THE IMPACT OF EDUCATION ON THE UTILIZATION OF FAMILY PHYSICIAN SERVICES IN CANADA

By

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1.0 INTRODUCTION

Since 1971, Canada has utilized a public health care system. Under this system, all Canadians have the right to an identical standard of care irrespective of their ability to pay. Unfortunately, the benefits of public health care do not come without costs, which is why many political debates and concerns within Canada are focused on the health care system. Some contributors to public policy believe that the current system is not efficiently delivering timely treatments to those who need it, while others wonder whether it is sustainable in the long run due to ever-increasing expenditures.

1.1 Research Objective

This essay aims to address the latter of the two issues mentioned above. In particular, the link between demand for medical care and education[1] is examined in order to determine whether promoting educational attainment, with an emphasis on more health education, throughout Canada could help control the fast-growing provincial government expenditures on physician services.[2]

Instead of focusing on all physicians, the empirical investigation will be conducted using family physician expenditures. The reason for this is that family doctors play the role of "gate keeper" in the Canadian health care system. If an individual wishes to see a specialist for a particular issue, he or she must obtain a referral from the family doctor. Specialist visits therefore depend on whether the family physician deems the medical

[1] Education is used as a synonym for "level of schooling". It does not refer to prior life experiences or on-the-job training.

[2] This paper analyzes the impact of general education, but the effective policy response should be to focus more on promoting health education. An example could be adding a compulsory grade 12 health education course to high school curriculums. Increasing general education by itself would be too wide a policy suggestion to propose for reducing health care expenditures.

issue necessary for additional attention. This paper attempts to isolate whether the decision to seek primary care is affected by education level.

To conduct this analysis, provincial time-series data have been collected from 1996 to 2008 on family physician services expenditure, supply of physicians, education, an index of health care indicator, age of population, and population.[3] The two credible data sources are Statistics Canada and the Canadian Institute for Health Information (CIHI).

1.2 Relevance of the Analysis

Worldwide, health care systems are being characterized as unsustainable due to rising costs. Munshi (2013) explains that in almost all countries, per capita health care spending is currently growing at a faster pace than per capita income. In Canada, health care spending has historically grown faster than consumer price inflation and population (CIHI, 2011b). In 1976, total health care costs were 7 percent of GDP and in 2010, CIHI states that it reached 11.9 percent (CIHI, 2012b, p.9). Although actual numbers have not yet been tabulated, CIHI (2012b, p.9) estimates that Canada's GDP grew faster than health expenditures in 2012 resulting in a lower health spending to GDP ratio than in the two years prior. Nonetheless, spending is forecasted to have reached an inflation-adjusted gross amount of 207 billion dollars at the end of 2012 (CIHI, 2012b, p.2), which is double the amount it was a decade ago.

Since the Canadian government is striving to eliminate the current budgetary deficit, this escalating expenditure is currently being addressed. Canada's premiers state that the new federal health accord will take away almost 36 billion dollars from provincial coffers over the ten-year deal (Fekete, 2012). In order to provide the same level of care but with

[3] Finding health care data to test the research question proved to be very difficult; the time frame of analysis is confined to 13 years due to data constraints. Data limitations will be discussed in section 3.2.

lower funding, it is essential to discover what the health care cost drivers are. The Canadian health care system can only be cost effective in the long run if a sustainable method for controlling health care cost drivers is implemented.

Grossman (1972) has created a model of the demand for "good health". He defines health as a durable capital stock that produces an output of healthy time; hence this model has been deemed in economic and healthcare literature as the Grossman production function for health status. In this model individuals are endowed with an initial stock of health that naturally depreciates with age, but can be improved through investments. Household production functions with direct inputs such as the consumer's time, medical care, diet, exercise, recreation, and housing determine the amount of gross investment in health capital.[4] Another important factor within this production function is the level of education because this influences the efficiency of the production process. In this framework, level of health is an endogenous variable, which depends on the resources allocated to its production.

Grossman proposes that those with higher educational attainment are more efficient producers of health status. His basis for this education-efficiency theory is that more years of schooling leads to better knowledge about use of technology and how to stay healthy.[5] Kenkel (1991) states that many economists, such as Grossman, have theorized that more expenditure on education is a cost effective method for increasing the aggregate health level. Health status may determine the need to contact the health care system, but it is

[4] The effects of negative inputs including sedentary life style and substance abuse are also considered in the model.

[5] People with higher education typically make better choices in relation to inputs in the production function for health status. For example, they are likely to eat healthier and be more physically active than individuals who have less education.

important to keep in mind that factors such as education and income can affect how frequently one accesses the system.

This analysis takes conventional theory and findings about a positive relationship of education to health status and applies it to the use of family physician services. It also examines previous literature pertaining to health care demand models and access to health care services to determine whether there is support for the hypothesis that more education is correlated with less use of family physician services. If this is true, then Canada should consider devoting more resources towards increasing the general education, and more importantly heath education, level of the population as a preventative measure for the growing health care expenditure problem.

1.3 Organization of the Study

The content of this essay is divided into five sections. Following the introduction, section 2 provides a review of some important relevant literature on education and health care services. Section 3 discusses the econometric model and data being used to analyze the research question. Section 4 describes the regression results and section 5 concludes the study.

2.0 LITERATURE REVIEW

2.1 The Increasing Physician Services Expenditure Issue

Health care spending by the government spans across a few different areas. The Canadian Institute for Health Information (CIHI) explicitly states these areas as goods and services related to health care, capital investment, insurance plans, public health programs and research. These areas of funding can be categorized into the following nine main uses of funds: capital, administration, public health, hospital, drugs, other health spending, other institutions, other professionals, and physicians (CIHI, 2012b).

CIHI reports that in 2010, hospitals accounted for the largest component of health care spending at about 29.1 percent of total expenditure, second largest were drug costs at 15.9 percent, while physicians followed closely behind, making up 14.2 percent (CIHI, 2012b, p. 39).

CIHI (2011b) emphasizes that payments to health care providers is a major cost driver for health care spending. In 2011, the largest contributor of public health care spending was the hospital sector (37 percent) and physicians made up the second largest contribution (20 percent).[6] Physician spending went up 6.8 percent between 1998 and 2008 and the cause was mainly attributed to rising physician service fees at 3.6 percent annually, which was well ahead of annual inflation (CIHI, 2011b). During this period, compensation for physician services was growing more rapidly than that for other health workers and the labour market in general. From 1975 to 1998, payments to physicians were growing at a slower rate compared to the prices of other public goods and services.

[6] Note that these two percentages differ from the percentages in the previous paragraph because CIHI is only considering public health care spending here, not the private aspects of health care spending (e.g. medication).

Rathwell (1994) states that the difficulty in controlling the physician services expenditure is sometimes due to doctors viewing cost control as income control. Since medical practitioners are usually paid on a fee-for-service basis and, in Canada, there is a bilateral monopoly between provincial medical associations and provincial governments, renegotiating the fee schedule for certain services with medical associations is not an easy task.

Table 1 shows that active physicians per-capita are rising in Canada. According to CIHI (2012a), growth in demand and supply of physicians and hospital workers is a major cause of inflation in health care spending over the last decade. Due to increasing fees and supply of physicians, physician compensation has a higher growth rate than drugs and hospitals for the past five years (CIHI, 2011b, 2012a). The high growth rate can be attributed to the (bilateral) monopoly power of medical doctors preventing competition to control expenditures despite increasing physicians per-capita. This will continue to occur unless the trend is universal or, more pertinently, south of the border.

Table 1. Supply of active* physicians in Canada, 2000-2012

Year	Number of physicians	Physicians per-capita
2002	59 357	0.00189
2003	60 859	0.00192
2004	61 803	0.00193
2005	61 582	0.00191
2006	62 935	0.00193
2007	63 819	0.00194
2008	65 794	0.00197
2009	66 992	0.00199
2010	69 267	0.00203
2011	70 088	0.00203
2012	72 368	0.00207

*Active physicians are non-resident physicians under 80 years old (CMA, 1994). Sources: Canadian Medical Association (2012) "Number of physicians by province/territory and specialty; Canada, 2000-2011" and Statistics Canada. (2012) CANSIM Table 510001. "Estimates of population, by age group and sex for July 1, Canada, provinces and territories, annually; persons".

Freund (1986) reviewed Alain Enthoven's influential health care policy book *Health Plan: The only practical solution to the soaring cost of medical care,* written in 1980. In this book, Enthoven declares that efficiency is at stake when implementing a fee-for-service rather than capitation payment scheme. He focuses on the theory that giving consumers a choice between competing medical insurance plans is the most effective way to lower health care inflation (Freund, 1986). In certain areas around the world, some of the competitive elements suggested in Enthoven's book have been implemented. For example, in many countries, such as Holland and the United Kingdom, insurer competition and universal coverage coexist.

Evans (1984) builds on Enthoven's work by further discussing the efficiency dilemma. He explains that organizations bringing together practitioners using a capitation payment scheme rather than fee-for-service experience more efficiency. In the United States, some of these places include Prepaid Group Practices, Closed-Panel Practices, or Health Maintenance Organizations (HMOs) (Evans, 1984). Physicians will provide services to people who are enrolled based on a set dollar amount related to the time period of helping an enrollee. If an enrollee seeks services outside the practitioner group he or she is either partially reimbursed or pays completely out of pocket.

The main reason why these organizations achieve more efficiency is due to the differences in product mix between prepaid and fee-for-service practices. Evans (1984) reports that studies conducted under different conditions show that çuse hospital services (the largest area of expenditure) approximately 40 percent less than those who visit fee-for-service physicians (Evans, 1984, p.121). Practitioners who are a part of these capitation groups, for different economic and professional reasons, follow practice guidelines that push for admitting hospital patients less frequently for less time. These findings have given motivation to United States policy supporting HMOs. In Canada, these results maintain interest in finding alternatives to fee-for-service but, unfortunately, creating varying types of practice is difficult under a universal health care system. The evidence presented by Enthoven and Evans strongly suggests that switching from a fee-for-service to capitation user fee has the serious potential to increase efficiency and inevitably decrease expenditures. Since the 1990s, Canada has been on a very slow path of introducing and expanding capitation payments to general practitioners.

Hutchison, Abelson and Lavis (2001) explain that the potential to improve the efficiency and cost effectiveness of primary care is being hindered by the approach to improve primary care. Successfully tackling the increasing physician services expenditure issue will not occur through "big bang" reforms, which have been popularly advocated throughout political history. An immediate implementation of an ideal model for primary care organization, funding, and delivery, would inevitably generate disapproval from physicians. Widespread opposition from physicians needs to be prevented by all means as they constitute the base of Canada's publicly funded health care system. In order to address any health care system issue, politicians need to shift their mindset to opportunities for cumulative incremental change. If the hypothesis posed in section 1.2 holds, one way to create this incremental change could be to determine how to make Canadians better educated in general and about their health. It would be easier to achieve efficiencies through proper education that, in turn, would lead to an efficient utilization of healthcare resources. This method of change would then dominate organizational reform.

2.2 Demand for Health Care Services

As stated in section 2.1, CIHI has identified the increase in demand for health care services as one of the main factors contributing to the health care expenditure issue.[7] The demand for health care can be defined as "seeking of care to address either a current health concern or to prevent a future health concern" (IRMACS, 2006, p.1). In order to understand how to slow down this rising demand, various determinants of the demand for health care must be analyzed.

As discussed in section 1.2, Grossman (1972) has constructed a theoretical model that contains medical care as an endogenous variable. In this model, individuals are endowed with an initial stock of health that naturally depreciates with age, but can be improved through investments. He draws on human capital theory posed by Becker (1967) and other researchers to explain how people invest in the stock of health by utilizing medical services and other inputs including time, diet, exercise, recreation, and housing. With the aid of utility functions subject to a wealth constraint, he argues that health care is demanded for two core reasons. It is desired as a consumption commodity that is direct inputted into the utility function and as an investment commodity to increase healthy time for productive activities.

Wagstaff (1986) comprehensively tests the real-world application of Grossman's theoretical model. When fitting data from the 1976 Danish Welfare Survey to an empirical demand for health model containing health status, wage rate, prices for medical services, environmental, and level of education variables he discovers that most coefficients are opposite of what Grossman had suggested.

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[7] In section 2.1, it was established that the supply side (i.e. the bilateral monopoly) of health care services also drives the cost. In this section only the demand side of health care services is discussed.

In particular, Grossman expects the education variable to be negative because the education-efficiency hypothesis states that better educated people should be more efficient producers of health (Wagstaff, 1986). This means that these people require less medical services to produce an extra unit to their stock of health capital. However, Wagstaff's empirical results suggest that those who have more education use more health services. His interpretation is that there may be a more favorable relationship between physicians and higher educated patients. Therefore, the more education an individual has, the stronger the desire to seek medical advice from a family physician.

Another study which disputes the "efficiency" effect in the use of health care services has been conducted by Garrison (1978). He uses primary data to show that people nineteen and older who are more educated will enter the hospital for surgery at the same stage in illness as those who are less educated.[8] Also, both groups of adults choose the same type of physicians and have approximately the same length of hospital stay as well as same surgical outcomes. Thus, in the context of surgical procedures, there little support for the education-efficiency hypothesis, as both classes of adults appear to use medical care in the same manner.

One aspect Wagstaff (1986) and Garrison (1978) do not address is that in many health care systems around the world, accessing the system is easier for those who have higher education and income. This "access" factor could partially explain why Grossman's (1972) theorized negative relationship between education and health is not observed in these two studies. If an individual's ability to acquire care is controlled for, it is possible that the lesser educated use the system more often. In fact, this study about

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[8] This observation is not surprising since, at the surgical state of care, a particular specialist is in charge. Unless it's an emergency surgery, the patient would have consulted the general practitioner first.

family physician service utilization in Canada is another empirical attempt to understand the relationship between education and expenditure on physician services. The topic of access to health care will be further examined in section 2.5.

Breyer, Kifmann, and Zweifel (2009) give theoretical evidence that contradicts some of the inferences from the Grossman model. In their model of health related behavior, they discover a negative relationship between health and medical care, rather than the positive relationship Grossman's theory assumes. Empirical evidence from Leu and Doppman's study (as cited in Zweifel et al., 2009) supports Zweifel et al.'s theoretical derivations. These two authors use a comprehensive set of health indicators from a 1980 Switzerland health survey that contains 3,155 adult respondents. Using multiple regression analysis they consistently find significant negative elasticites for ambulatory care visits, days in hospitals, and days spent at other health clinics with respect to the dependent health status variable.

Leu, Gerfin, and Spycher (1992) reach the same conclusion as Leu and Doppman about the health-medical services relationship. Their sample consists of 1985 West Germany general population survey respondents, aged 18-80 years old, who are identified as suffering from chronic bronchitis. One finding from their MIMIC (multiple indicators multiple causes) index model is that those who indicate worse health symptoms tend to utilize more medical care. Since education and health are observed to move in the same direction (as will be explained in the following portion of this essay), these results do not seem to contradict the hypothesis that education and medical care services are negatively related.

Although evidence presented in this section questions the validity of the Grossman model, insights from his approach remains influential in health care economics today.

Gilleski (2008) reviews many past economic investigations based on the Grossman framework to thoroughly explain its real world application in current time. She explains that the Grossman model can be used to answer many health policy questions because it addresses relationships pertaining to inferences about demand behaviors, health production, and other questions of interest (e.g. health and work). However, she notes that countless shortcomings exist including Grossman's failure to consider child and family health (he only focuses on adult health in his model), uncertainty, and the role of the physician. Instead of explaining specific results from health status production function analyses, she briefly overviews relevant research sorted into three broad categories: determinants of the demand for medical care and nonmedical care inputs, role of various inputs in producing health, and the solution and estimation of the theoretical model itself. Gilleski makes it clear that the Grossman model is multi-faceted as it can be applied in a variety of health related settings, but inadequacies of the model have been discovered and important extensions to the model have been created.

Pohlmeier and Ulrich (1995) specify two health care demand models that are not explicitly based off the popular Grossman model. The dependent variables are numbers of visits to a general practitioner and a specialist.[9] The main explanatory variables include sex, martial status, income, illness, age, education and population. Estimating these models using data from the 1985 West German Socioeconomic Panel (SOEP) lead to the major finding that the initial decision to contact and the frequency at which they contact general practitioners versus specialists should be modeled separately because putting the

[9] Note that individuals have the choice between visiting either a general practitioner or specialist under some systems, but in others they first have to pass through a general practitioner. Thus, in certain cases, there exists a sequence from general practitioner to specialist.

two together could yield inconsistent estimates.[10] This finding is clearly seen when observing the sign of the education variable; it is negative for general practitioner visits and positive for specialist visits. The negative coefficient in the general practioner equation coincides with the education-efficiency argument; people who are more educated visit general practitioners less.

Through estimating demand for physician services using the European Community Household Panel (ECHP), Jimenez-Martin, Labeaga, and Martinez-Granado (2004) find that behavioral differences exist between the 12 European Union countries analyzed in their study. Variability depends on differences such as age, income, and the role of general practitioners as gatekeepers in the public health system. Also, since they find that two different types of statistical models should be used for visits to general practitioners and visits to specialists, Jimenez-Martin et al (2004) reinforce Pohlmeier and Ulrich's (1995) conclusion that demand for general practitioners and specialist services should be modeled separately.

In the Jimenez-Martin et al. study, cross-sectional econometric methods are used to arrive at the empirical results. Bago d'Uva and Jones (2009) utilize the ECHP dataset as well, but by exploiting the panel nature of the data, they provide different insights into the determinants of health care use. Instead of only analyzing the differences between general practitioner and specialist visits, they look at distribution in number of visits based on different types of individuals using count models. Explanatory variables in their models include income, subjective health measures, gender and age dummies, education, marital status, and employment status. The variables of interest are income and education.

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[10] The difference in estimates would be starker in the British health care systems where the general practitioner is the first point of contact.

They observe that for general practitioner visits, the effect of income is mostly positive on the probability of seeking care and mostly negative conditional on number of visits for high and low frequency users. However, it is important to note that, the coefficients of income on total number of general practitioner visits are mainly insignificant. For specialist visits, low frequency users are more income elastic than high users and the probability of using medical care is more income elastic than the conditional number of visits. Richer individuals appear to use more specialist care than those less well-off. Overall, they find that across countries the education variable is consistently negative for general practitioner visits and positive for specialist visits.

2.3 The Relationship between Education and Health

In *The Economics of Health and Health Care* Folland, Goodman, and Stano (2004) address the strong link between education and better health. They explain that those who are in university or college have shown to be in much better health than those individuals who are not. There are many possible reasons for this, such as students being more "efficient producers of health", less likely to smoke, or more likely to eat a healthier diet (Folland et al., 2004).

Grossman (1999) explains that the concept "efficient producers of health" is derived from the health capital model (Becker, 1967). Health can be seen as a productive good in that it produces healthy days. Students realize that they require as many healthy days as possible in order to attend classes and complete course work effectively. As they become more educated, they must become more efficient producers of health because more healthy days will be required to be productive. This could indicate that higher educated individuals visit general practitioners more often to ensure their health is optimal; therefore, higher education may correlate with higher family doctor service utilization.

This education-efficiency hypothesis is widely accepted in health economics but some researchers such as Fuchs (1979) believe it only explains part of the correlation between education and health. His main concern is that Grossman could not find a significant effect for IQ level on health. Intuitively it would seem that years of schooling and IQ should correlate to health in the same direction and manner.

Folland et al. (2004) give another perspective on the relationship between education and health by explaining that investment in health is a function of education. The marginal efficiency of investment (MEI) measures the return on investment as a product of what one puts into the investment. An individual is assumed to invest in health care measures if the resources he or she uses will result in higher rates of return. As expected, the MEI curve exhibits the same diminishing return characteristic as other marginal curves; the rate of return on the second unit of resource put into better health will be less than the first. It also shows that the rate of return declines as the amount of investment increases (Folland et al., p.130, 2004). Since more education may cause a person to be a more efficient producer of health, those who have higher education are expected to have a higher MEI curve than those who have less. Education raises the marginal product of direct inputs (one outcome of better health for students, for example, is more effective study time) so it reduces the quantity required to create a specific amount of gross investment. The MEI curves explain the correlation between level of education and health status in supply rather than in demand terms; those with higher education are likely to produce more health.

2.4 Empirical Analyses Describing the Education-Health Relationship

Some examples of empirical work done surrounding the linkage between education and health include studies by Berger and Leigh (1989), Kenkel (1991), and Lleras-Muney (2005). These researchers' conclusions coincide with the theory presented in section 2.3, such that more education appears to signify better health.

Berger and Leigh (1989) note that previous literature shows that education is a large and significant positive determinant of health status, but the exact pathway of this relationship remains controversial. Grossman (1976) contends that more schooling directly improves health, but others disagree. For example, Fuchs (1982) states that a third party effect happens where some other unobservable variable, such as genetics, causes health and education to move in the same direction. Another widely accepted view is that the reverse causality occurs where better health means more years of schooling (Berger and Leigh, 1989). The aim of Berger and Leigh's (1989) empirical analysis is to find out which of the three views is dominant.

They create econometric models using United States data from the Health and Nutrition Examination Survey and the National Longitudinal Survey of Young Men. Four control function models are developed using the following different measures of health: blood pressures (systolic and diastolic), presence at work, and function limitations. The overall result points towards education directly affecting health rather than the other two alternatives.

Kenkel (1991) determines the reason why more schooling leads to better health. He investigates the relationship between the two variables by looking at health behavior of individuals. He separates schooling into general education and health knowledge to determine which has a stronger impact. The hypothesis is that additional years of school will improve the choice of health inputs in the production function of health status by making individuals more health knowledgeable. In this analysis, the allocative education efficiency rather than the productive education efficiency hypothesis is being tested.

Kenkel's measures of health are quite different from Berger and Leigh's (1989). He uses consumption of cigarettes, alcohol, and exercise as his health inputs and states that those who have more education are deemed more likely to have health information allowing them to make an informed decision about consuming these items. He observes that even while sorting through the raw data, it was obvious that those who were highly educated lived healthier lifestyles (Kenkel, 1991). His immediate explanation is that education helps people analyze and understand the relationship between health behaviors and health outcomes and thus live healthier lifestyles.

To test the research question, he estimates tobit models using United States data from the Health Promotion/Disease Prevention (HPDP) and 1985 Health Interview Survey. His findings demonstrate that exercise is positively related to education and health knowledge, while heavy alcohol and cigarette consumption is negatively related. He also finds that even after health knowledge is controlled for, years of schooling still has a significant positive effect on health status. As expected, health knowledge has a stronger impact on health status.

An important potential concern Kenkel addresses in his study is the role of unobservable determinants of health behavior and health knowledge. He explains that this is where "cognitive dissonance" may be a factor such that individuals try to reconcile their self-image as a good, intelligent person with possibly contradictory actions. For instance, a smoker may not admit that smoking is the cause of certain serious illnesses.

The existence of cognitive dissonance would give way to two econometric estimation problems.

The first is that health knowledge would contain an unobservable measurement error, which is systematically related to choice of health input (the dependent variable) since people are not admitting that the behavior is unhealthy. However, if cognitive dissonance causes people to change their information sets to fit their beliefs a second problem arises; a pair of simultaneous equations would describe health behaviors and health knowledge.

To see whether these two factors have generated inaccurate estimates in his original model, he sets up a two stage methodology to treat health knowledge as an endogenous explanatory variable in the health behavior equations. The results of this econometric process show that the original results about the effects of health knowledge on health behavior are not affected by endogeneity bias or cognitive dissonance.

Lleras-Muney's (2005) study assesses the dependency health has on education by analyzing mortality rates. Her examination is a natural experiment and considers the effects of certain laws on health. The analysis timeframe is from 1915 to 1939 because this was the period where major child labour and compulsory schooling laws were implemented. She theorizes that if more education results in better health, then those who were forced into going to school should have lived a longer and healthier life than those individuals living in states that did not make the changes to child labour and compulsory schooling laws.

When explaining the intent of the study, she questions the credibility of prior analyses, including Berger and Leigh's work in 1989. She states that the choice of methodology in previous studies, such as Grossman (1972), is questionable because their samples include only adults. An adult sample may not be adequate because there is much potential for childhood and teen-aged health to powerfully affect their adulthood health outcomes. She avoids this limitation because her study followed people who were 14 years old between 1915 and 1939.

Lleras-Muney (2005) uses US census data to create cohort generations so that she can follow groups of individuals over time to determine mortality rates. These cohorts are paired up with school and child labour laws that were in place during the time they were fourteen in their states of birth. The results show that the compulsory laws had a significant effect on adult mortality rates because the returns to schooling in terms of health were found to be large. An additional year of school lowered the possibility of death in the next ten years by 3 to 6 percentage points (Lleras-Muney, 2005, p.215). Once again, this supports the typical finding that more education leads to better health.

The three studies presented in this section reach the same conclusion that health and education are positively correlated. Although they all use empirical methodology to arrive at this result, their research approaches to the topic vary. Berger and Leigh (1989) identify that the causal link runs from education directly to health, not vice versa. Kenkel (1991) accepts this viewpoint and takes the analysis one step further by determining why and how the causal link exists. Llears-Muney (2005) creates more of a natural experiment to examine the education-health relationship. By doing this she is able to use longitudinal data to avoid a downfall of many previous empirical studies, which is that they only focus on a shorter-term adult sample and therefore do not give a definite casual relationship.

2.5 Education and Access to Health Care

Even in health care systems characterized by universal coverage, barriers to access services may still persist. The existence of private medical insurance plans (e.g. for vision, dental, and drugs) hinders the ability of a system to ensure health care utilization depends solely on need of care rather than ability to pay for care. When considering the existence of barriers to access, the efficiency-education hypothesis may not be the best reasoning behind the education-medical services relationship. In this case, one could expect that those with higher income and education are more able to utilize health care services; this trend is frequently observed in empirical analyses.

On the premise that income is not the only barrier to access medical care services, Van Doorslaer, Koolman and Jones (2003) investigate the impact years of schooling has on services utilized. By estimating various empirical models using European Community Household Panel data, these researchers discover that other than income, education is the most important factor widening the inequality gap in visits to specialists.[11] This result is observed for all countries in Europe but there is a stronger effect in those that have private insurance coverage or private proactive options for receiving quicker, preferential access. In terms of general practitioner visits, Van Doorslaer et al. observe that education, rather than income, appears to be a bigger determinant for number of visits. However, it does not appear that a barrier to access general practitioner services exists because those who are less educated utilize these services more often.

Studies conducted by Wagstaff and Van Doorslaer (2000), as well as Bago d'Uva, Jones, and Van Doorslaer (2009) have also confirmed the existence of horizontal inequity in health care systems throughout Europe. They find that the probability of seeing a

[11] This, in part, follows from the positive correlation between education and income.

physician and the number of visits (conditional on the first visit) are not identically distributed within various income or education groups when controlling for differences in need of care.

When analyzing health care in England, Morris, Sutton and Gravelle (2005) also find that inequalities exist in a universal health care system with respect to education levels. Through a multiple regression analysis using Health Service for England data, they find evidence in line with Van Doorslaer, Koolman and Jones' findings. They observe that those who have lower education attainment are more likely to visit their general practitioner. Possible explanations for this finding may be that low socio-economic status groups visit the general practitioner for non-health reasons more often than other groups or that there may be unobserved morbidity factors positively related to low socio-economic status.

Rather than years of schooling, an alternative measurement for education could be the level of health information. This is the approach Dwyer and Liu (2012) take when analyzing visits to physicians and the emergency room. Dwyer and Liu focus on the role health information has on number of visits to the physician's office. Researchers such as Kenkel (1990) and Hsieh and Lin (1997) have previously discovered that a direct relationship exists between level of consumer health information and years of schooling. In their empirical analysis, Dwyer and Liu confirm past findings that the coefficient on education is positive and significantly associated with non-physician health information seeking by patients.

Using the United States Community Tracking Study Household Surveys to estimate OLS, tobit, and probit models they consistently find that more health information leads to higher use of physician services. Since health information and education move in the same direction, it can be inferred that those who are more educated will use physician services more. Their analysis contradicts findings in Van Doorslaer, Koolman and Jones (2003) and in many studies presented in section 2.2. This study sheds light on the possibility that not only do financial barriers affect the delivery of health care, but lack of information, i.e. education, could be another important access barrier too.

Syse, Haegeland, and Ronning (2013) investigate the social inequality issue by researching cancer treatment in Norway. The purpose of their analysis is to discover whether the establishment of regional cancer wards exploits the existence of differential treatment based on education. Several studies document that there are fewer complications and greater survival chances at national, as opposed to local, hospitals (Syse et al. 2013). From 1980 to 2000, many new local cancer wards opened and hospital transfer guidelines became stricter. Patients were sent to local hospitals based on home address and transferred to national hospitals only if specialized treatment was essential.

Their difference-in-difference study indicates that during this period, cancer survival probability significantly fell for patients holding a university degree. This shows that a reduction in treatment inequality based on education occurred because, before heavy decentralization, patients with a university degree were more likely to transfer to national hospitals than those without a degree. The authors explain that survival probabilities fell for the higher educated because due to stricter transfer guidelines, they were unable to use information or competency advantages to acquire better care at national hospitals.

The empirical analyses in this section provide evidence for the existence of barriers to access medical attention, even in universal health care systems. Van Doorslaer, Koolman and Jones (2003) find that those who are more educated, as opposed to the less educated, will utilize more specialist services, but less general practitioner services. Morris, Sutton and Gravelle (2005) reinforce the latter finding. Dwyer and Liu (2012) focus specifically the role health knowledge has on visits to the physician's office and explain that health knowledge and education have a positive relationship. Their results give an opposing view to the first two studies, since they discover that more health information and hence education leads to higher use of all physician services. Syse, Haegeland, and Ronning (2013) do not specifically analyze physician services but through an in-depth analysis about cancer treatment they find strong evidence that social inequality occurred in Norway before implementation of strict treatment guidelines.

3.0 METHOD OF ANALYSIS

3.1 Introducing the Model

To test whether individuals who are more educated utilize family physician services less frequently, a health care demand model is estimated with a focus on family physician care. The general function of the model is as follows:

$$S_{it} = f(E_{it}, P_{it}, H_{it}, A_{it}, e_{it}) \qquad (1)$$

Where i= region within Canada (province), t= time period (year)

Family physician services (S_{it}) is measured as the real dollar value of the provincial health care expenditure incurred on family physician services. This dependent variable is expressed as a function of education (E_{it}), number of family physicians (P_{it}), health indicator (H_{it}), and age (A_{it}). A random error term is also included in the model (e_{it}).

The family physician variable was calculated using the number of family physicians in a province divided by that province's population. The education variable is the percentage of a province's population that holds an undergraduate degree in that particular year. The health indicator is the mortality rate by province; it gives a sense of overall health for each province's population. The age variable is the percentage of persons aged 65 and above in each province's population. The rationale behind including these independent variables in the model is discussed in section 4.2.

The variable of interest is education, as it is theorized to potentially have an impact on the demand for medical care. All other variables are simply control variables so that it can be tested whether education determines demand for family physician services in isolation from the effects of other expenditure determinants. S_{it}, P_{it}, E_{it}, and A_{it} are measured as "per capita" variables (divided by population of the respective province) to eliminate the heteroskedasticity issue associated with the cross section component of pooled data.

3.2 Data Explanation and Sources

The family physician care demand model, as specified in the previous section, is estimated using pooled time series data for all Canadian provinces for the period 1996 to 2008. The study is limited to a thirteen-year period due to data constraints.[12] The cross-section is comprised of the ten Canadian provinces. The three territories are excluded because not enough data are available for the time period examined. The data sources used are the Canadian Institute for Health Information (CIHI) and Statistic Canada's socio-economic database (CANSIM). Appendix A1 identifies the statistical tables containing each variable and explains important calculations.

The impact of the education variable on family physician service utilization is the focus of this paper. As reviewed in section 2.2, the relationship between this variable and health outcomes or service utilization has been studied in many different settings using various methodologies. For example, Wagstaff (1986) and Garrison (1972) modify the production function for health status with a focus on education, while Pohlmeier and Ulrich (1995) and Bago d'Uva and Jones (2009) formulate their own models to test the effect of education. A common control variable within all the health care demand regressions is an indicator for health status, which is why this control variable is in equation (1). The number of persons over 65 and number of family physicians are also included as explanatory control variables because according to CIHI's National Trend

[12] The publicly available data for number of family physicians on the Canadian Institute for Health Information website start in 1996. The table in Statistic Canada's socio-economic database used to obtain the education variable (477-0014) extends to 2008.

Expenditures Report for 1975 to 2012, they are important determinants of the health care expenditure amount being spent in each province.

Family Physician Services Expenditure. This is the dependent variable in the model, measured in real dollar amounts (2002 dollars). For the past six years, physician services expenditure has been one of the fastest growing categories out of the nine areas of health care spending in Canada (CIHI, 2012b, p.31). The CIHI Data Tables for National Health Expenditure Trends only contain nominal amounts for overall physician services by province. The calculations used to arrive at an estimate for family physician services each year provincially involve slightly complicated calculations and a few necessary assumptions. The steps taken to calculate the dependent variable are fully explained in Appendix A1. The assumptions needed for the derivation are as follows:

1. The percentage split between Alternative Payment Plan (APP) family physician services and Fee for Service (FFS) family physician services is the same for clinical and non-clinical physicians.
2. The APP percentages of payments are only recorded in the CIHI National Physician Database Data Releases for 2006 and beyond. To obtain APP percentages for previous years, the assumption is that the growth of APP percentages is constant. This constant growth rate is calculated using the average of the growth of the growth rate for APP percentages from 2006 to 2008. Working backwards from 2006, the percentage of APP payments is decreased (or increased) for by this amount.
3. Using the above method, the APP percentage for Ontario becomes negative in 2001. Since that does not make sense, all values from 1996-2001 for Ontario are assumed to be 0. This truncates the APP percentage observations at zero, but is

not a major econometric issue since this is a preliminary step in calculating the dependent variable. Total average family physician payments (which is APP and FFS combined) is therefore smaller than what it should be in reality, however no ordinary least squares assumptions are violated when estimating the model.

4. The Alberta and Nova Scotia provincial governments give CIHI the clinical payments for all physicians collectively. Therefore, for these two provinces, this percentage is applied to both APP family medicine and specialist doctors.

Family physician services expenditure reflects variations in the "number of family physician services" because each service provided comes with a price that is recorded in the physician category of heath care spending. Hence, this variable allows a test of whether education level affects the utilization of family physician services. It is important to note that that since the dependent variable consists of only family medicine services data, rather than all physician services data combined, this empirical model avoids the inconsistent estimates problem that Pohlmeier and Ulrich (1995) assert would occur if general practitioner and specialist physician data are pooled into the same model. Intuitively, it would not make sense to put all physicians into one model because patients typically have the ability to choose general practitioner services while the general practitioner recommends specialist services.

Level of Education. The total number of people holding an undergraduate university degree in a given year is found in the CANSIM database (Table 282-0004). This variable is chosen in order to test whether educational attainment of a population influences the family physician services expenditure. Though there is conflicting evidence regarding the effect education has on health care services, the dominant view appears to support the efficiency-education viewpoint. This means that those who are more educated should demand less family physician services. Thus, based on the majority of literature presented in section 2, E_{it} is expected to have a negative coefficient.[13]

The Number of Family Physicians. This variable includes the number of family physicians in each province and the yearly values are obtained from the CIHI Supply, Distribution, and Migration of Canadian Physicians reports. These numbers are comprised of active physicians in clinical and non-clinical practice who have a MD degree and valid mailing address. Those who are residents, physicians in the military, semi-retired or retired are not included.

The variable is included in the model to capture the effects of the supply side of family physician care. Hansen and King (1996) explain that a common misspecification issue of demand models is the tendency to assume the supply side is passive. The two researchers emphasize that when modelling the demand for health care one must realize that even if the public demands more health care, they may not be able to receive it if not enough doctors or hospital beds are available. This especially occurs under public or non-market healthcare systems where supply adjusts with significant lags.

In this case, if not enough family doctors are available in a given area, some members of society will have to seek an alternative option when needing medical attention. They may choose to substitute general practitioner visits with visits to a hospital's emergency room. Since emergency room visits are not available on any public dataset provincially and for this time frame, number of general practitioners per capita is used as a proxy

[13] Note that there are a couple sources in the literature review (e.g. Wagstaff (1986) and Dwyer and Liu (2012)) that find a positive relationship between education and general practitioner services. Therefore, it would not be completely surprising if the empirical results show that education positively affects the family physician services expenditure.

variable for the substitution effect. Hence, if P_{it} increases S_{it} is expected to increase as well.

Health Indicator. Variable H_{it} is the mortality rate for each province, which is recorded in CANSIM (Table 102-0504). Statistics Canada (2001) states that this statistic is a well-established measure to signify the overall health of a population. It defines this measure as "crude rate and age-standardized rate of death from all causes per 100,000 population" (Statistics Canada, 2001). A more accurate measure for the health of a given population would be the morbidity rate, but unfortunately this statistic is not publicly available at the provincial level, only for Canada as a whole.

CIHI's National Health Expenditure Trends Report (2012b) identifies population health needs as a determining factor of health care expenditure amount. Intuitively it makes sense that amount of family physician services utilized would be greater in an area with poor health; therefore, it is expected to have a positive coefficient and must be controlled for in the regression equation.

Number of Persons over 65. Another important determinant of health expenditures explained in the 2012 CIHI National Health Expenditure Trends Report is age distribution of the population. Aging populations are expected to have higher health care costs, as seniors typically require more health care services than younger generations. To control for the "senior" effect, number of persons over age 65 are included in the regression. These figures are obtained from Statistics Canada in CANSIM database (Table 510-001).

3.3 The Empirical Model

The general model described in section 3.1 is estimated using a fixed effects model[14] of the following form:

$$S_{it} = \beta_1 + \sum_{i=2}^{10} \beta i Di + \beta_{11}E_{it} + \beta_{12}P_{it} + \beta_{13}H_{it} + \beta_{14}A_{it} + e_{it} \qquad (2)$$

Where “i” denotes a province and “t” denotes a year starting from 1996 to 2008. Each notation is described here:

S_{it} = Family physicians services expenditure (2002 dollars)

D_i = Dummy variables representing each province

E_{it} = Percentage of population with an undergraduate degree

P_{it} = Family physicians per-capita

H_{it} = Health indicator: mortality rate

A_{it} = Percentage of population over 65 years old

e_{it} = Error term

Kennedy (1985) suggests using dummy variables to account for the cross section component of data when pooling cross-sectional and time series data because intercepts could vary across each cross-section. In this empirical model, it is likely that the intercepts will vary across provinces as unobservable province-specific factors influence the family physician services expenditure. These factors could include how far individuals typically have to travel to get to a doctor’s office, prevalence of alternative medicine, and differences in climate or weather. To control for these unobservable aspects, there is a time invariant term (D_i) representing each province.

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[14] Fixed effects model is an approach used when the average of the dependent variable is expected to be different for each cross-section (i.e. province).

To get ride of time invariant variables that might confound the analysis, fixed effects models demean the dependent and independent variables. Essentially, the within-subject mean for each variable is subtracted from the observed values of the variable. Therefore, within each subject the demeaned variables will have a mean of zero. For time-invariant variables, the demeaned variables have a value of zero; these variables are therefore eliminated from any further analysis because they are constants. Using this method, all between-subject variability is gone and only within-subject variability is left.

4.0 EMPIRICAL RESULTS

4.1 Discussion of Econometric Results

Table 4 reports the estimation results for the health care demand model. The correlation matrix of coefficients shown in Table A2.1 of Appendix A2 gives evidence that no severe multi-collinearity exists between any of the explanatory variables.

Table 4. Fixed effects estimation results for family physician services (S)

Family physician services (S)	Fixed effects (1)	Fixed effects with robust standard errors (2)
Education (E)	19.592	19.592
	(2.837)***	(8.129)**
Family physicians (P)	1573.144	1573.144
	(407.830)***	(797.439)*
Health indicator (H)	-0.153	-0.153
	(0.081)*	(0.086)*
Age (A)	3.267	3.267
	(5.573)	(12.042)
Constant	-0.596	-0.596
	(0.601)	(0.831)
Observations	130	130
rho	0.926	0.926
Corr(provincial dummies, regressors)	-0.548	-0.548

***, **, * indicates significance at the 1%, 5%, and 10% level respectively. Standard errors are presented in parentheses. These results are computed from the fixed effects specification (2) over the 1996-2008 sample period. Sources: Statistics Canada (2008) CANSIM Table number 4770014. "University degrees, diplomas and certificates granted, by program level, Classification of Instructional Programs, Primary Grouping (CIP_PG) and sex, annually: number". Statistics Canada (2009) CANSIM Table number 1020504 "Deaths and mortality rates, by age group and sex, Canada, provinces and territories, annually". Statistics Canada (2012) CANSIM Table number 510001. " Estimates of population, by age group and sex for July 1, Canada, provinces and territories, annually; persons". Canadian Institute for Health Information: Supply, Distribution, and Migration of Canadian Physicians reports. For data sources used in the calculation of "family physician services" variable please refer to Table A1.1.

The sign of the coefficient for education contradicts the hypothesis that promoting education will decrease the family physician services expenditure. If the percentage of the population holding an undergraduate degree increases by one percentage point, family physician services utilized will increase by about 20 dollars on average. This observation also contradicts many of the empirical studies discussed in section 2.0. However, some empirical analyses such as Wagstaff (1986) as well as Dwyer and Liu (2012) find that education positively impacts health care services. Following Wagstaff's (1986) explanation it is possible that the positive coefficient is due to higher educated people having a better relationship with the family physician, which could result in more visits to the doctor's office. Additionally, those with lower education might refrain from seeing their family doctor if they believe they will be prescribed medication that they will have to pay for (at least partially) out of pocket. Higher education typically correlates with higher income so this may not affect the decision to visit a family physician for those who have more education.

For every percentage point increase in family physicians per-capita, family physician services utilized will increase by approximately 1573 dollars on average. This signifies that the substitute (i.e. emergency room visits) becomes less attractive to less severe cases and that individuals prefer to go to their family doctor than the emergency room.

As the mortality rate increases by one unit, family physician services utilized will decrease on average by about 15 cents. This health indicator does not positively affect the family physician services variable as originally expected. This finding questions whether mortality rate is a good choice to use for the health indicator. Intuitively it makes sense that as more individuals die, less family physician services would be needed; therefore, this variable may not be properly controlling for health of the population. A better option would have been the morbidity rate, as stated in section 3.2.

Although CIHI (2012b) explains that an important determinant of future provincial health care expenditures is the percentage of people over 65, the age variable is the only explanatory variable (other than the constant) not statistically significant at the ten percent level. In the Health Care in Canada 2011 report CIHI states that even though seniors use proportionally more health care services than non-senior adults, population aging in Canada has caused health care spending to increase by only 0.8 percent each year for the past decade (CIHI, 2011a). This 0.8 percent increase is for the nine expenditure categories all together, so it makes sense that senior utilization for one part of one category (family physicians) is not large enough to be statistically significant.

If the homoskedasticity and no serial correlation OLS assumptions are violated, the standard errors in column (1) are smaller than their true size. This would mean that the t-ratios are artificially inflated which could cause an incorrect conclusion that a given variable is significantly different than zero, also known as a Type I error. In their *Introduction to Econometrics* textbook, Stock and Watson (2003) explain, "At a general level, economic theory rarely gives any reason to believe that the errors are homoskedastic. It is therefore prudent to assume that errors might be heteroskedastic unless you have compelling reasons to believe otherwise" (p. 128-129). To verify that heteroskedasticity exists, the Modified Wald test for group-wise heteroskedasticity is conducted. The null hypothesis of constant variance across cross-sectional units is rejected at all significance levels since the chi-squared statistic is 510.51 and p-value is 0.000. Serial correlation is tested for using the Wooldridge test for autocorrelation in panel data; the null hypothesis is that no first order autocorrelation is present in the model. With a F-statistic of 77.809 and p-value of 0.000, this null is rejected at all significance levels.

In order to obtain proper inferences from the family physician services model, the violation of these two OLS assumptions must be corrected for. The Stata longitudinal data/panel data reference manual (2011, p.470) describes that applying robust standard errors to the model will produce efficient OLS estimators when the disturbances have serial correlation or are not identically distributed over panels. Column (2) in Table 4 presents the fixed effects estimates with robust standard errors. Education, health indicator, and family physicians still remain significant at the ten percent level.

The between, within, or overall R-squared values are not reported in Table 4 because they would not provide the typical R-squared explanation. One way to obtain a correct estimate of the R-squared statistic is to manually create dummy variables for each cross-section and run a regular OLS regression (Indiana University, 2012). In this equation, the explanatory variable coefficients would the same as those in the fixed effects model. After running this OLS model in Stata, the adjusted R-squared value obtained is 0.890. This means that about 89 percent of the variation in family physician services can be explained by the explanatory and provincial dummy variables included in the regression equation.

Estimating a fixed effects model eliminates problems of omitted variable bias due to due to time invariant factors. This type of regression essentially adds a constant for each cross-section, so all of the time invariant unobserved heterogeneity for an observation is captured within its corresponding constant. Table 5 shows that the constant for each province is necessary because the null hypothesis that all provincial dummies are equal to zero is rejected at all significance levels. Also, this table exhibits that the fixed model in its entirety is of importance because the null that the coefficients for all independent variables are equal to zero is also rejected at all significance levels.

Table 5. F-tests for family physician services fixed effects regression

H_0: all independent variables = 0, **H_A:** not H_0	
F(4,116)	66.61
p-value	0.000***
H_0: all provincial dummy variables = 0, **H_A:** not H_0	
F(9,116)	74.93
p-value	0.000***

***, **, * indicates significance at the 1%, 5%, and 10% level respectively. These results are computed from the fixed effects specification (2) over the 1996-2008 sample period.

Rho is known as the intra-class correlation or, alternatively, the fraction of variance due to provincial specific fixed heterogeneity. Its value in Table 4 shows that 92.6 percent of the variance is due to differences across provinces. Corr(provincial dummies, regressors) represents the correlation coefficient between the provincial specific fixed effects and the independent variables. If unobserved factors affecting provincial spending in family physician services increases, the regressors collectively would decrease by 54.8 percent. Both rho and the correlation coefficient support the finding that provincial dummies should not be omitted in the regression.

Another common way to estimate panel data is by using the random effects model. The main assumption of this type of regression is that the individual heterogeneity term is not correlated with any of explanatory variables. The correlation coefficient of -0.539 between dummy variables and regressors appears to support that the fixed effects model is the appropriate specification, but to confidently decide which is the suitable model a Hausman test should be conducted. The null hypothesis is that both methods are consistent, but the random effects model is efficient versus the alternative hypothesis that the fixed effects model is the consistent model. In the appendix, Table A2.2 reports the full results from this statistical test. The null is rejected at the five percent level because the chi-squared value is 12.55 and p-value is 0.014; therefore, the fixed effects model is the correct model to estimate.

5.0 CONCLUSION AND RECOMMENDATIONS

5.1 Summary of the Study

The purpose of this study is to investigate the impact educational attainment of the Canadian population has on the family physician services expenditure. This is an important issue to address because physician services expenditure has been the fastest growing component of the health care expenditure over the past five years (CIHI, 2011b, 2012a). The reason why family, and not all, physicians is the focus of this essay is to avoid inconsistent estimates that arise when all physicians are analyzed within a single model (Pohlmeier and Ulrich, 1995) and because the family doctor is the first point of contact when an individual wishes to seek non-emergency medical attention.

The Canadian government has recently implemented health care funding cuts, but in order to effectively control costs in the long run, policies addressing the sources of this increasing health care budget should be put into place. It is hypothesized that if education has a negative relationship with healthcare services then encouraging more Canadians to attain more education, in particular health education, could be one way to help prevent future health care cost escalation.

A fixed effects health care demand model is estimated using panel data for the ten Canadian provinces covering the period of 1996 to 2008. Based on the literature review in section 2 and the 2012 CIHI National Health Expenditure Trends Report, factors speculated to be important determinants of the health care expenditure are entered into the regression as control variables. These control variables include family physicians per capita, a health indicator, and percentage of people over 65. The results of this panel data analysis indicate that education is positively related to family physician services. This is the opposite of what was originally postulated, but based on results from empirical analyses such as Wagstaff (1986), Garrison (1978), and Dwyer and Liu (2012) it is not an unexpected finding. Increasing education levels therefore appears to not be an effective remedy to the growing health care expenditure issue.

5.2 Recommendations for Future Research

This study is limited in scope as the analysis focuses only on the utilization of family physician services by provinces in aggregate. The usage of family physician services may vary for different demographic groups in the population. Perhaps education would have a different effect on family physician services utilized if the population was split into gender, cultural, age, or religious groups.

Some demographic groups make more frequent use of physician services than others. For example, the Centers for Disease Control and Prevention (2001) conducted a study which shows that even when pregnancy visits are controlled for, women are 33 percent more likely to visit a physician than were men (p. 2). Also, it finds that visits concerning annual examinations and preventative care are observed to be 100 percent higher for women compared to men. This indicates that the demand curve for physician services is likely to be quite different for women and men and thus should be analyzed separately. An examination of family physician services utilized by gender is not done in this study because the physician services expenditure is not separated into male and female counterparts.

The rate at which people visit the doctor can also depend on their religious group. Koenig, McCullough, and Larson (2001) discuss why it is important for studies to examine the use of health services by members of different religious groups. The usage rates for people in religious groups can vary considerably, depending on the intensity of religious belief, practice, and commitment. They also explain that some religious groups are at a higher risk than others for certain mental illnesses, such as depression. Many studies observe that members of the Judaism religion are at a higher risk for mental disorder (Koenig et. al, 2001 survey some of these studies). This can lead to more use of family physician services because people with mental disorders typically require more care and medication.

Cultural values can affect the quantity of physician services demanded. Falvo (2004) explains that individuals within certain cultures do not seek professional medical advice because it viewed as a weakness. In others cultures, women would rather go to older women family members than practitioners for medical care. Immigration Watch Canada (2010) affirmed that for the last twenty years, Canada has admitted approximately 250,000 immigrants annually from diverse cultural backgrounds. As Canada becomes more multi-cultural, the rates of public health care utilization will change; therefore, studying the effects of cultural change is important for future research on demand for physician services.

Another recommendation for future research would be to split education into different levels and test the impacts on physician service utilization. It is possible that attainment of an undergraduate degree in the population would have a less significant impact on physician services utilization than would a graduate degree.

The last suggestion for future research pertains to the different types of health care expenditures. Education may have a significant effect on other types of expenditures, such as other health care professionals, and this relationship could be investigated in future research. Unfortunately, time constraints on this essay only allowed for testing one type of expenditure and education level. A more in-depth analysis on the topic of education and utilization of different health services would provide a more holistic explanation about the relationship between education and the increasing health care expenditure.

6.0 REFERENCES

Bago d'Uva, T., & Jones, A. M. (2009). Health care utilisation in Europe: new evidence from the ECHP. *Journal of health economics*, *28*(2), 265-279.

Bago d'Uva, T., Jones, A. M., & Van Doorslaer, E. (2009). Measurement of horizontal inequity in health care utilisation using European panel data. *Journal of health economics*, *28*(2), 280-289.

Becker, G. S. (1976). *The economic approach to human behavior*. Chicago: University of Chicago Press.

Berger, M., & Leigh, J. (1989). Schooling, self-selection, and health. *The Journal of Human Resources*, *24*(3), 433-455.

Breyer, F., Kifmann, M., & Zweifel P. (2009). *Health economics*. Oxford University Press.

Canadian Institute for Health Information (2012a). Canada's health care spending growth slows. Retrieved July 17, 2013, from http://www.cihi.ca/cihi-ext-portal/internet/en/document/spending+and+health+workforce/spending/release_30oct12

Canadian Institute for Health Information (2012b). National health expenditure trends 1975-2012, 1-178. Retrieved July 17, 2013, from https://secure.cihi.ca/free_products/NHEXTrendsReport2012EN.pdf

Canadian Institute for Health Information (2011a). Health care in Canada, 2011: a focus on seniors and aging. Retrieved August 16, 2013 from https://secure.cihi.ca/free_products/HCIC_2011_seniors_report_en.pdf.

Canadian Institute for Health Information (2011b). Health spending to reach $200 billion in 2011. Retrieved July 17, 2013, from http://www.cihi.ca/cihi-ext-portal/internet/en/document/spending+and+health+workforce/spending/release_03nov11

Canadian Medical Association (1994). Number of physicians by province/territory and specialty, Canada. Historical Data. Retrieved July 17, 2013 from http://www.cma.ca/historical%20data

Centers for Disease Control and Prevention (2001). Utilization of ambulatory medical care by women: United States, 1997–98. *Vital Health and Statistics* , *13*(149), 1-50.

Dwyer, D. S., & Liu, H. (2012). The impact of consumer health information on the demand for health services. *The Quarterly Review of Economics and Finance*.

Evans, R.G., (1984). *Strained mercy. The economics of Canadian health care*. Toronto: Butterworths.

Falvo, D. R. (2004). *Effective patient education: a guide to increased compliance* (3rd ed.). Sudbury, Mass.: Jones and Bartlett Publishers.

Fekete, J. (2012). Federal health cuts would dram $36B from provincial coffers, premiers warn. *Canada.com.* Retrieved from http://o.canada.com/2012/07/27/federal-health-cuts-would-drain-36b-from-provincial-coffers-premiers-warn/.

Folland, S., Stano, M., & Goodman, A. C. (2004). *The economics of health and health care* (4th ed.). Upper Saddle River, NJ: Pearson/Prentice Hall

Freund, D. (1986). On national health insurance and health services planning. *NCBI*. Retrieved July 17, 2013, from www.ncbi.nlm.nih.gov/pmc/articles/PMC1072215/pdf/hsresearch00530-0099.pdf

Fuchs, V. R. (1982). Time preference and health: an exploratory study. *NBER working paper series.* No. 539.

Fuchs, V. R. (1979). Economics, health, and post-industrial society. *The Milbank Memorial Fund quarterly. Health and society*, 153-182.

Garrison, L. (1978). Studies in the economics of surgery. Stanford: Stanford University.

Gilleskie, D. (2008). Health Capital: Theory and Empirical Evidence. *Incentives and Choice in Health Care MIT Press: Cambridge, MA*.

Grossman, M. (1999). *The human capital model of the demand for health* (No. w7078). National Bureau of Economic Research.

Grossman, M. (1976). The correlation between health and schooling. In *Household production and consumption* (pp. 147-224). National Bureau of Economic Research.

Grossman, M. (1972). On the concept of health capital and the demand for health. *The Journal of Political Economy*, 80(2), 223-255.

Hansen, P., & King, A. (1996). The determinants of health care expenditure: A cointegration approach. *Journal of Health Economics*, *15*, 127-137. Retrieved July 1, 2013 from the ScienceDirect database (10.1016/01676296(95)00017-8).

Hsieh, C. R., & Lin, S. J. (1997). Health information and the demand for preventive care among the elderly in Taiwan. *Journal of Human Resources*, 308-333. Retrieved July 19, 2013 from the Jstor database.

Hutchison, B., Abelson, J., & Lavis, J. (2001). Primary care in Canada: so much innovation, so little change. *Health Affairs*, *20*(3), 116-131.

Indiana University. (2012*). In Stata, why does .xtreg return an R-squared statistic for* *fixed-effects models that is different from that reported in SAS and LIMDEP?*. Retrieved August 14, 2013, from http://kb.iu.edu/data/auur.html

Immigration Watch Canada. (2010). *Canada's annual intake of 250,000 immigrants is too high and makes no sense*. Retrieved August 1, 2013, from http://www.immigrationwatchcanada.org/

IRMACS. (2006). Modelling the demand for healthcare. Burnaby, BC: Author.

Jiménez-Martín, S., Labeaga, J. M., & Martínez-Granado, M. (2004). An empirical analysis of the demand for physician services across the European Union. *The European Journal of Health Economics, formerly: HEPAC*, *5*(2), 150-165.

Kenkel, D. (1991). Health behaviour, health knowledge, and schooling. *Journal of Political Economy*, *99*(2), 287-305.

Kenkel, D. (1990). Consumer health information and the demand for medical care. The Review of Economics and Statistics, 72(4), 587–595.

Kennedy, P. (1985). *A guide to econometrics* (2nd ed.). Cambridge, Mass.: MIT Press.

Koenig, H. G., McCullough, M. E., & Larson, D. B. (2001). *Handbook of religion and health*. Oxford: Oxford University Press.

Leu, R. E., Gerfin, M., & Spycher, S. (1992). The Validity of the MIMIC health index some empirical evidence. In *Health Economics Worldwide* (pp. 109-142). Springer Netherlands.

Lleras-Muney, A. (2005). The relationship between education and adult mortality in the United States. *Review of Economic Studies*, *72*, 189-221.

Morris, S., Sutton, M., & Gravelle, H. (2005). Inequity and inequality in the use of health care in England: an empirical investigation. *Social science & medicine*, *60*(6), 1251-1266.

Osborne, J. (2002). Notes on the use of data transformations. *Practical Assessment, Research & Evaluation*, 8(6).

Munshi, S. (2013). *Health spending projections through 2014: changes on the horizon*. Retrieved September 3, 2013, from http://www.hhmglobal.com/knowledge-bank/articles/health-spending-projections-through-2015-changes-on-the-horizon.

Pohlmeier, W., & Ulrich, V. (1995). An econometric model of the two-part decisionmaking process in the demand for health care. *Journal of Human Resources*, 30(2), 339-361.

Rathwell, T. (1994). Health care in Canada: a system in turmoil. *Health Policy*, *27*(1), 5-17.

SHAZAM Pooling by OLS. (n.d.). *An introductory guide to SHAZAM*. Retrieved July 1, 2013, from http://shazam.econ.ubc.ca/intro/poolols

Stata (2011). *Stata Longitudinal-Data/Panel-Data Reference Manual: Release 11*. Stata Press.

Statistics Canada (2001). "Definitions and data sources". *Health Indicators*. Last updated June, 2001. http://www.statcan.gc.ca/pub/82-221-x/00601/4061270-eng.htm.

Stock, J. H., & Watson, M. W. (2003). *Introduction to econometrics* (Vol. 104). Boston: Addison Wesley.

Syse, J. H. F., Hægeland, T., & Rønning, M. (2013). *Access to treatment and educational inequalities in cancer survival*. Research Department of Statistics Norway.

Van Doorslaer, E., Koolman, X., & Jones, A. M. (2003). Explaining income related inequalities in doctor utilisation in Europe: a decomposition approach. *ECuity II Project*.

Wade A. & Koutoumanou E (2010). Summarising Data. In *Statistics & research methodology* (chap. 3).

Wagstaff, A. (1986). The demand for health: some new empirical evidence. *Journal of Health economics*, *5*(3), 195-233.

Wagstaff, A., & Van Doorslaer, E. (2000). Measuring and testing for inequity in the delivery of health care. *Journal of Human Resources*, 716-733.

APPENDIX

A1: Data Sources and Calculations

General function of the model: $S_{it} = f(E_{it}, P_{it}, H_{it}, A_{it}, e_{it})$

Deriving the dependent variable (S)

For each province annually this is the methodology used to derive "Physician services expenditure pertaining to family medicine (per capita)":

A. Fulltime equivalent (FTE) fee-for-service (FFS) family medicine average payments
   Note: A practitioner is considered FTE if he or she is billing within a certain top percent of physicians of the province. The benchmark percentages CIHI uses are updated periodically.
B. Alternative payment plan (APP) family medicine average payments
C. Total family medicine payments = A+B

D. FTE FFS all other physician average payments
E. APP all over physician average payments
F. Total other physician average payments = D+E

G. Percentage of payments pertaining to family medicine = C/(C+F)
H. Total physician expenditures (constant 2002 dollars) = Total physician expenditures (current dollars)/GDP deflator
   Note: GDP Deflator = Nominal GDP/Real GDP
I. Physician services expenditure pertaining to family physician services = G*H

J. Physician services expenditure pertaining to family physician services (per capita) = I/Population

Table A1.1 Data sources used in steps A to J

Step	Data	Source
A, D	Fee-for-service average payments	Canadian institute for Health Information (CIHI) Average payment per Physician Reports (1996-1997 to 2004-2005) CIHI Physicians in Canada: Average Gross Fee-for-Service Payments (2005-2006) National Physician Database Data Releases (2006-2007 to 2008-2009)
B, E	Alternative payment plan payments	CIHI National Physician Database Data Releases (2006-2007 to 2008-2009)*
H	Current dollar value of the provincial health expenditure incurred on physician services	CIHI Data Tables for National Health Expenditure Trends: Series D1
H	Nominal GDP	CANSIM Table 3790025
H	Real GDP	CANSIM Table 3840002
J	Population	CANSIM Table 510001

*Gross APP payments are not recorded in these documents. In order to estimate APP average payments, I used the available data about clinical payments relating to APP physicians to estimate a percentage of gross FFS payments that would pertain to APP physicians.

Assumptions needed to calculate the dependent variable:

1. The percentage split between Alternative Payment Plan (APP) family physician services and Fee for Service (FFS) family physician services is the same for clinical and non-clinical physicians.
2. The APP percentages of payments are only recorded in the CIHI National Physician Database Data Releases for 2006 and beyond. To obtain APP percentages for previous years, the assumption is that the growth of APP percentages is constant. This constant growth rate is calculated using the average of the growth of the growth rate for APP percentages from 2006 to 2008. Working backwards from 2006, the percentage of APP payments is decreased (or increased) for by this amount.
3. Using the above method, the APP percentage for Ontario becomes negative in 2001. Since that does not make sense, all values from 1996-2001 for Ontario are assumed to be 0. This truncates the APP percentage observations at zero, but is not a major econometric issue since this is a preliminary step in calculating the dependent variable. Total average family physician payments (which is APP and FFS combined) is therefore smaller than what it should be in reality, however no ordinary least squares assumptions are violated when estimating the model.
4. The Alberta and Nova Scotia provincial governments give CIHI the clinical payments for all physicians collectively. Therefore, for these two provinces, this percentage is applied to both APP family medicine and specialist doctors.

Table A1.2 Independent variables explanations

	Description	Source	Calculation
E	Percentage of population who have graduated with a university undergraduate degree in a given year	CANSIM Table 477-0014: Degrees granted annually (number of persons)	Education (number of persons) /population
P	Percentage of population who are family physicians*	Canadian Institute for Health Information: Supply, Distribution, and Migration of Canadian Physicians reports	Number of family physicians /population
H	Health indicator: mortality rate	CANSIM Table 102-0504: Mortality rates, annually	N/A
A	Percentage of province population above 65 years old	CANSIM Table 051-001: Estimates of population by age group (65+) annually (Persons)	Total number of people over 65/population

*Number of family physicians includes active family doctors in clinical and non-clinical practice who have an MD degree and a valid mailing address. Those who are residents, physicians in the military, semi-retired or retired are not included.

<u>A2:</u> Additional OLS Estimation Results

A2.1. Correlation matrix for regressors within family physician services fixed effects regression

	Education (E)	Family physicians (P)	Health indicator (H)	Age (A)
Education (E)	1.000			
Family physicians (P)	0.222	1.000		
Health indicator (H)	-0.491	-0.019	1.000	
Age (A)	0.026	0.132	0.777	1.000

These results are computed from the fixed effects specification (2) over the 1996-2008 sample period. Sources: Statistics Canada (2008) CANSIM Table number 4770014. "University degrees, diplomas and certificates granted, by program level, Classification of Instructional Programs, Primary Grouping (CIP_PG) and sex, annually: number". Statistics Canada (2009) CANSIM Table number 1020504 "Deaths and mortality rates, by age group and sex, Canada, provinces and territories, annually". Statistics Canada (2012) CANSIM Table number 510001. " Estimates of population, by age group and sex for July 1, Canada, provinces and territories, annually; persons". Canadian Institute for Health Information: Supply, Distribution, and Migration of Canadian Physicians reports.

A2.2 Hausman test for fixed effects versus random effects family physician services regressions

Family physician services (S)	Coefficients			
	Fixed effects (b)	Random effects (B)	Difference (b-B)	Standard error
Education (E)	19.592	19.067	0.525	0.830
Family physicians (P)	1573.144	1360.451	212.693	108.696
Health indicator (H)	-0.153	-0.101	-0.051	0.022
Age (A)	3.267	4.530	-1.263	1.530
$\mathbf{H_0}$: b and B are consistent but B is efficient, $\mathbf{H_A}$: b is consistent				
Chi2(4)	12.55			
p-value	0.014**			

***, **, * indicates significance at the 1%, 5%, and 10% level respectively. The sample period is 1996-2008. Sources: Statistics Canada (2008) CANSIM Table number 4770014. "University degrees, diplomas and certificates granted, by program level, Classification of Instructional Programs, Primary Grouping (CIP_PG) and sex, annually: number". Statistics Canada (2009) CANSIM Table number 1020504 "Deaths and health indicator rates, by age group and sex, Canada, provinces and territories, annually". Statistics Canada (2012) CANSIM Table number 510001. " Estimates of population, by age group and sex for July 1, Canada, provinces and territories, annually; persons". Canadian Institute for Health Information: Supply, Distribution, and Migration of Canadian Physicians reports. For data sources used in the calculation of "family physician services" variable please refer to Table A1.1.