries and does not necessarily improve the health conditions within these countries. Thus, the dynamics of private health care require further analysis to fully understand its performance and level of complexity.

Some argue that the government of Canada should allow more privatized institutions, for example private clinics, to operate. These for-profit firms could increase the level of resources available to health care; for example, by attracting workers from outside Canada, and could help to reduce the increasing demand and strain on the supply

for services in the public sector. However, these firms could draw professionals out of the Canadian public sector and harm the resources available to the public.

The illusion of 'free' health care in Canada is rather misrepresentative. Canadians do have to pay for a number of health services out of their own pockets or through insurance companies, and these services make up a significant portion of the overall spending on health care in Canada. If other services were made private, Canada could easily follow in the footsteps of the United States where most of health care is privately operated. This type of system is extremely inefficient and contains many problems, as will be discussed further into the essay, which has forced the US to begin debating if and how its system of health care could be improved.

Amid these arguments, this essay will scrutinize private health care systems in order to determine whether they provide better health outcomes than public health care systems. Evidence will be collected indicating whether Canada would likely benefit from reforming health care with the introduction of a practical private health care system and private health insurance.

The economics surrounding health care will be discussed, raising issues such as scarcity, efficiency and equity, and the Canadian health care system will be described thoroughly. The health care systems of 11 countries from North America, Europe and Asia will be introduced, taking into account the different methods of financing health care that exist. Data representing health outcomes and inputs of health will be collected from each of these countries and models will be created and analyzed using regressions to identify the existence of any relationships between the independent and the dependent

variables. By investigating these relationships I will attempt to distinguish any specific correlation between the method of financing health care and the health outcomes.

## **1.2 Defining 'Health Care'**

The subject of health care is broad and comprises many components. "*The economics of health involves the two-way causal relations between the health status of individuals and their economic activities, which include production, distribution and exchange.*"<sup>1</sup>

The economics of health care is a small aspect of the overall economics of health and involves specifically the "*set of goods and services, which have been identified as having a unique relationship to health status, and the activities associated with their production and consumption.*"<sup>2</sup> The economics of health care relates to this essay in that the relationships involving public health care and private health care are being questioned as to what type of impact either may have on the overall health of a population.

Among the many different ways of describing health, the World Health Organization uses the phrases: "*a state of complete, physical, and social well-being*" and not "*merely the absence of infirmity.*"<sup>3</sup> These statements are consistent with the economic term for utility, or the overall welfare of individuals. A general description of health care is as follows:

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<sup>1</sup> Robert Evans, Strained Mercy: The Economics of Canadian Health Care (Toronto: Butterworth 1984) 3.

<sup>2</sup> Robert Evans, Strained Mercy: The Economics of Canadian Health Care (Toronto: Butterworth 1984) 4

<sup>3</sup> Robert Evans, Strained Mercy: The Economics of Canadian Health Care (Toronto: Butterworth 1984) 5

*“Health care is the prevention, treatment and management of illness and the preservation of mental and physical well being through the services offered by the medical and allied health professions.”<sup>4</sup>*

The above definition is quite self-explanatory; however, the debate comes from the variations in other definitions and becomes intricate because of legal obligations (in the case of Canada by the Canada Health Act) and the broad interpretation of this, and other, definitions. To summarize, health care is the service, administration, financing, funding, prevention, etc., that involves, in any way, the health of people within a system.

Another problem that has become extremely relevant, especially in the case of legality, is that some definitions include the term ‘medically necessary’. This term can be defined as:

*“Covered services required to preserve and maintain the health status of a member or eligible person in accordance with the area's standards of medical practice.”<sup>5</sup>*

That is, the services are required in order to sustain an individual at an ordinary, acceptable level of health status. It is also the cause of much debate in the medical community, as well as in the broader Canadian health care system. Generally speaking, health care is medically necessary if the care that is to be provided satisfies the generally accepted standards of medical practice while offering effective procedures that cannot be

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<sup>4</sup> “Answers.com,” 17 Nov. 2005 <<http://www.answers.com/health%20care%20>>.

<sup>5</sup> “Washington State Office of the Insurance Commissioner,” 17 Nov. 2005 <<http://www.insurance.wa.gov/consumers/glossary.asp>>

provided by a less expensive alternative method. The obvious reason for the debate is that generally accepted standards of medical practice are vague, unofficial and constantly changing based on technology and access, thus they are not always as clear-cut as would be preferred.

The economics of health care attempt to use theory to explain behavior that occurs with respect to the dynamics of health care and helps to identify specific problems and possible solutions to these problems.

### ***1.3 Economic Definitions***

Referring to the definition of health care described in the last section it is clear that health implies the physical and mental well being of an individual while care implies the treating and preventing of any illness that could affect an individual's health status. While these points can be generally thought of as comparable from country to country, what makes a system of health care unique is the form of financing. The two systems of financing come from public and from private markets.

Referring to a health care system as **public** can be interpreted as insuring and providing universal health coverage through methods of public financing such as taxation. Viewing a health care system as **private** refers to the financing and/or the delivery of health care through private markets. Many systems of health care incorporate either a public or a private form of financing and some integrate alternative forms of financing such as the implementation of co-payments. Co-payments refer to users paying a mandatory and specific amount (or percentage of the cost) to accompany the payments made through public or private funds.

When speaking of the problem of allocating resources between public and private means, health care can be considered a **scarce resource**. That is, there is only a finite level of services available to the population, reflecting the fact that the supply of health care workers and technology within a country is limited and can only grow slightly during a small time interval. In Canada, most health resources are allocated through the public health care system and if Canada were to install a market for open private insurance and private health care, the effect may only be a re-allocation of the existing resources, rather than an increase in the capacity of the overall health care system.

Health care may be limited by several factors such as the number of doctors, the number of patient beds, the number of nurses and the number of operating rooms in a country, just to name a few. These factors are not completely limited; for example, Canada could import trained health care workers from other countries that meet educational standards and thus would increase the availability of patient care. Through a system of public-private health care, additional financing could be generated that might be capable of covering the cost of increasing the capacity of the health care system.

**Efficiency** and **equity** are both extremely important terms when referring to health care. Efficiency means obtaining the maximum possible output from the given resources. When referring to efficiency in consumption, we mean allocating goods between consumers so that there is no other way of re-allocating resources that would make some people better off without making others worse off. Equity, on the other hand, refers mainly to equality. That is, if a service maximizes equity, it offers the service to all recipients without prejudice, or equally. These two functions often work against each

other; however, the goal for any market is to maximize both efficiency and equity to the best of its ability.

In some countries, health care could be considered a **luxury** service while in others it may be an **essential** service. Referring to health care as a luxury means that it can be purchased and its consumption generally increases as income increases. Health care considered as an essential service refers to health care as mandatory, much like firefighters or police. In this case, a society could not function properly without these services and, with respect to productivity; health care will impact the growth of an economy by providing healthy workers. In Canada, in particular, much of the focus on health care involves the universality of health care, thus it can be considered an essential service. There is the possibility, as well, that health care can be an essential service and a luxury at the same time. In this context, primary health care and emergency care could be considered essential services while non-emergency and non-essential health care services could be considered a luxury.

In developing countries, the majority of the population is poor and often very little health care is available to them. Over the course of a lifetime most individuals will never receive anything more than traditional forms of health care. These countries typically experience a low life expectancy and are often plagued with disease and illness. In more developed countries, the citizens are generally wealthier and the established forms of government usually offer some form of health care as a guaranteed service or allow open markets to provide the services demanded by the population. In both cases the citizens pay for the health care provided (either directly or through tax contributions) and most have consulted with medical providers from time to time.

With the constraint of a country's economic status and access to resources, its population will depend heavily on its government to provide a stable, accessible system of health care, either through public financing or a market system. For this reason, as well as availability and quality of data, this paper will focus on only a limited number of health care systems from developed countries as a way of comparison to the system in Canada and this data will be the basis of our statistical analysis.

### ***1.4 Public vs. Private Insurance***

As mentioned in the previous section, health care can be financed publicly, privately or as a combination of both. Some of the many problems that exist with respect to public financing include inefficiency in the allocation of health resources, abuse by individuals in the form of misusing resources and long waiting periods.

The market for private insurance can reduce the problem of misuse by patients by requiring users to pay fees. It can also reduce waiting periods in that services would be rendered upon receipt of payment where prices are subject to supply and demand. Private insurance; initially, seems to provide the remedy for the inefficiencies in the public sector, as private markets often do; however, this remedy is not without its side effects. These side effects consist of the failures (or the inefficiency of the market) of private insurance in the health industry and include<sup>6</sup>:

- (1) The non-realization of the economies of scale
- (2) Insufficient information for rate-making
- (3) Adverse selection

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<sup>6</sup> Robert Evans, Strained Mercy: The Economics of Canadian Health Care (Toronto: Butterworth 1984) 38

#### (4) Moral hazard

The problem of economies of scale with a competitive health insurance market arises when considering that with many small private insurance companies, costs such as load factor costs (i.e. the cost of operating the insurance program) and premiums reflecting the risk status (i.e. the actuarially fair premium) lead to inefficient small-scale operations. Thus a buyer would be deterred from purchasing insurance, due to the high cost, *opting to support a public system of health insurance.*<sup>7</sup> The public insurance market is less burdened by load factor costs, while acting as a large monopoly type organization, and able to provide coverage for a lower cost.

The second problem leading to inefficient markets is the insufficient information for ratemaking. *This failure refers to the fact that private insurance is not able to determine risk and has difficulty assigning responsibilities for future illness states.*<sup>8</sup> Thus private insurance would not be offered effectively due to the lack of information and the market would fail in the sense of operating inefficiently.

The third problem leading to inefficient markets is adverse selection. The idea behind this failure is that *the buyer of insurance may have better information of their risk than the seller, which represents an asymmetry of information.*<sup>9</sup> Eventually, the problem would lead to group risk rating, much like auto insurance in Ontario, and such problems arise as falling levels of coverage and the deterioration of the market for high-risk individuals. These problems will eventually lead private insurance to an inefficient market.

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<sup>7</sup> Robert Evans, Strained Mercy: The Economics of Canadian Health Care (Toronto: Butterworth 1984)38-9

<sup>8</sup> Robert Evans, Strained Mercy: The Economics of Canadian Health Care (Toronto: Butterworth 1984) 40

<sup>9</sup> Robert Evans, Strained Mercy: The Economics of Canadian Health Care (Toronto: Butterworth 1984) 42

The fourth problem leading to inefficient markets is moral hazard and this represents the tendency for the *existence of insurance coverage of any form to raise the expected losses insured against, as a result of either or both of greater loss or increased probability of occurrence.*<sup>10</sup> Moral hazard reflects the fact that for insurers to cover costs, they would have to charge high premiums that would result in individuals having lower wealth after insurance premiums than the wealth they would have if they didn't purchase insurance. The result would be that individuals would remain uninsured and the market for private insurance would not operate effectively.

These market failures make it difficult to incorporate private health insurance as the primary financier of health care. Most developed countries in the world today provide some form of publicly financed health care and those who have installed a market for private insurance usually only incorporate these systems to co-exist with the public system.

Therefore, it has been shown that health care is a complex subject in which many different factors play important roles. Health care can be interpreted differently and confusion exists based on these interpretations. Private insurance markets, in practice, do not necessarily improve or create efficiency in health care, and often cause the market to actually become more inefficient. A further look into the Canadian health care system and alternative systems is required to investigate the impact of methods of financing on health outcomes, and these systems will be discussed in the second chapter.

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<sup>10</sup> Robert Evans, Strained Mercy: The Economics of Canadian Health Care (Toronto: Butterworth 1984) 44

## **Chapter 2 - Health Care Systems**

### ***2.1 Health Care in Canada***

#### **2.1.1 The Canadian health care system**

To begin our analysis, an extensive look at Canadian health care policy is in order. The problems surrounding the Canadian health care system will be discussed in detail and the historical origins of Canada's public health care system will be described. Afterward, the Canada Health Act and current Canadian health structure will be explained including a look at the federal-provincial relationship with respect to health care. Finally, recent developments in health care will be reviewed in order to give a basis for any future theories on the direction of health care in Canada, which will then be discussed later in this paper.

#### **2.1.2 Problems with health care in Canada**

Canada is the only country in the world that has a strict and predominantly public health care system and though there are strong advantages to having a system based fundamentally on equity and fairness to all, many question the efficiency of the public system in place.

A major problem with public health care is that when considering the service of health care as a limited resource, there is only a finite supply available. When certain medical services are in excess demand, many users have to wait for extended periods of

time before receiving the publicly insured service. In other words, though the service is provided without additional direct surcharges, individuals could have to wait months, and even years, to receive needed health care because the demand for the service is far greater than the supply.

Other problems have that have arisen with the public system of health care in Canada include conflict between the different levels of government that must co-operate in order to provide the service of health care to Canadians. Also, the administration as well as the delivery of health care is often inefficient due to a lack of incentives to reduce waste, creating bureaucratic-type waste problems. The incorporation of an alternative form of health care could help to ease tension between levels of government and could also help to improve efficiency in the overall delivery.

Another problem is the abuse of the health care system by individuals who do not necessarily need the treatment they seek. In health, symptoms signify possible health problems; however, these symptoms may not necessarily represent a specific problem. Many users of health care fear the worst and seek treatment immediately when it would be more efficient to wait and consult with a family doctor or a clinic. The misuse by individuals on the public health care system results in over consumption of health resources (in particular, hospital emergency rooms) and creates a bottleneck effect in the form of longer waiting periods, impairing those who need the greatest amount of attention. It is also very difficult to discourage users from abusing the system because the only cost to the individual is the cost of his/her time.

The Canadian health care system, though flawed, has proven to be quite adequate in the past. A current issue; however, is how health care will be affected by an

approaching shift in Canadian demographics. In a relatively short period of time, a large portion of the Canadian population (the baby-boomers) will be approaching retirement and as these baby-boomers age, the size of the Canadian workforce will decrease. Typically, those who are older require more health care than those who are younger meaning that as the baby-boomers age, the demand for health care will rise to unprecedented levels.

With this influx of demand for health care and a diminishing level of the workforce (and thereby taxpayers), it will be extremely difficult to cover the costs of health care while providing a reasonably responsive system. In addition, surgeries such as knee, hip and eye, which have already seen some of the longest wait times of any health care service, will be extremely difficult to maintain at the current level because seniors are typically those who consume these specific services the most. If the current Canadian health care system is to survive there must be a change in either the approach to providing health care services or a change in the expectations of individuals with respect to the health care itself.

Before analyzing alternative methods of health care it is important to understand how the Canadian health care system has developed over the last half century and how it currently operates. In order to understand the Canadian health care system many questions must be answered. For example, who is responsible for administering health care in Canada? What is the procedure for the delivery of health care to Canadians? How is the cost of health care financed? The answers to these questions, among others, reflect the Canadian policy for health care and are an essential part of understanding the analysis

of Canada's health care system. The following section will give a descriptive view of the Canadian health care system.

### **2.1.3 A historical background**

Before 1947, health care in Canada was a completely private service. People who needed health care were expected to pay for the services themselves. The supply of health care services was minimal with a small number of doctors doing, for the most part, house calls.

In 1947, Tommy Douglas developed the first public health care in Canada for the province of Saskatchewan. Eleven years later, in 1958, Prime Minister John G. Diefenbaker's government passed legislation to assist provincial hospital insurance plans. He offered any province that installed a hospital plan 50% reimbursement from the federal government<sup>11</sup>.

By 1972, additional legislation had been passed and all the provinces and territories in Canada covered a wide range of health care services including doctors' services. Finally, in 1984, Prime Minister Pierre Trudeau's government passed the Canada Health Act which discouraged extra-billing by penalizing provinces for extra charges billed to Canadians.

Universal public health care was then part of Canadian policy with the creation of the Canada Health Act and ever since, there has been great debate over whether this system of providing health care is the most efficient and equitable system available. The

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<sup>11</sup> "Mapleleafweb," 17 Nov. 2005  
<[http://www.mapleleafweb.com/features/medicare/romanow/part\\_2/health\\_act.html](http://www.mapleleafweb.com/features/medicare/romanow/part_2/health_act.html)>

following section will discuss the impact of the Canada Health Act and how governments are responsible for the overall health care system.

#### **2.1.4 Current Canadian health care structure**

The essence of the Canada Health Act is to ensure that all Canadians have reasonable access to ‘medically necessary’ insured services without directly charging an individual at the time of the service. Each province and territory is responsible for administering and delivering these medically necessary services for their respective populations with the help of funding from the federal government.

The responsibilities of the federal government in Canadian health care includes deriving the principles of the Act, monitoring the provinces, partially funding health care, and providing the delivery of health care to First Nation and Inuit people, RCMP, military, and inmates of federal prisons. To be sure that the provinces adhere to the fundamental principles of the Canada Health Act, five conditions the provinces must satisfy were established in order for them to receive funding in the form of cash transfers from the federal government. These five conditions are as follows<sup>12</sup>:

- (1) Public administration
- (2) Comprehensiveness
- (3) Universality
- (4) Portability
- (5) Accessibility

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<sup>12</sup> “Government of Canada,” 17 Nov. 2005 <<http://laws.justice.gc.ca/en/C-6/17077.html>>

As mentioned earlier, the most important of these principles are that health care must be available for every citizen (universality) and that health care is accessible for all citizens (accessibility). These are the fundamental principles of the Canada Health Act. The provinces must satisfy the criterion for the conditions above to a satisfactory level and in return are granted funding.

The tool that forces the provincial governments to follow the conditions described in the Canada Health Act is funding. Each province is granted funds from the federal government, under the original title of the Canada Health and Social Transfer (CHST). (These transfers have since been renamed the CHT- 'Canada Health Transfer' and the CST- 'Canada Social Transfer. ') These funds are financed through tax revenue from personal and corporate income tax. The level of funding for each province depends on certain properties such as the population of the province, the need (demand) for health care, and the province's ability to satisfy the conditions of the CHA.

In addition to the federal transfer, provinces must fund the remaining portion of their respective health programs. Some provinces collect additional funding through financial sources such as sales tax and lottery proceeds. Provinces such as British Columbia, Alberta and Ontario also charge a health care premium for services, although due to the conditions of the CHA, services cannot be denied to those who cannot afford to pay the premium.

The provinces must satisfy the principles created by the federal government; however, there is a great deal of flexibility given to the provinces in determining their respective health care plans. These plans are similar from province to province but slight

variations in non-guaranteed services offered by provinces create distinction among the provincial plans.

Every province is expected to offer the coverage that is guaranteed by the Canada Health Act, which includes medically necessary services. Services that are not guaranteed include the cost of prescription medication, dental care, vision care and appliances for independent living (e.g. wheelchair). Most provinces offer a restricted level of some of these services to its population. For example, in most provinces, routine eye examinations are not covered for those aged 19-64. For younger and older citizens, the service may be partially insured by the province. Another example is that in most provinces, dental service is not insured; however, in extreme cases such as the need for hospital care after dental surgery, the service may be covered.

Some provinces choose to cover more non-guaranteed services for their citizens because they can afford to. In Alberta, there is partial coverage for chiropractic services, podiatry and optometry. As another example, British Columbia offers payment assistance for pharmaceuticals to lower-income citizens under the Pharmacare plan.

In Ontario and other provinces, there are conditions that accompany the insured health plans of its citizens. For example, in Ontario each citizen is given a health card. The health card entitles the individual access to OHIP, which is the Ontario Health Insurance Plan and when requiring insured medical care, the individual presents the card to receive services. To qualify for OHIP, an individual must be a Canadian citizen or have immigration status, make their permanent or principle home in Ontario and spend at least 153 days out of 12 months in Ontario. These conditions are similar in other provinces.

The system of health care in Canada is unique in that private insurance plays an infinitesimal role in the overall delivery of health care. Under federal law, private clinics may not provide services that are guaranteed by the Canada Health Act. In practice; however, many private clinics exist that do offer services that are covered by the Act.

Private insurance does legitimately exist in Canada, and offers coverage for services that are not included in the Canada Health Act. As mentioned above, the cost of prescription medication, dental care, vision care and appliances for independent living are not necessarily covered by provincial health insurance plans. These services can be covered by private insurance or else the individual must pay out-of-pocket. Many employers offer partial or full insurance, as part of the benefits offered to employees, to cover health care services. Benefits are given to those who possess private insurance; for example, private hospital rooms are prioritized for those who have insurance while those without insurance normally share rooms with other patients. The federal government also offers assistance to those who accumulate substantial medical bills.

The Canada Health Act is what links the federal government to health care in Canada and is also the reason for much debate in federal-provincial politics. Some say the federal government should allow the provinces full jurisdiction over health care and limit interference in the service of health care. Others say the federal government should become more involved in order to preserve the public system now in place. Nevertheless, the Canada Health Act has been the instrument that has kept health care public in Canada and helped to distinguish Canada in a global context.

The relationship between the federal government and the provinces has been volatile at times because many provinces dislike having to attain funding for health care

through the federal government. The following section will discuss recent outcomes from government participation in health care and what the future may hold.

#### **2.1.5 Future expectations**

The relationship between the provinces and the federal government has been less than perfect with respect to health care. The provinces would ideally prefer to have no federal involvement in the service of health care. The federal government maintains a resolve to remain a part of Canadian health care due to fear of provincial alterations to the established fundamental principles of the health care system. For example, provinces may not follow the conditions set by the Canada Health Act, specifically the universality and accessibility conditions, if given the power to decide on their own. Some provinces could choose to move more towards a system of private health care.

Another problem related to giving the provinces full jurisdiction over health care is that if health care systems in provinces became noticeably different, many Canadians would ‘shop’ for health care from province to province. This could lead to a shift, or movement of labour, that could harm the economies of some provinces that have less of a competitive edge.

In response to growing concern from critics, in 2003, Ottawa identified three paths that the federal government could take to increase its presence in health care and increase federal funding.<sup>13</sup>

- The first path is for the federal government to interact directly with individuals as well as health providers.

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<sup>13</sup> Bruce G Doern, How Ottawa Spends: managing the minority (McGill-Queen’s University 2005) 33-6

- The second path is for Ottawa to tie new funding to provincial initiatives.
- The third path is to restock provincial treasuries with cash under the existing CHT (Canada Health Transfer).

There are examples of how each of these paths has been incorporated by the federal government in the past. The government does interact directly with individuals via income tax credits for medical expenses and disabilities. Ottawa also has tied new funding to provincial initiatives; for example, the 2003 Health Care Renewal Accord under Prime Minister Jean Chrétien. Transfers from the federal government to the provinces increased by \$29.5 billion from 2003-04 and 2007-08.<sup>14</sup> Most of this money was transferred under the 'Health Reform Transfer' and the 'Medical Equipment Fund'. The third path has been the primary path that the federal government has taken since 1984, and is the easiest option. That is because it involves the least interference from the federal government, which keeps the provincial governments more content.

When it comes to the actual funding of health care today, the federal government covers approximately 33% of provincial health spending. This is derived from the approximately \$27.2 billion<sup>15</sup> that is contributed through the Canada Health Transfer, the Health Reform Transfer, and the Diagnostic/Medical Equipment Fund, as well as funding for public health and immunization. The federal government offers equalization payments to eight of the ten provinces, which could potentially be used for health care. As well, the federal government contributes about \$5 billion directly into health care for First Nations' health, veterans' health, health protection, disease prevention, health information and

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<sup>14</sup> Bruce G Doern, How Ottawa Spends: managing the minority (McGill-Queen's University 2005) 34

<sup>15</sup> "Government of Canada, Department of Finance," 17 Nov. 2005  
<[http://www.fin.gc.ca/facts/fshc7\\_e.html](http://www.fin.gc.ca/facts/fshc7_e.html)>

health-related research.<sup>16</sup> The federal government also offers assistance through tax measures; for example, credits for medical expenses and disability. All of these contributions add up to over \$35 billion a year (based on the year 2004-05) and covers up to 40% of national spending on public health.<sup>17</sup>

Although the federal government would like to become more involved in health care, it is not entirely welcomed by the provinces. Most federal governments have found it difficult to keep the provinces content while attempting to maintain their own political mandates. For this reason it is common for the federal government to allow the provinces a great deal of freedom when it comes to health care. If the future of health care in Canada is to remain public, the federal government will have to continue to participate in the funding of health care and if the system is to change, the federal government may have to assume an even greater role in assuring that a new system provides the same level of service that the current system has been able to achieve.

Canada operates under a system of public, universal health care where the federal government delegates most of the responsibility of health care to the provinces and territories. The public health care system is financed through tax dollars and some costs of health care are financed through private means. Many differences exist between provincial health care plans and problems exist between the federal and provincial levels of government. There are positive outcomes that have come from the public system in

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<sup>16</sup> "Government of Canada, Department of Finance," 17 Nov. 2005  
<[http://www.fin.gc.ca/facts/fshc7\\_e.html](http://www.fin.gc.ca/facts/fshc7_e.html)>

<sup>17</sup> "Government of Canada, Department of Finance," 17 Nov. 2005  
<[http://www.fin.gc.ca/facts/fshc7\\_e.html](http://www.fin.gc.ca/facts/fshc7_e.html)>

place and if Canada is to reform its health care system, it will have to learn from this public experience to help identify how the system may be improved.

## ***2.2 Comparing Health Care Systems***

It is obvious that flaws exist in the Canadian health care system; however, these flaws may not be uncommon in the subject of health care, regardless of the actual system in place. All health care systems suffer from inefficiencies whether they are publicly financed or privately financed; therefore, no system is completely flawless. We have to take into account the fact that countries that achieve higher levels of health outcomes recognize external factors that affect the overall health of its citizens. These factors can include such things as the level of smoking, obesity and substance abuse that may occur within the country, as well as health practices such as diet, exercise, and environmental conditions. Consequently, if Canada is to change its approach to providing health care, the social structure of society must not be ignored.

It is important to determine what alternative systems of health care might provide more efficient service than the current Canadian health care system before any reforms should be carried out. There are many approaches to determining what systems perform to a superior level compared to others. Researchers have used different methods of analysis to determine whether a health care system is functioning efficiently based on the goals of the respective society. An example is equity approaches. An equity approach measures the fairness of the system in place in order to meet the needs of a society as a whole. Other approaches include theoretical approaches using statistical data and efficiency approaches, which use analysis such as cost-benefit. In cost-benefit analysis,

the overall cost of the health care system is compared to the overall benefit that the health care system generates. Cost-benefit analysis can be complicated in an area such as health care because often the benefit of health care is quite difficult to measure.

When analyzing a health care system data can be compared from one health care system to that of another and theoretical conclusions about the effectiveness of the systems can be made based on the outcomes of the study. In the field of health care it should be noted that even after rigorous data analysis the results and conclusions are seldom completely accurate and evidence usually can only suggest that theories are likely or unlikely.

Factors such as the political system, the economic framework and the customs and values of a particular society lead to health care decisions that are constantly altering its health care system. Some countries choose to provide equitable health care for everyone while others allow for markets to determine who should be able to consume health care by means of monetary capability.

By comparing alternative health care systems to that of Canada, evidence may indicate whether a change would be justified, in that bad choices could lead to negative impacts on health to Canadians. Canada could choose to rearrange the current system of health care; however, changing the structure of the system in place could be costly and may prove to be more inefficient than the existing system. Canada would also have to maintain some form of public health care to ensure that service is provided to those who wouldn't be otherwise able to pay for services on their own.

To distinguish between health care systems the most apparent difference can be identified by how a country finances its health care. As mentioned before, there are many

alternatives to the financing and delivery of health care; for example, some countries require individuals to assist in financing their health care needs through co-payments. Other countries mandate the population to purchase health care insurance while some countries allow for private insurance companies to operate somewhat freely. Most developed countries do; however, provide some form of universal health care as a public service in order to insure that those who cannot afford to pay for insurance or health care are given a basic level of health coverage.

Alternative health care systems will be discussed following a brief description of methods that can be used to compare health care systems.

### ***2.3 Methods of Comparison***

The data used to compare different health care systems in this essay will consist of measurements commonly used in health economics. Certain measurements will indicate factors that may explain why a health care system is successful; although, there is no measurement that can be used to conclude that a system is necessarily 'better' than another.

One of the measurements used to identify health success will be life expectancy. Life expectancy will be compared from country to country and is a good way of determining how health care is effective and impacts the general ability of people to live longer. For example, a country with high life expectancy can certainly acknowledge that health care has indeed improved the quality of life for its inhabitants, which could lead to extended lifetimes. It should be noted here that improvements in life expectancy could not be completely credited to the health care policy of a country. Many factors such as

improvements in living conditions and nutrition are also responsible for high life expectancy for the population of a country.

Another statistic that will be used to identify health success is the infant mortality rate. Infant mortality, although affected by sociological factors such as poverty, is a good way of measuring the accessibility to basic health care for the population because a low infant mortality rate can signify that most citizens have reasonable access to health care when needed.

Many other statistics will be collected for comparison purposes, such as the percentage of the GDP that a country spends on health care, the level of public and private expenditure per capita, the level of income per capita and the percentage of the population over 80 years of age.

Studies based on health care data have been developing for years. Many organizations such as the World Health Organization have developed measurements that they use to rank different countries' health care systems against each other. In the case of the WHO, in 1997, 191 countries were ranked based on certain characteristics of health care systems such as health responsiveness and fairness in financial contributions. These characteristics created the quality, equity and efficiency measurements that were eventually used to rank each country's system of health. To measure these characteristics, the WHO assessed systems based on indicators such as the overall level of population health, health inequalities within the population, etc.

The framework for health care system performance that the WHO used was unique in that each country's health system was compared to what the 'experts' estimated as being the upper limit of what could be done based on a country's resources. The WHO

found in this study that all countries were under-utilizing the resource of health care and derived reasons why health care systems failed. For example, the WHO supports the usage of both public and private sector health care citing that some countries ignore one or the other, leading to inefficiencies and a failure in the health care market. Another example is the formation of “black markets” and the inability of some countries to prevent them from occurring.

The WHO also found that successful health care systems are not always a result of how much a country invests in health care. Many times a country spends a great deal on health care but has poorer results in certain health outcomes such as life expectancy. A good example is the US, which in 2000 spent the highest percentage of GDP on health care, yet ranked low on many comparable statistical measurements. The US ranked 37th overall in the study while Canada ranked 30th. The reason for the lower ranking, in Canada’s case, would have to be as a result of the limited private sector health care availability incorporated in the Canadian health care system. As mentioned, the WHO recognizes a market for private health care and criticizes countries that do not allow the private market to operate in health care. The highest-ranking country in the survey was France while Italy, Singapore, Spain and Japan were also among the top 10.

Many criticize the WHO’s system of ranking health care systems because some countries were given high rankings even though they lack the merit other countries have worked hard to achieve. For example, the health care system of Columbia was ranked 22nd overall mainly because the system in Colombia allows for someone with a low income to pay a lower rate for the same health care as someone who makes a higher income. The Columbian system outranked Canada who, through taxation, achieved

fundamentally the same result with a higher quality of health care delivery. In Canada, lower-income citizens pay a lower tax rate than higher-income earners, which could result in a similar payment distribution; however, Columbia was still able to earn a higher ranking. The result is that because systems were ranked based on what experts thought is the 'ideal' results for what a country is capable of achieving; the method is not accurately evaluating the overall quality of health care systems. For our purpose, we will only note the WHO's system of health care ranking. When comparing countries to Canada, only statistical comparisons will be made, rather than attempting to formulate what each country should achieve and how close they actually get to reach this point.

Another point worth mentioning is that health care data, like other forms of data, are not always extremely accurate. Many factors such as the method of collecting data and the integrity of those collecting data may alter the quality of the data. Inaccurate data may also have influenced the results from the WHO study because of the 191 countries analyzed, not all have reputable sources of data collection and many times the WHO would have relied on information that may be deceptive. In this essay, the countries being examined have reputedly reliable data collecting techniques; however, it must be assumed for our purposes that all the data that is analyzed is accurate.

## ***2.4 Other Health Care Systems***

In order to compare systems of health care the goals and structures of alternative health care systems must be understood. Every country has a unique form of health care, differing in the form of financing, funding and the delivery of health care services. Therefore, in this section, a group of health care systems from different developed

countries will be described and categorized, and the data regarding these countries will be assembled.

The type of financing, or the collection of revenue that is used to pay for the operation of a particular health care system, can be of many types including direct payments by consumers of health care, private insurance premiums, social insurance contributions, as well as direct and indirect taxes. Some countries choose to target one method of financing primarily while others choose to combine different methods.

As mentioned before, most of the health care system in Canada is financed through direct and indirect taxes, which are collected by the federal government. The direct taxes collected in Canada include personal income tax, corporate taxes and capital gains taxes, which are paid by both individuals and corporations. Indirect taxes collected in Canada include expenditure taxes, for example GST or the government's sales tax, and excise duties. Canada also finances some of its health care system through direct payments and private insurance premiums; however, as mentioned before, only a limited group of health care services that are not publicly provided may be subject to these alternative means of financing.

The health care system in the UK provides universal public health care to its population financed mainly through direct and indirect taxation. The UK allows for private firms to operate and offer health services that are also covered by the public system. These services can be paid through direct payments and private insurance premiums and assist in the overall financing of the health care system. Private insurance coverage is supplementary and only about 11% of the population is covered under private

insurance.<sup>18</sup> Private hospitals and doctors offer services for direct payments, which includes out-of-pocket expenditures by consumers for the services provided. Private insurance companies offer insurance at premiums, which generally come from a community rating or may be risk-adjusted. These private insurance companies may also require the insured individual to pay part of the cost of the health treatment through cost-sharing. In the case of health care in the UK, direct payments and private insurance are optional because the government provides the same health care as a public service; however, for those who would rather avoid the problems associated with public health care, there is an option available.

Another health care system, and one in which Canada's system of health care is often compared, is that of the United States. The system in the US; however, is quite different than that of Canada. The health care system in the US relies heavily on private insurance premiums as well as direct payments to finance its health care system. Many people choose to not purchase health care insurance and rely instead on direct payments.

The US does maintain a publicly financed system of health care (through taxation) for those that cannot afford to be covered under private health care and those who are elderly or disabled. Unfortunately, the safety nets that are available are not extremely effective. In fact, 14% of the American population in 1997 was not covered under insurance or safety nets<sup>19</sup>.

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<sup>18</sup> B. Ross, et al., International approaches to funding health care Occasional Papers: Health Financing Series Volume 2, (Commonwealth Department of Health and Aged Care, 1999) 67

<sup>19</sup> B. Ross, et al., International approaches to funding health care Occasional Papers: Health Financing Series Volume 2, (Commonwealth Department of Health and Aged Care, 1999), 73

The health care system in Japan will also be included in this discussion. In Japan the entire population is covered by health insurance. Having to purchase insurance is compulsory and the government has set up a system in which insurance plans depend on what type of work an individual does. For example, if a person works for a large firm, the individual is covered by the 'Society Managed Health Insurance' plan. If an individual is self-employed, they are covered by the 'Citizen's Health Insurance' plan.

Japanese health care is financed mainly through mandatory insurance contributions made through employers, government subsidies and co-payments; and is managed for the most part by private firms. Individuals pay a premium and in return, receive health insurance. For those without insurance through employers, a national insurance program is available and administered by local governments and operates similarly to employer-based insurance. Conditions surround the application of the insurance; for example, insurers do not reimburse routine check-ups. The Japanese government does provide public health care services, which are funded through government subsidies, but only cover a limited range of services. Services beyond those covered must be paid for through direct payments or co-payments.

The health care system in New Zealand offers universal health care to its citizens using publicly financed money. What makes this system unique is that even though universal health care is available, about 40% of the population pays for private health insurance because primary care is not publicly funded.<sup>20</sup>

The health care system in New Zealand demonstrates the ability of a country to impose co-payment requirements. Health care is financed through taxation, private

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<sup>20</sup> B. Ross, et al., International approaches to funding health care Occasional Papers: Health Financing Series Volume 2, (Commonwealth Department of Health and Aged Care, 1999) 52

insurance and co-payments. For those who do not purchase private insurance, direct payments may be used to pay for services not covered by the public system and this allows for individuals to assist the government in financing health care.

Countries such as France, Sweden, Germany, Finland, Austria and the Netherlands will also be compared and included in this discussion.

France operates under a system of universal health care. A unique feature in the French system is a considerably higher level of cost-sharing and supplementary insurance. Supplementary private insurance is available for purchase while public health services are available for those who do not work steadily. France finances its health care system through direct and indirect taxes, private insurance contributions and cost-sharing. The World Health Organization ranked France's health care system as first in 1997, and a large reason for the top ranking is the universality of health care as well as the availability of private markets.

Sweden, a highly socially conscious country, provides publicly funded health care, which is financed through taxation and government grants. Sweden does, surprisingly, allow for limited private health care and private health insurance. Sweden's system of health care is similar to the UK's and both represent a possible direction that Canadian health care could take. The Swedish health care system is very similar to that of the UK in that health care is financed through direct and indirect taxation as well as private insurance premiums, which play a small role in financing.

Germany offers its population publicly funded health care only as a last resort. Those who can afford private health insurance have the option of purchasing private

plans or paying out of their pockets for services. For those who cannot afford to pay, there is the 'Statutory Sickness Fund' available as a publicly funded safety net.

The health care system in Germany is financed primarily through private insurance premiums as well as direct payments, or out-of-pocket payments. Health care is also financed through direct and indirect taxes, which fund the public health care system offered as a last resort for those who cannot afford to pay directly.

The health care system in Finland is universal, regardless of the individual's financial situation, and paid through direct and indirect taxes; however, supplementary private health care is available. Most of the private health care is financed through out-of-pocket spending as well as private insurance. Finland, as a country, spends very little on health care and has transformed its health care system from a primary health care system to a family doctor system with guaranteed wait times. This has reduced hospital expenditures and proven to be very successful.

Austria boasts a similar system to Finland where health care is publicly financed and universal, while private insurance and co-payments provide additional sources to financing the health care system.

Finally, the Netherlands offers a peculiar system of both public and private health insurance, with private insurance the predominant provider. The Netherlands have been moving towards a universal health care system with less than 1% of the population not covered by any insurance<sup>21</sup>. A unique feature in the system is that low to mid-income earners must purchase insurance coverage and split the cost 50-50 with employers. For the rest of the population, private health care is optional. The Netherlands combines

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<sup>21</sup>B. Ross, et al., International approaches to funding health care Occasional Papers: Health Financing Series Volume 2, (Commonwealth Department of Health and Aged Care, 1999) 63

direct and indirect taxation, private insurance premiums and co-payments to finance its health care system.

These are only a small sample of health care systems from a large pool of possible alternatives, but they do offer a good variety of possible health care financing and delivery methods. The reason these 10 countries were chosen to be included in the model, along with Canada, is that data sets are relatively complete for these countries and the sources of data collection are relatively reliable. Also, they provide a diverse mix of health care systems and can therefore be compared to that of Canada.

It is apparent that no two systems of health care are completely identical and many vary greatly with respect to financing. Every country mentioned, emphasizes quality of health care and most go to great lengths to provide the most basic levels of health care to the poorest members of society. Some countries have found success with systems that could well fail in another country and most continue to pursue more efficient alternatives to the system already in place.

This discussion gives a solid basis on which a more empirical outlook on health care systems can be performed. The Canadian system of health care will now be compared to the other systems, mentioned in this chapter, through data analysis in order to identify any relationships between the method of financing and health outcomes.

## Chapter 3 – Data analysis

### ***3.1 Theoretical Model***

The third portion of this essay will focus on the analysis of the data collected from the countries described in chapter two. Regressions will be conducted in order to determine any relationships that exist between the method of financing health care and the overall health of a population. This section will give a description of the theoretical framework on which the models for regression were based.

To begin with, consider the overall health level of a country, or the population health. The population health represents the aggregate health level of the entire population and can be affected by many different factors, or inputs of health. These inputs of health, mentioned in earlier chapters, may strengthen or weaken the level of population health; therefore, it is important to look at these factors and to determine the type of impact they may have on the health of the population.

To begin with, the level of population health is affected greatly by the health care system that is available to the population. Health care systems, as discussed in the previous chapters, can differ by the method of financing; publicly, privately or as a combination of both methods.

One possible impact of health care systems on the level of population health is that private health care (and private financing) provides higher levels of population health than public health care (and public financing). To explain this possibility the nature of private markets must be considered. In a competitive private market, firms have

incentives to make profit and can achieve higher profits by lowering input costs. Because firms are price-takers, each individual firm provides goods and services at market price and can increase production and profit by lowering marginal costs. Therefore, the market, which consists of all of these cost-minimizing firms, will operate efficiently resulting in higher levels of population health. Comparatively, public health care systems are inefficient due to the fact that the systems are financed through the public and the level of financing does not depend on how efficient the system operates. Because of the lack of incentives to operate more efficiently, the public market typically misuses resources resulting in lower levels of population health.

Another possibility is that public health care systems (and public financing) provide higher levels of population health than private health care systems (and private financing). To support this argument, consider the similarities between public markets and large corporations. Both achieve lower costs through the principle of economies of scale. As output increases, the average cost of a unit of output decreases. Lower costs indicate greater capacity indicating that the public market will operate at a more efficient level leading to higher health outcomes. Referring to the discussion of failures in the private health insurance market from the first chapter, a serious problem incurred by private health insurance is that in an industry like health care, when many small competitive firms operate, there are higher costs of operation and these firms will often fail to provide health services at an efficient level because of the imposition of high costs thus resulting in a lower population health.

Another factor that affects the level of population health is the country's demographics. If a population has a large elderly demographic, the level of population

health would be lower as people generally have lower health status in the later years of life. If a population has a large youth demographic, the level of population health may be higher because those who are young are generally in better health. Therefore, the age of the population will certainly affect the level of population health.

Another factor that affects the level of population health is the level of wealth within the population. One would expect that the wealthier people are, the healthier they will be because wealth can enable people to attain health services with greater ease. In this context, the distribution of wealth must also be considered. The distribution of wealth is explained by the GINI coefficient. The GINI coefficient measures the distribution of wealth in a country and for countries where a smaller portion of the population owns a larger share of the wealth; high levels of poverty commonly exist. Poverty may affect the level of population health in that the higher the level of poverty, the lower the level of population health is likely to be because those who are poor tend to have difficulty attaining health services. Therefore, a wealthier population will have a positive impact on the level of population health while a small portion of the population owning a large share of this wealth will have a negative impact on the level of population health.

The environment may also play a role in the level of population health as countries with good environmental conditions; clean water, low levels of pollution and good working conditions generally show higher levels of population health. As well, the level of technology, medical knowledge and health resources available to a population should affect the level of population health positively if any of these factors were to increase.

Social factors also play a large role in overall health. Such things as the level of smoking, level of obesity and level of substance abuse within a population can affect the overall level of population health. If any of these factors were to increase for a population, it would result in a negative impact on the level of population health. In contrast, a population where a good diet, regular exercise and healthy lifestyle is common, will likely exhibit higher health outcomes.

The factors mentioned in this section all suggest that the level of population health is affected both negatively and positively depending on the specific nature of the factor, and these factors can be altered to target desired levels of population health. Then, in theory, the impact of health spending, or any input for that matter, on the level of population health should be simple to derive; however, there is no method of measuring the aggregate health of the entire population. Therefore, indicators of health outcomes must be used to provide a general perception of the level of population health.

### ***3.2 Data Description***

The following section will discuss indicators of health outcome that can be used to predict the population health as well as discuss specific health inputs that could affect the population health. The indicators and inputs will be defined and statistical information regarding these factors of health will be presented. As mentioned before, the population health is difficult to measure and can only be suggested by indicators of health outcomes. I will incorporate two of these health outcomes as dependent variables and they are the life expectancy and infant mortality of a population.

Life expectancy describes the average number of years that an individual should expect to live from the time of birth assuming that the specific mortality levels remain constant. The data collected was generated using a non-weighted average for the life expectancy of both men and women. Life expectancy of both men and women in a country were added and divided by two to give us the average. Life expectancy is a good measure of health outcome because it represents, essentially, a population's goal; to live as long as possible. A country that exhibits a higher life expectancy, it may be argued, has achieved a higher level of population health. For a country with a low life expectancy, the population health is certainly low.

Summary statistics for the health outcome of life expectancy from the countries included in the data can be found in table 1. The average life expectancy in Canada through the period of 1970-2002 was about 77 years, almost two years more than the average of the entire group during these years. The highest level attained by Canada is 79.7 and compared to the other countries in the group, follows only Sweden (79.9) and Japan (81.8). Of all the countries included in the analysis, the US had the lowest maximum level at 77.2 years. All of the countries show similar patterns of increasing life expectancy, from the low 70s in the 1970s to high 70s in 2002. Certain inputs of health described in the last section may explain the increase in life expectancy over the last 30 years. Factors such as technology, knowledge and health resources may have helped to increase life expectancy.

Infant mortality is defined as the number of deaths of children no older than twelve months that occurs within a given year. This number is then expressed as the number of deaths per 1000 births to become the infant mortality rate. Ideally, a country

would like a low level of infant mortality (as opposed to desiring a higher life expectancy), because a low infant mortality means that fewer infants are dying. The reason this variable may be considered a health outcome is that the infant mortality rate signifies the availability of health resources to mothers and children. A higher infant mortality rate indicates that there are fewer resources available to the population which results in a lower population health. A lower infant mortality rate signifies that there are greater resources available to the population resulting in a higher population health. For example, countries with lower infant mortality rates tend to be countries with well-established health institutions and suitable structure in the administration of health care.

It should be noted that there exist inconsistencies in the reporting of data for the infant mortality rate between countries. In Canada and the US, the infant mortality rate includes premature births that have a very low probability of survival whereas in other countries they are not included. The result is inconsistency and may alter the real effects on the population health between countries; however, for the purpose of the data analysis, I will assume that the method of measuring infant mortality is constant across countries.

Summary statistics for the dependent variable infant mortality rate can be found in table 1, and it is observed that the average infant mortality rate in Canada for the years 1970-2002 is 9.2; that is, on average 9.2 infants die for every 1000 live births, which is close to the average for the entire group. Presently, the infant mortality rate in Canada is 5.2 and among the highest of the group with the Netherlands (5), New Zealand (5.4), and the UK (5.2). The lowest-ranked infant mortality rates are those of Japan and Finland (3) while the highest infant mortality rate belongs to the US (6.8). Health inputs mentioned in the last section such as social structures and health care systems have definite impact on

infant mortality, while the level of wealth and the distribution of income surely play a role as well.

These two indicators of population health will be compared separately against selected inputs of health; which include: the year (Year), the percentage of the GDP spent on health (PCGDP), the public expenditure on health care per capita (Public), the private expenditure on health care per capita (Private), the income per capita (IPC), and finally the percentage of the population over 80 (pop).

The first independent variable that will be discussed is the percentage of the GDP that is spent on health care. The GDP is the gross domestic product of a nation and is the value of all the final goods (and services) produced in a nation in a year. In this context, the percent of GDP spent on health care refers to the proportion of all goods and services related to health that were purchased in a country during the year compared to the overall spending. This variable is included in the model because it describes the use of overall resources a country makes available for health care as well as indicating the level of reliance of some countries on its system of health care. One would expect to see an increase in life expectancy and a decrease in infant mortality as the level of spending on health care increases, however; as the WHO concluded in its report on health care systems mentioned earlier, health results may not be improved greatly by spending more on health, perhaps due to the fact that a country may spend more on health care because the health of the population in general is weaker.

Table 2 indicates summary statistics for the inputs of health mentioned in this section. It is observed that Canada, on average during the period of 1970-2002, spent

8.2% of the GDP on health care. This figure is above the group average of 7.7%, however; Canada ranked close to the middle of the group overall. In 2002, Canada spent 10% of the GDP on health care, which was lower only to that of Germany (10.9%) and the US (14.6%). The lowest ranked country was the UK who spent only 7.7% of the GDP, in 2002, on health care.

The second and third independent variables come from the sources of financing that a health care system requires in order to operate and these are derived from the total spending on health care of a country. The OECD defines the total expenditure on health as the accumulated expenditure through such means as medical, paramedical, nursing and technology activities that offer specific goals including the following: promoting health and disease prevention, curing illness, caring for those who suffer from chronic illness, and the administrating and delivery of public health care, as well as private health care which includes private insurance.<sup>22</sup>

Total expenditure on health care can be subdivided into two categories: public and private expenditure on health care. Public expenditure on health care is defined as the health expenditure that is incurred through public funds. Private expenditure on health care is defined as the health expenditure that is privately funded. Included are sources such as out-of-pocket payments, cost sharing, private insurance programs, and occupational health programs.

For the purpose of the analysis of data, these variables will be transformed into the public and private expenditures on health care per capita, in US dollars taking into account the purchasing price parity, where the base year is 2000. The transformed variables will help to avoid the problem of perfect multi-collinearity in the regression and

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<sup>22</sup> Variable definitions adapted from [sourceoecd.org](http://sourceoecd.org)

will insure that all figures are equally derived from each country. These factors are important in the context of this essay because any relationships found between a method of financing and health outcomes may indicate possible relationships between health care financing on the level of population health.

Referring to the summary statistics from table 2, the statistic for the average level of public expenditure on health care per capita, in Canada, for the years 1970-2002 was about 1004\$/person. This figure is above the group average of 909\$/person for this period of time. Canada spent 1982\$/person in 2002 which was less than France, Germany and Sweden. The US spent the most with 2375\$/person and New Zealand spent the least with 1441\$/person. The figure for the US is interesting in that the American system is famous for the openness of the market to private health care, yet the US spent the most publicly on health per person.

The statistic for the average level of private expenditure on health care per capita, in Canada, for the years 1970-2002 was about 373\$/person. This figure is slightly above the group average of 363\$/person. Canada spent 861\$/person in 2002 which ranked lower only to the Netherlands and the US (which ranked highest at 2911\$/person). The country that spent the least on private health care in 2002 was the UK who only spent 371\$/person. These findings are somewhat interesting when compared with public spending. Canada, a country that boasts a strong stance against privatized health care, spent much more privately than most countries that offer private insurance and private services.

The fourth independent variable is income per capita. Taking the average income of every worker in a country and converting the currency into US dollars while taking the

purchasing power parity (with 2000 as the base year) into account is how this variable is derived. In the regressions, this figure will be divided by 1000 for simplicity. Income per capita is included in the model because it represents the level of wealth of individuals in a country, and it would be expected that as income per capita increases the result would be an increase in life expectancy and a decrease in the infant mortality rate.

Referring to the summary statistics in table 2 it is apparent that between the periods of 1970-2002, Canadians made on average 8,516\$/capita. The Canadian average is above the group average of 8115\$/capita indicating that Canadians were generally wealthier than average. In 2002, Canadians made 15,373\$/capita behind the Netherlands, Sweden and the UK. Americans earned the most at 21,095\$/capita and New Zealanders earned the lowest of the group at 9,543\$/capita in 2002.

The fifth independent variable is the percentage of the population over 80 years of age. This demographic group is expressed as a percentage of the entire population and is included in the model in order to represent the impact of an elderly population on the life expectancy and the infant mortality rate within a country. It would be expected that as the population over 80 years of age increases, the life expectancy would decrease and the infant mortality would increase because as more individuals become elderly and consume more health resources, this reduces resources for others, and causes a strain in the health care system.

The summary statistics from table 2 indicate that in Canada, an average of 2.1% of the population was over 80 years of age during the period between 1970 and 2002. This figure is below the group average of 2.8%. In 2002, Canada reached 3.2% of the population over 80 years of age. This figure is the second lowest, slightly above New

Zealand who had a group low of 3% while the highest figure came from Sweden at 5.2% of the population above the age of 80 years.

Two additional independent variables will be considered in this analysis. The variable for MRI machines per million people (MRI) and the variable for physicians per thousand people (Phys) will both be discussed in order to give representation to the technology and resources available to a population and the impact they might have on the population health.

MRI stands for magnetic resonance imaging and is basically a diagnostic procedure that uses a magnetic field to produce images of internal organs or internal structure. These machines help health care workers find problems in the body, in particular the brain and spinal cord. MRI machines will be expressed as the number of machines per million people and represents the growth in technology, demonstrating the increasing capabilities in the technology of health because these machines have been extremely effective in the delivery of health care. The MRI unit was first available in 1977 and has been able to complement and advance the medical capabilities in all countries. One would expect that as the level of MRI increase, life expectancy would increase while the impact on infant mortality may not be significant.

Summary statistics from table 2 indicates that Canada had 4.2 MRI machines per million people in 2002, which is low compared to the other countries in the group. New Zealand had the lowest level at 2.7 machines per million people and the highest figure was that of Japan who had 35.3 machines per million people

The number of physicians is expressed as the number of physicians per thousand people and represents the availability of trained staff and resources available to the

population. It is expected that as this variable increases, life expectancy should increase and infant mortality should decrease.

Summary statistics from table 2 indicate that Canada, in 2002, provided 2.1 physicians per thousand people, below the group average of 3.3 physicians per thousand. France, Germany, the Netherlands, Sweden and Austria each had 3.3 physicians per thousand people and the lowest figure was that of Japan with 2 physicians per thousand people.

The last independent variable that will be discussed is the year. The year is included in the model because it allows for a time-trend when conducting the regressions. Because the data includes approximately 30 years of information from eleven countries, it would be unpractical to overlook the variable for year. When comparing data from year to year, there is a common improvement in the health outcomes for all countries. If data from 1972 is compared to data from 1999, there is an obvious trend that is consistent amongst all countries and that is an increase (or decrease) in the health outcomes.

The outcomes of health, representing the population health, and the independent variables discussed in this section will be compared to identify any relationships that exist between them. Models will be generated using all of the factors mentioned in this section and these models will be analyzed by means of the methodology discussed in the next section. It should be noted that certain inputs of health mentioned in the first section of this chapter, (i.e. the level of smoking) are not included in this discussion and the models because data regarding these inputs is rather inconsistent.

### **3.3 Methodology**

The approach taken to determine whether relationships exist between the outcomes and inputs of health, discussed in the last section, was to estimate linear regression analysis of the dependent variables (outcomes of health) on the independent variables (inputs of health). The method of ordinary least squares (OLS) is a standard regression procedure that, without going into great detail, can produce estimates for the intercept and variable slopes in a simple linear regression model. These estimates minimize the sum of the residuals, or in other words, minimize the difference between the data that was observed and the estimates that were predicted and can then be used to identify relationships in the data relating to the dependent variable. The slope coefficient captures the relationship between the dependent variable and the independent variable and can be used to predict the effect of changing one of the independent variables, holding all others constant, on the dependent variable.

Multiple regression analysis requires that certain assumptions be made when conducting this analysis. The most important assumptions for the purpose of this essay include<sup>23</sup>:

- Homoskedasticity: Constant variance among the residuals
- No perfect multicollinearity: No perfect linear relationships among the independent variables
- No autocorrelation between the residuals: Zero correlation between any two residuals

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<sup>23</sup> Damodar N. Gujarati, Basic Econometrics: fourth edition (New-York: McGraw-Hill/Irwin. 2003) 66

- The multiple regression model is linear in the parameters
- The mean value of the residuals are zero

Another assumption made is that the model is correctly specified and is important because of the nature of the problem in question. It has been shown that in the study of health care many different inputs of health could be included in a model to explain a dependent variable representing health outcomes. If the model is not correctly specified then the results may not be accurately suggestive and the OLS regressions non-informative.

Certain measurements will be included in the analysis of the models to determine the quality of the test in general. The adjusted R-squared value of the models will be discussed to identify the goodness-of-fit of the models. The Breusch-Pagan test will be performed in order to identify any heteroskedasticity that is present in the models. The Breusch-Pagan test specifically tests for heteroskedasticity related to the independent variables and it must be assumed that the error term is normally distributed. Because of this assumption, the test will show that as the sample size increases, the computed chi-square asymptotically follows the chi-squared distribution with  $m-1$  degrees of freedom (where  $m$  represents the number of variables in the model, including the constant).<sup>24</sup> Once the test statistic is computed, it will be compared to the critical value to determine whether heteroskedasticity is present.

In addition, a fixed effects regression will be performed and compared with the standard OLS regression models. The general idea behind this type of analysis is that it allows for the intercepts to vary for each cross-section but assumes that the slope

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<sup>24</sup> Damodar N. Gujarati, Basic Econometrics: fourth edition (New-York: McGraw-Hill/Irwin. 2003) 412

coefficients are constant across these groups. Fixed effects regressions will be looked at in order to account for the ‘individuality’<sup>25</sup> of each cross-sectional unit and will determine whether the fixed effects models give more accurate observations than the original models. The fixed effects model differs from the random effects model in that the random effects model assumes the independent variables are random whereas the fixed effects model assumes that the independent variables are fixed. The fixed effects generally produce smaller standard errors and based on the Hausman test, detailed in table 4, will become the alternative regression to the original models.

The two models that were created will identify if relationships exist between the outcomes of health, represented by the life expectancy and infant mortality rate, and the inputs of health. Life expectancy and infant mortality will be regressed against year, the percentage of GDP spent on health care, public and private expenditure per capita on health care, income per capita and percentage of the population over 80 years of age.

Two additional models will be formed, similar to the first two models; however, they will include the independent variables MRI machines per million people and physicians per thousand people. These variables are not included in the first two models because data for them is rather incomplete resulting in a much smaller sample size. The tests performed on the two additional models should, in any case, determine if a relationship exists between outcomes of health and the level of technology and resources available to the population.

The independent variable representing year is included in the models in order to allow for a time-trend. As mentioned earlier, outcomes of health tend to follow a

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<sup>25</sup> Damodar N. Gujarati, Basic Econometrics: fourth edition (New-York: McGraw-Hill/Irwin. 2003) 642

common path as time increases. By including the year variable I have allowed the model to capture missing variables that are constant across countries. Results from tests performed on the model that were derived in this section excluding the variable for year can be found in appendix A, and can be referred to for comparison purposes with the models that include the variable year.

An additional test was performed to identify the effect of including technology and resources in the model. The dependent variable for infant mortality was regressed against the independent variables from the first model; however, only the years that have data for both MRI/million and phys/thousand were included in the regression. As will be shown in the next section, there was very little difference in the estimated coefficients and the signs remained constant.

### ***3.4 Results from regression***

Based on the dependent and independent variables that were defined in the previous sections, four models were created and regressions were performed on each model, using OLS, to identify any possible relationships between the health outcomes and the inputs of health.

#### **MODEL 1**

The first two models will estimate the impact of the independent variables on the dependent variable for life expectancy. The first model can be written in the following form:

$$\text{Life expectancy} = c + b1 (\text{Year}) + b2 (\text{PCGDP}) + b3 (\text{Public}) + b4 (\text{Private}) + b5 (\text{IPC}) + b6 (\text{pop}) + ui$$

From this model a regression was estimated and the results can be found in the first column of table 3. The estimated coefficient for each variable is included in the table, while the standard error is found underneath each estimate. The results of the regression are somewhat interesting although certain problems exist in the model.

To begin with, the estimated parameter representing the variable for time (year) signifies that this variable is positively related to life expectancy. A positive relationship is not surprising considering the increase in medical knowledge and the development of new medical equipment that comes with time and indicates that the variable for year is capturing any unobserved trends that are constant across countries.

There is a positive coefficient on the proportion of GDP spent on health care indicating a positive relationship with the independent variable life expectancy. The estimated coefficient for public expenditure per capita is insignificant in this model indicating that it has no relationship with life expectancy. The estimated coefficient for private expenditure per capita signifies that an increase in private expenditure on health care, keeping all other variables constant, is related to a decrease in life expectancy, contrary to what might be expected.

An increase in the life expectancy is related to an increase in the average earnings of workers and a decrease in life expectancy is related to an increase in the population over the age of 80.

The above observations are consistent with the predictions from the theoretical model, with the exception of the estimated parameter for the private health expenditure per capita. The adjusted R-squared for this model, which measures the goodness-of-fit for the model, is 0.73 which is high enough to conclude that the model is well-fit. The Breusch-Pagan test found a value of 3.1, which is lower than the chi-squared critical value of 12.59 at the 95% confidence level, suggesting that there is no heteroskedasticity related to the independent variables.

I observed from the first model that based on evidence taken from 11 countries over the time period beginning in 1970 and ending in 2002 that the year, the percentage of the GDP spent on health care and the income per capita variables have positive relationships with the variable life expectancy. The variables private expenditure per capita and the percentage of the population over 80 both have negative relationships with the variable life expectancy.

## **MODEL 2**

The second model, derived from the variables, will also measure the relationship between the independent variables and the dependent variable for life expectancy. This model is similar to the first with the addition of the independent variables for the number of MRI machines per million and Physicians per thousand. The model can then be defined as:

$$\begin{aligned} \text{Life expectancy} = & c + b1 (\text{Year}) + b2 (\text{PCGDP}) + b3 (\text{Public}) + b4 (\text{Private}) + b5 (\text{IPC}) \\ & + b6 (\text{pop}) + b7 (\text{MRI}) + b8 (\text{Phys}) + ui \end{aligned}$$

The results of the regression for this model can be found in the second column of table 3.

In this model, the estimated coefficient for Year is insignificant, therefore; has no relationship with life expectancy, contrary to the findings from model 1. The estimate for the percentage of GDP spent on health care shows a negative relationship with life expectancy, which is also contrary to the observation from the first model.

Looking at the estimated coefficient for public expenditure per capita it is apparent that an increase in the level of public expenditure per capita, keeping all other variables constant, is related to an increase in life expectancy. In this model the estimate for private expenditure per capita and income per capita are both insignificant at the 95% confidence level indicating that both variables have no relationship with life expectancy. The estimated value for the variable population over 80 indicates a negative relationship with life expectancy and is consistent with the first model.

The two additional variables included in the second model offer a statistically significant estimate for the MRI per million people variable, however; the estimate for physicians per thousand people is not statistically significant indicating that there is no relationship with life expectancy. From table 3 it can be seen that there is a relationship between an increase in the level of MRI machines in proportion with the population and an increase in the life expectancy. This result is extremely relevant because it supports the prediction regarding technology made in the theoretical model, and demonstrates the impact of technology on life expectancy.

The second model has a lower adjusted R-squared value than the first model at 0.66. The low goodness-of-fit in this model signifies that model 1 is better-fit

comparatively; however, this figure is high enough to accept the second model as being well-fit. The number of observations for the model is quite low, compared to the size of the dataset. There are only 108 observations included in the regression and is a result of insufficient data for the variable MRI per million people. The lower level of observations occurs because some countries provide more MRI data than others and only certain years (usually from 1990-2000) are included in the regression. The Breusch-Pagan test indicates a value of 2.46 which is lower than the chi-squared critical value of 15.5 at the 95% significance level indicating that there is no heteroskedasticity related to the independent variables.

I observed from the second model that based on evidence taken from 11 countries over the time period beginning in 1970 and ending in 2002 that the variables percentage of the GDP spent on health care and the percentage of the population over 80 both have negative relationships with the variable life expectancy. The variables public expenditure per capita and MRI machines per million both have positive relationships with the variable life expectancy.

### **MODEL 3**

The third model that was derived is identical to the first model with respect to the independent variables. In this case, the dependent variable life expectancy will be replaced by the dependent variable infant mortality rate. The model bears the following form:

$$\begin{aligned} \text{Infant Mortality} = & c + b1 (\text{Year}) + b2 (\text{PCGDP}) + b3 (\text{Public}) + b4 (\text{Private}) + b5 (\text{IPC}) \\ & + b6 (\text{pop}) + ui \end{aligned}$$

Referring to the third column in table 3, the estimated coefficient for the variable year indicates that as time increases; unsurprisingly, there is a negative relationship with the infant mortality rate. The estimate for the percentage of the GDP spent on health care indicates that there is a negative relationship with infant mortality.

The estimated coefficients for both public and private expenditure per capita indicate a positive relationship with infant mortality. The finding is unusual and contrary to the theoretical model in that it would be expected that as more financing went into health care, from any source, infant mortality would decrease. One possible explanation for this finding is that infant mortality could be affected by other variables that may or may not be included in the model. Certain social issues, mentioned in the theoretical model could explain these findings, for example, factors such as smoking or improper pregnancy practices could also cause higher infant mortality rates even with increasing levels of financing.

Working in contrast to the results from public and private expenditure, the percentage of the GDP spent on health has negative relationship on infant mortality. This observation is troublesome, and can best be explained by the possibility of other variables affecting the model that have been overlooked.

The estimated coefficient for income per capita offers an interesting statistic. Based on the estimate it is apparent that an increase in the income per capita is related to a decrease in the infant mortality rate. The estimate for the percentage of the population over 80 indicates a positive relationship with infant mortality.

The third model contains all statistically significant estimates and the adjusted R-squared value is acceptable, at 0.75, to conclude that the model is well-fit. The result

from the Breusch-Pagan test indicates a value of 117.69 which is significantly more than the chi-square critical value of 12.59 at the 95% confidence interval. Therefore, it can be concluded that heteroskedasticity exists among the independent variables.

I observed from the third model that based on evidence taken from 11 countries over the time period beginning in 1970 and ending in 2002 the year, the percentage of the GDP spent on health care and the income per capita variables have negative relationships with the variable infant mortality rate. The public expenditure per capita, private expenditure per capita and percentage of the population over 80 variables have positive relationships with the variable infant mortality rate.

#### **MODEL 4**

The fourth, and final, model measures the impact of the independent variables on the dependent variable for infant mortality. This model is similar to the third model with the addition of the variables MRI machines per million people and Physicians per thousand people. The model can be written as:

$$\begin{aligned} \text{Infant mortality} = & c + b1 (\text{Year}) + b2 (\text{PCGDP}) + b3 (\text{Public}) + b4 (\text{Private}) + b5 (\text{IPC}) \\ & + b6 (\text{pop}) + b7 (\text{MRI}) + b8 (\text{Phys}) + u_i \end{aligned}$$

The results of the regression for this model can be found in table 3, in the fourth column. The estimated coefficient for the variable year shows that the year has a negative relationship with the infant mortality rate and is consistent with the previous model's finding. In this model, the estimate for the percentage of the GDP spent on health care

has a positive relationship with infant mortality which is opposite the finding from the third model.

The estimate for the public expenditure on health care per capita indicates a negative relationship with infant mortality and is opposite the finding from the third model. The finding indicates that if more services are available to the public, more people who are financially limited will likely seek health care; therefore, regardless of the distribution of income or any other social factors, if more money is spent on the public system, there will be added benefit to infants.

In this model the estimated coefficient for private expenditure per capita is not significant indicating that there is no relationship between private spending and infant mortality.

The estimate for income per capita suggests that increases in income is related to a higher infant mortality rate which is contrary to the third model's observation while the estimated coefficient for the percentage of the population that is over 80 is insignificant indicating that there is no relationship with infant mortality.

The estimate for MRI machines per million people suggests that an increase in the number of machines is related to a decrease infant mortality. This finding is rather unusual as MRI machines are generally used for those who are older; however, this variable can represent technology and signifies that as technology increases a decrease is related to infant mortality.

The estimated coefficient for the number of physicians per thousand people is not statistically significant indicating that there is no relationship between this variable and infant mortality, contrary to the theoretical model prediction.

This model has a relatively high adjusted R-squared of 0.828 indicating that the model is well-fit and the Breusch-Pagan test value is 0.09, significantly smaller than the chi-squared critical value of 15.5 at the 95% significance level indicating that there is no heteroskedasticity among the explanatory variables.

I observed from the fourth model that based on evidence taken from 11 countries over the time period beginning in 1970 and ending in 2002 the year, the public expenditure per capita and the MRI machines per million variables have negative relationships with infant mortality. The variables percentage of the GDP spent on health care and the income per capita both have positive relationships with infant mortality.

### ***3.3 Country fixed effects model***

The final portion of the analysis will be to look at the models that were generated with a fixed effects regression. The fixed effects models are being used to control for any unobserved constants that are specific to countries. It should be noted that comparing the fixed effects model to the random effects model gave very similar estimates and were both somewhat different from the original models. Using the Hausman specification test, the fixed effects model was found to be more appropriate for conducting regressions on the models in this essay.

Referring to the first column of table 4, regression results appear for the fixed effects regression model with related variables to our first OLS model. The estimated coefficients for the independent variables are similar to those found in table three, using the OLS regression. The positive relationships with life expectancy for the variable year is slightly larger in the fixed effects model while the positive relationships of the

percentage of GDP spent on health care and the income per capita variables on life expectancy are smaller in the fixed effects model. The private expenditure on health care per capita maintains a negative relationship with life expectancy; however, the relationship is slightly less than in the OLS model. The estimate for the percentage of the population over 80 is now insignificant, contrary to the OLS model.

In the fixed effects model, the estimated coefficient for public expenditure per capita is significant whereas in the OLS model it was not. The estimated coefficient indicates that an increase in public expenditure per capita, holding all other variables constant, is related to a decrease in life expectancy. This supports the World Health Organizations findings that increasing spending on health care does not necessarily help to increase the overall health outcomes of a country.

The adjusted R-squared value in the fixed effects model is slightly less than in the OLS model, however, does indicate that this model is well-fit.

The second column from table 4 provides estimates for the fixed effects model that is related to the second OLS regression model. The fixed effects estimated coefficient for the percentage of the population over 80 remains negative, and has a slightly larger relationship with life expectancy than that of the OLS model. The estimate for MRI machines per million maintains a positive relationship with life expectancy in the fixed effects model, although it was found to have a smaller relationship than the estimate in the OLS model.

The estimated coefficient for year in the fixed effects model indicates a positive relationship with life expectancy contrary to the OLS model where year had no relationship with life expectancy. Other estimates that were not significant in the OLS

model but were found to be significant in the fixed effects model includes the estimate for income per capita which has a negative relationship with life expectancy and the number of physicians per thousand which indicates a positive relationship with life expectancy.

The estimates for the percentage of the GDP spent on health care and the public expenditure on health care per capita are not significant in the fixed effects model whereas in the OLS model these variables have significant estimates. The estimate for private expenditure per capita remains not significant in the fixed effects model.

The adjusted R-squared for the second fixed effects model is 0.51 which is lower than that of the second OLS model, however, it may still be considered well-fit.

The third column of table 4 provides estimates for the fixed effects model relating to the third OLS regression model. The estimated coefficients in each independent variable retain the same relationship with infant mortality as in the OLS model, only the degree of the relationships change. The estimates for year, percentage of the GDP spent on health care and income per capita have more of a negative relationship with infant mortality than in the OLS model. The estimates for the public and private expenditure on health per capita are interesting in that both retain positive relationships with infant mortality, however, in the OLS model, the public expenditure per capita had a smaller relationship with life expectancy, whereas in the fixed effects model the private expenditure per capita has a smaller relationship with life expectancy.

The adjusted R-squared value is 0.556 which is lower than that of the corresponding OLS model but is high enough to conclude that the model is relatively well-fit.

The fourth column of table 4 provides estimates for the fixed effects model related to the fourth OLS regression model. The estimated coefficient for year, in the fixed effects model, has a negative relationship with infant mortality, consistent with the OLS model, yet exhibits a slightly greater relationship. The estimate for the percentage of the GDP spent on health care has a negative relationship with infant mortality in the fixed effects model, contrary to the finding from the OLS regression.

The estimated coefficients for public expenditure per capita, income per capita and MRI machines per million people are not statistically significant in the fixed effects regression whereas in the OLS regression these variables had relationships with infant mortality. The estimates for private expenditure per capita and the population over the age of 80 remain not significant in the effects regression contrary to the OLS regression.

The estimate for physicians per thousand is significant in the fixed effects model; whereas, it was not in the OLS regression. The estimated coefficient signifies the relationship that as the number of physicians per thousand people increases infant mortality will decrease.

Referring to the adjusted R-squared value of 0.356 it is apparent that this model is not well-fit; however, the model does offer alternative estimates from those of the OLS model.

The fixed effects models presented in this section offer an alternative view of the models that were developed in OLS and many observations were consistent with the theoretical model. The fixed effects model can be considered superior to the OLS model because it takes into account variables that may affect health outcomes but are not

included in the model. By taking these omitted factors into consideration, the estimates in the fixed effects model tend to be more accurate and exhibit lower standard errors.

Finally, a regression was conducted using model 4 of the original OLS regressions to determine the relationship between infant mortality and the years that are present in the model. This model consists of only 108 observations, and the variables for MRI per million and Physicians per thousand were removed from the model.

The result was very similar to the original model, in that the estimated coefficients kept the same signs, only the estimates changed slightly. In this model, more variables were statistically insignificant and it can be concluded that infant mortality is not affected greatly by the omission of the independent variables MRI and Phys.

## Chapter 4 – Conclusion

It is important in the study of health care to understand that no system of health care is perfect. Every system has problems and flaws, which may result in skepticism among critics. The nature and economics of health care systems have been discussed raising such issues as the methods of financing health care, problems with private insurance and the complexity of health care in general.

The Canadian health care system was then reviewed thoroughly in order to create a basis in which health care systems could be compared. Alternative health care systems were defined, and the methods in which comparisons could be made were outlined. Data was collected and a theoretical model was developed leading into models that were regressed using OLS and the fixed effects approaches.

Observations made from these regressions included a positive relationship between public expenditure per capita and life expectancy in the second model of OLS. The first OLS model indicated a negative relationship between private expenditure per capita and life expectancy. These observations were consistent with the second possibility mentioned in the theoretical model, that public health care would lead to higher population health while private health care would lead to lower population health. In the fixed effects model both private and public health expenditure per capita exhibited negative relationships with life expectancy, contrary to both possibilities from the theoretical model.

In the OLS model and the fixed effects model, private and public expenditure per capita exhibited positive relationships with the infant mortality rate. These findings are also contrary to the theoretical model.

Therefore, it can be concluded from the data analysis that perhaps the method of financing health care is not as significant as other factors in the outcome of health care. Perhaps, the focus of improving health conditions in a country should be the targeting of better health practices or increased health awareness.

Health care and health care systems are extremely complex entities and based on evidence given in chapter 3 of this essay, many questions still exist on how they may be affected by factors of health. There is no conclusive evidence to show that private health care systems would improve the current Canadian system, however; perhaps the question is not so much whether it would help to enhance the public health care system, but rather what kind of damage it could cause to the public system.

The real issue is what Canadians want. Are Canadians satisfied with the availability of service and the accessibility of health care? Do Canadians want to risk loosing a system of health care in which most are proud and dependent of in exchange for a system where some of the population may benefit but others may not? A private-type health system may complement a public system quite effectively as it does in Finland and the UK or could lead to problems as is the case of the United States. Therefore, Canada must be extremely prudent in the decisions it makes regarding the growing tension surrounding its health care system.

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Table 1: Country Statistics

Country	Life Expectancy (Yrs)			Infant Mortality rate		
	Mean	min	max	Mean	min	max
Canada	77.150	72.800	79.700	9.285	5.200	18.8
France	75.730	72.100	79.400	8.976	4.100	18.2
Germany	74.491	70.400	78.500	10.636	4.200	22.5
Japan	77.552	72.000	81.800	6.436	3.000	13.1
Netherlands	76.324	73.700	78.300	7.912	5.000	12.7
New Zealand	74.694	71.500	78.700	10.906	5.400	16.7
Sweden	77.085	74.700	79.900	6.452	3.300	11.1
UK	75.560	71.800	78.200	11.042	5.200	19.9
USA	74.527	70.900	77.200	11.312	6.800	20
Finland	74.445	70.000	78.200	6.715	3.000	13.2
Austria	74.282	70.000	78.800	11.948	4.100	26.1
Total	75.593	70.000	81.800	9.234	3.000	26.1

Statistics based on observations made from 1970-2002

Source OECD

Table 2: Country Statistics

Country	% of GDP spent on health care			Public expenditure per person			Private expenditure per person			Income per person ('000)			% of population 80 years or older			MRI machines per million people			Physicians per thousand people		
	Mean	min	max	Mean	min	max	Mean	min	max	Mean	min	max	Mean	min	max	Mean	min	max	Mean	min	max
Canada	8.252	6.700	10.000	1003.909	206.000	1982.000	373.000	88.000	861.000	8.517	2.318	15.373	2.179	1.500	3.200	0.994	0.000	4.200	1.924	1.400	2.100
France*	8.694	5.400	9.700	1345.000	159.000	2101.000	416.412	52.000	661.000	7.904	1.933	14.983	3.264	2.300	4.100	1.769	0.400	2.800	2.467	1.200	3.300
Germany*	9.088	6.200	10.900	1152.688	197.000	2291.000	314.844	73.000	625.000	8.470	2.297	14.289	3.836	3.600	4.100	3.192	1.100	6.000	3.092	2.800	3.300
Japan	6.309	4.500	7.900	761.667	104.000	1743.000	215.030	45.000	396.000	7.771	1.418	14.499	2.158	0.900	4.200	19.180	6.100	35.300	1.413	1.100	2.000
Nether*	7.810	6.600	9.300	855.226	199.000	1733.000	413.581	127.000	1042.000	7.938	2.254	15.728	2.573	1.700	3.300	1.543	0.100	3.900	2.156	1.300	3.300
NZ*	6.512	5.100	8.200	679.455	168.000	1441.000	167.818	27.000	409.000	5.739	2.016	9.543	2.600	2.300	3.000	2.633	2.600	2.700	1.793	1.100	2.300
Sweden	8.342	6.900	9.300	1131.182	266.000	2208.000	153.485	43.000	386.000	8.650	2.598	16.149	3.767	2.300	5.200	2.538	0.200	7.900	2.434	1.300	3.300
UK*	6.079	4.500	7.700	746.515	142.000	1860.000	141.818	21.000	371.000	7.669	2.158	16.331	3.236	2.200	4.300	4.900	4.600	5.200	1.473	0.900	2.100
USA	10.503	6.900	14.600	950.091	126.000	2375.000	1268.030	221.000	2911.000	11.031	3.010	21.095	2.609	1.800	3.400	4.950	0.600	8.600	1.759	1.200	2.300
Finland*	6.967	5.600	9.100	783.788	141.000	1536.000	227.455	50.000	477.000	7.308	1.697	13.610	2.352	1.100	3.600	4.421	0.200	12.500	2.308	2.000	2.600
Austria	6.882	5.100	8.500	804.182	121.000	1517.000	329.424	71.000	719.000	8.279	1.777	15.101	3.085	2.100	3.900	6.867	0.700	13.400	2.112	1.400	3.300
Total	7.720	4.500	14.600	908.922	104.000	2375.000	363.038	21.000	2911.000	8.115	1.418	21.100	2.840	0.900	5.200	4.018	0.000	35.300	2.026	0.900	3.300

Statistics based on observations made from 1970-2002

\* Denotes that country has fewer than 20 observations for at least one variable

Source OECD

Table 3: Regression results (including variable for YEAR)

Variables	Life Expectancy models		Infant Mortality models	
	LE(1)	LE(2)	IM(1)	IM(2)
Constant	-182.682* (49.534)	145.124* (75.546)	723.745* (102.212)	279.426* (74.236)
Year	0.128* (0.025)	-0.033 (0.037)	-0.356* (0.051)	-0.137* (0.037)
% of GDP	0.345* (0.098)	-0.440* (0.177)	-1.323* (0.192)	0.381* (0.174)
Public expend	-0.000 (0.001)	0.003* (0.001)	0.003* (0.001)	-0.002* (0.001)
Private expend	-0.003* (0.000)	0.000 (0.001)	0.009* (0.001)	0.000 (0.001)
Income/capita	0.522* (0.086)	-0.021 (0.129)	-0.996* (0.179)	0.260* (0.127)
%pop>80	-0.868* (0.138)	-0.421* (0.187)	2.102* (0.275)	-0.064 (0.183)
MRI/million	/	0.089* (0.023)	/	-0.086* (0.023)
Physicians/thou	/	0.168 (0.253)	/	-0.214 (0.248)
Sample size	289	108	303	108
Adj. R-squared	0.783	0.664	0.745	0.828
Breusch-Pagan	3.1	2.46	117.69	0.09

\* Signifies variable coefficient is significant at a 95% confidence level.

Table 4: Fixed effects regression (including variable for YEAR)

Variables	Life Expectancy models		Infant Mortality models	
	LE(1)	LE(2)	IM(1)	IM(2)
Constant	-370.847*	-403.398*	1002.274*	601.032*
	(40.218)	(32.429)	(122.362)	(71.172)
Year	0.223*	0.242*	-0.496*	-0.296*
	(0.020)	(0.016)	(0.062)	(0.036)
% of GDP	0.287*	-0.085	-1.717*	-0.368*
	(0.054)	(0.060)	(0.165)	(0.132)
Public expend	-0.001*	0.000	0.010*	0.001
	(0.000)	(0.000)	(0.001)	(0.001)
Private expend	-0.001*	0.000	0.005*	0.000
	(0.000)	(0.000)	(0.001)	(0.000)
Income/capita	0.278*	-0.106*	-1.324*	0.123
	(0.061)	(0.054)	(0.189)	(0.118)
%pop>80	-0.095	-0.470*	2.321*	0.227
	(0.137)	(0.118)	(0.406)	(0.259)
MRI/million	/	0.037*	/	0.033
	/	(0.010)	/	(0.023)
Physicians/thou	/	0.504*	/	-1.604*
	/	(0.184)	/	(0.404)
Sample size	289	108	308	108
Adj. R-squared	0.727	0.518	0.556	0.356
Hausman test	0.994	0.311	0.010	0.000

\* Signifies variable coefficient is significant at a 95% confidence level.

## Appendix A: Regression results (excluding variable for YEAR)

Variables	Life Expectancy models		Infant Mortality models	
	LE(1)	LE(2)	IM(1)	IM(2)
Constant	71.810*	77.371*	18.524*	4.178*
	(0.652)	(1.330)	(1.329)	(1.389)
% of GDP	0.161	-0.345*	-0.871*	0.767*
	(0.096)	(0.141)	(0.194)	(0.148)
Public expend	0.001*	0.002*	0.000	-0.004*
	(0.001)	(0.001)	(0.001)	(0.001)
Private expend	-0.004*	0.000	0.009*	-0.001
	(0.000)	(0.001)	(0.001)	(0.001)
Income/capita	0.715*	-0.011	-1.597*	0.301*
	(0.081)	(0.128)	(0.168)	(0.134)
% pop>80	-0.970*	-0.406*	2.406*	-0.001
	(0.143)	(0.186)	(0.292)	(0.194)
MRI/million	/	0.083*	/	-0.110*
	/	(0.022)	/	(0.023)
Physicians/thou	/	0.143	/	-0.316
	/	(0.251)	/	(0.262)
Sample size	289	108	303	108
Adj. R-squared	0.763	0.664	0.705	0.806
Breusch-Pagan	1.55	3.13	66.57	0.01

\* Signifies variable coefficient is significant at a 95% confidence level.