



# **Estimates for Ontario's Investment in Health Care**

*by*

**Joe Ruggeri and Barry Watson**

**May 2008**

# **Estimates for Ontario's Investment in Health Care**

*by*

**Joe Ruggeri and Barry Watson**

**May 2008**

Joe Ruggeri is Vaughan Chair in Regional Economics and Director of the Policy Studies Centre at the University of New Brunswick. Barry Watson is a researcher with the Policy Studies Centre.

*The Caledon Institute of Social Policy occasionally publishes reports and commentaries written by outside experts. The views expressed in this paper are those of the authors.*

Copyright © 2008 by The Caledon Institute of Social Policy

ISBN 1-55382-278-1

Published by:

The Caledon Institute of Social Policy

401-1390 Prince of Wales Drive

Ottawa, ON K2C 3N6

CANADA

Phone: (613) 729-3340

Fax: (613) 729-3896

E-mail: [caledon@caledoninst.org](mailto:caledon@caledoninst.org)

Website: [www.caledoninst.org](http://www.caledoninst.org)

## Table of Contents

Abstract	1
Introduction	1
Conceptual Issues	2
Conceptual Issues: Investment Criteria	2
Features	2
Uses	2
Valuation	3
Conceptual Issues: Human Capital	4
Conceptual Issues: Civic and Social Capital	6
Methodology	8
Concepts	8
Methods	12
Results	14
Conclusion	16
References	18

## ***Abstract***

Ruggeri and Doucet (2007) presented a new methodology for estimating the proportion of government spending on health care that can be classified as investment. This methodology includes investment criteria based on the properties of physical capital and a dynamic analytical framework for measuring human capital. Using the same methodology, this paper estimates the proportion of health care spending by the Ontario government that may be assigned to investment by analyzing the 2004-05 Public Accounts and 2004 Canadian Institute for Health Information health expenditure data. The results show that over 60 percent of health care spending may be treated as investment.

## ***Introduction***

In a recent contribution, Ruggeri and Doucet (2007) presented a new methodology for estimating the proportion of government spending on health care that can be classified as investment. This methodology includes investment criteria based on the properties of physical capital and a dynamic analytical framework for measuring human capital. They applied it to federal government spending on health care in 2004-05 as recorded in the Public Accounts.

The federal government is not directly involved in the delivery of health care services. Therefore, the results obtained at the federal level cannot be extended to provincial health care spending. To test for differences between the two orders of government, we estimated the share of health care spending by the government of Ontario that may be assigned to investment. For our estimates, we separately used the details contained in the 2004-05 Public Accounts and the information provided for the same year by the Canadian Institute for Health Information (CIHI). The results show that, under both approaches, over 60 percent of health care spending may be treated as investment. The close similarity of the results suggests that the more aggregated approach based on CIHI data is a close approximation to the detailed approach based on the Public Accounts information and can replace it. Our results have important implications for both methodology and public policy.

The National Accounts record investment as spending only on physical capital, although it is generally accepted that spending on education and skill acquisition is also an investment. This practice is even less justifiable if more than half of health care spending can be classified as investment.

Our results suggest that focusing on human capital public policy that takes into account only education spending may also be unwarranted and could lead to misplaced priorities. If a large portion of health care spending is an investment in human capital, then the development of effective policy aimed at human capital requires a joint decision-making process for education and health care.

## *Conceptual Issues*

In theory, health care spending may involve investment in physical, human, social and civic capital. We need consistent definitions and measurements of these forms of capital to determine what portion of health care spending is investment. The definitions found in the literature, however, indicate that they have been developed independently with little effort to maintain consistency among the various forms of capital. This lack of consistency is an impediment to the analysis of government investment and prevents a full evaluation of what percentage of government expenditures on health care should be considered investment. We developed consistent investment criteria based on the features of physical capital because this form of capital is grounded in extensive theoretical research and there is a well-established methodology for its measurement. We also placed the analysis of human capital within a dynamic framework that includes four dimensions: potential, acquisition, availability and effectiveness.

### *Conceptual Issues: Investment Criteria*

The investment criteria that will be applied to health care spending are derived from the main features, uses, and methods of valuation of physical capital.

#### *Features*

Physical capital is characterized by four main features. First, it is a reproducible asset through the decisions of economic agents. Second, since 2001 when computer software was included in fixed capital, it may be tangible or intangible. Third, physical capital is not consumed within the production process and is not incorporated into the final product; thus it possesses a level of survivability. Finally, physical capital is durable as it can be used over an extended period of time.

#### *Uses*

Physical capital is a factor of production because it is used to produce goods and services, which are ultimately demanded by consumers. Therefore, it generates utility for consumers indirectly by producing the goods and services that deliver utility when consumed or used by consumers. In practice, this property is not always observed and sometimes, especially in the case of residential construction – a capital asset delivers utility directly.

The National Accounts identify three categories of physical capital: (i) residential construction, (ii) non-residential construction, and (iii) machinery and equipment. Residential construction is new housing construction, while non-residential construction refers to buildings of industrial and commercial nature, and to engineering works such as roads and dams. For both types of construction, investment includes major renovations and structural changes. Machinery and equipment includes both tangible (e.g., motor vehicles, welding machines, computers) and

intangible (e.g., computer software) goods with an expected useful life of one year or greater. Spending on repairs and maintenance is not considered investment. In all cases, the determination of physical capital is based on the function of the object in question, not its structure or form. For instance, an automobile is treated as a consumption item when purchased by a consumer, but as fixed investment when purchased by a business or government.

### *Valuation*

The recorded value of physical capital is based on the asset's selling price, which incorporates all costs of production and distribution. Some of these costs, however, are not related to the asset's function. For example, the price of a building includes the costs of engineering and site preparation, which are an integral part of the building's performance, and real estate and legal expenses, which are related to the ownership of the building and not to its function. Moreover, part of the engineering and construction costs may be due to the aesthetic properties of a building. To maintain consistency in the treatment of all forms of capital, these special conventions in the National Accounts, which in part reflect the practical difficulties in separating functional from aesthetic components, must be applied uniformly.

For the purpose of analyzing government investment in human, social, and civic capital, two features of the treatment of physical capital in the National Accounts are particularly relevant. First, physical capital includes both tangible and intangible assets. The recent inclusion of computer software produced or acquired by business and government in fixed investment has eliminated the need for special justifications in treating other intangible assets, such as acquired skills, as capital. Second, while physical capital generally provides indirect utility through the production of goods and services, as in the case of residential construction, part of what is treated as capital is no different than consumption. For example, the aesthetic features of a new home do not generate shelter services, but provide direct utility to the owner; yet such costs are included in the value of this capital asset.

These features of physical capital lead to the following criteria for which an asset can be classified as capital:

- a) is either a tangible or intangible asset
- b) is reproducible by man or by nature
- c) is not destroyed in production, nor is it incorporated into a product
- d) can be used repeatedly over an extended period of time (at least one year)
- e) generates utility directly or indirectly as a factor in the production of goods and services.

In the case of government spending on health care, we recognize that there is no spending on natural capital and that spending on physical capital is already explicitly identified as investment. The CIHI data sources do not allow the identification of spending on social and civic capital, but the detailed information contained in the Ontario Public Accounts does.

Therefore, our analysis is confined to the measurement of health care investment in human capital, when we use the CIHI data, but also includes investment in social and civic capital when the Public Accounts are used.

### *Conceptual Issues: Human Capital*

The concept of human capital dates back to 1776 with the writings of Adam Smith. It was further elaborated 100 years later by Alfred Marshall (1890). While Smith established a direct connection between human and physical capital, as both involve large expenses and carry the expectation of higher earnings, Marshall stressed human capital's ability to increase a person's earning capacity not only through skills but also through other attributes and competencies. The concept of human capital was resurrected in the second part of the 20<sup>th</sup> century but, despite extensive research in this field, we still lack a generally accepted definition.

Four categories of human capital definitions may be identified. The first category aims to explain earnings differentials [Arnold 1992; Becker 1964; Bannock, Baxter and Rees 1992; Kiker 1966; Mincer 1958; Schultz 1961; Thurow 1970]. The second category stresses the role of education and skill acquisition in fostering economic growth [Blomqvist, Wannacott and Wannacot 1994; Gurak 2006; Husz 1998; Lucas 1988; Romer 1990]. While also emphasizing the importance of education in economic growth, the third category acknowledges explicitly the embodiment of education in human beings [NRTEE 2003; OECD 1996, 1998, 2001; UN 2001]. The final category recognizes the importance of innate abilities and attributes of human beings in addition to education [Blundel, Dearden, Meghir and Sianesi 1999; Laroche, Merette and Ruggeri 1998].

A major shortcoming of these definitions, particularly those in the first three categories, is their failure to connect human capital to the core elements of physical capital. As a result, we lack a consistent methodology that allows comparison between investment in human capital and physical capital. Another shortcoming is the practice of placing human capital within a static framework. Dynamic elements of human capital accumulation are recognized in the fourth category of definitions, which include innate abilities and attributes in addition to the acquisition of education. Thus human capital accumulation becomes a lifelong process through which these innate abilities are transformed into skills.

The investment criteria based on the properties of physical capital, and particularly the treatment of computers and software, indicate that human capital cannot be meaningfully analyzed within a static framework. Therefore, if we want to develop consistent measures of investment, we need to place human capital accumulation within a dynamic framework that covers a person's entire life. Such an analytical framework was developed by Ruggeri and Yu [2001], who identified four distinct dimensions of human capital: potential, acquisition, availability and effectiveness. This dynamic framework is consistent with the general criteria for investment developed in the subsection entitled *Conceptual Issues: Investment Criteria*. The combination of



the two serves as the foundation for our determination of what constitutes government investment in health care.

We use Smith's comparison between human and physical capital as the basis for developing a set of general investment criteria. With reference to government spending on health care as investment in human capital, we focus on two special components of physical capital, namely, computers (including software) and residential structures.

A computer is a capital asset composed of a shell, a central processing system, and software. From a human capital perspective, a human being is also made up of three parts. The body without the brain (the physical shell) is tangible, but by itself cannot perform any task. The brain (central processing system) is partly tangible (i.e., its mass) and partly intangible (i.e., the connections that make it function) and serves as the control centre for all body functions. However, it cannot exercise its functions without skills (software), which can be acquired because of human beings' innate ability to learn.

Computers and human beings also differ in a number of ways. Each of the three components of a computer is reproducible separately, but the human body and brain are reproduced jointly. Moreover, computer software is generic and interchangeable, while skills are individual-specific. A computer's capacity to perform a task is determined by the combination of software and hardware. A person's ability to function, however, is also influenced by genetics and society. Both computers and humans depreciate over time, but machines have scrap value at the end of their life while humans do not. Also, human beings possess intellectual, emotional and spiritual needs as well as physical ones. The extent to which these needs are satisfied can affect a person's health status and his/her acquisition and effectiveness of human capital [Ruggeri and Doucet 2007].

For the purpose of this paper, the fundamental conclusion is that computers plus software and human beings plus their skills meet the investment criteria developed in the section entitled Conceptual Issues. Therefore, the conventions used in the National Accounts to measure fixed investment may be applied directly to human capital. In particular, it is important to note the following. First, the purchase price of the computer includes the cost of tangible components and intangible services. Second, the purchase price includes costs that are not directly related for proper functioning of the equipment, such as aesthetic components (e.g., flat screen versus conventional screen). Third, while routine repair and maintenance of a computer are treated as current expenditures, major changes that affect its function are treated as investment.

Of relevance for the measurement of human capital are also the conventions used in the measurement of investment in residential structures. Both owner-occupied and rental units are classified as fixed investment. A homeowner is treated as a firm that sells housing services to himself/herself as a consumer; however, housing services cannot be sold separately from the structure. Similarly, an individual is the owner of the human capital he/she has acquired and the services of human capital may be purchased directly by the individual (self-employment) or may

be sold in the labour. However, these services cannot be sold separately from the body and mind (the structure). In either case, what is being sold is the use of the equipment or structure for a specified amount of time.

The treatment of residential structures in the National Accounts helps clarify an important methodological issue: spending on the acquisition of knowledge and skills should be classified as investment whether the acquired human capital is used for market or non-market activity. Moreover, aesthetic components and major renovations of a residential structure are treated as investment. The same treatment should be given to major medical procedures that improve a person's quality of life, such as a hip replacement.

When the above investment criteria and conventions are applied to the dynamic approach to human capital introduced by Ruggeri and Yu [2001], we have a methodological framework for analyzing and measuring human capital investment consistent with the measurement of physical capital. This new methodology was used in this paper for determining what portion of government spending on health care can be classified as investment.

### *Conceptual Issues: Civic and Social Capital*

While the separation between social and civic capital is not always clear-cut in the literature, and sometimes civic capital is treated as a component of social capital, the inter-connection between the two is often noted in the similarities of their definitions. Definitions of social capital stress the importance of networks, norms and trust, while the definitions of civic capital emphasize the capacity of entire communities to form collective decision-making mechanisms.

A simple schematic representation of the relationship between social and civic capital is shown in Figure 1, based on Stimson et al. [2003]. The common foundation of social and civic capital is a set of norms and structures. Each of them may, in turn, be classified as being formal or informal and their combination leads to four types of networks: informal, formal and a mix. The combination of informal structures and informal norms is a type of network typical of social capital. The combination of formal norms and formal structures is a type of network more representative of civic capital. The remaining two networks involve either the combination of formal structures and informal norms or informal structures and formal norms.

The networks identified in Figure 1 meet the criteria for investment derived from the properties of physical capital. They are: (a) intangible assets, reproducible and long-lasting, (b) coordinators of collective decision-making and action, and (c) generators of value-added by helping produce collective services for the community at large or for the members of the network.

**Figure 1**  
**Civic and Social Capital: Norms and Structures**

		Structures	
		Formal	Informal
Norms	Formal	<i>Formal Networks</i> (Formal structures plus Formal norms)	<i>Mixed Networks</i> (Informal structures plus Formal norms)
	Informal	<i>Mixed Networks</i> (Formal structures plus Informal norms)	<i>Informal Networks</i> (Informal structures plus Informal norms)

Source: Stimson et al, 2003

That the intangible nature of an asset is not an impediment for being classified as fixed capital has been established by the treatment of computer software as physical capital. Its extension to the concept of human capital can also be applied to the norms and values incorporated in the networks that we call civic or social capital. Computer programs, in fact, can be developed and used only by applying specific norms. Moreover, computer networks are made of software and hardware, a combination that connects various computers for the purpose of facilitating communication and producing services that could not be produced by each computer separately. Social networks are also composed of software (the norms and values) and a combination of hardware (the members of the organization) and software (the acquired skills). These networks are created for the purpose of exchanging information, facilitating collective decisions and coordinating collective action. These functions generate services that could not be produced separately by the members of the networks.

For the purpose of this paper, which focuses on health care spending, we treat as investment in civic and human capital any government spending directed at creating, supporting and strengthening organizations that promote and support the mental and physical health of Canadians. The details contained in the Public Accounts do not allow a clear distinction between social and civic capital with respect to health care spending. Moreover, Ruggeri and Dourcet [2007] found that, for the federal government, the combination of social capital accounted for only a small share of health care investment. We followed their approach and combined the two in our calculations.

## **Methodology**

This section explains the methodology for determining which portion of the Ontario government's spending on health care may be classified as investment. First we discuss the conceptual framework and then explain the measurement procedure.

### *Concepts*

Our conceptual framework is the application of the selected investment criteria to the four dimensions of human capital suggested by Ruggeri and Yu [2001]: potential, acquisition, availability and effectiveness.

The *potential* dimension is the building block of human capital analysis because without children there would be no human capital. This dimension is divided into two parts. The first part covers the period from conception to birth (*production*), a period during which environmental factors and parental behaviour affect the genetically determined potential of a child. The second part covers the period from age 0 to age 5, when *nurturing* may enhance or degrade a child's potential for acquiring human capital. The upper bound separates early childhood from the beginning of formal education.

We start the potential dimension at conception because without conception there would be no birth and no potential human capital. Even in the case of a machine, expenditures on the concept and design are part of what eventually becomes a capital asset and will be incorporated into its selling price. Using the time of conception as the starting point for the analysis of human capital implies that all government expenditures directed at the delivery of a healthy baby should be classified as investment in human capital. Five major elements of a mother's condition during pregnancy influence a newborn's health status: (a) *tobacco use*, (b) *alcohol consumption*, (c) *drug use*, (d) *exposure to environmental pollution*, and (e) *nutrition*. We suggest that government spending aimed at alleviating these factors should be treated as investment.

1. Tobacco. Fetal exposure to nicotine is known to generate health risks, such as miscarriage, asthma, underweight, and long-term cognitive and behavioural problems [Connor & McIntyre 2002; National Council on Welfare 1997]. It may also affect brain development in early childhood, increasing a child's vulnerability to Attention Deficit Hyperactivity Disorder (ADHD) [Biederman and Faraone 2005], a condition that may create additional behavioural problems, such as antisocial behaviour, psychiatric disorders, poor adjustment at school, family conflicts, and poor occupational performance [Biederman and Faraone 2005, Cantwell 1996, 1997; Nadder et al., 2002; Teicher 2002].

2. Alcohol. Children exposed to alcohol *in utero* are more likely to suffer from Fetal Alcohol Syndrome (FAS) and Fetal Alcohol Effects (FAE). FAS is associated with facial abnormalities, pre- and post-natal growth deficiencies, learning disabilities, behavioural problems and delayed development. FAS is the third leading cause of mental retardation in children, with 100 cases in Canada each year [Remkes 1993; Health Canada 1996].

FAE effects are less severe, but are still serious and include “hyperactivity, behavioural problems, learning disabilities, and a general inability to function normally in society” [National Council of Welfare 1997:9]. FAS and FAE are preventable causes of birth defects in infants and developmental delays in children [Connor & McIntyre 2002].

3. Drugs. A mother’s drug use during pregnancy can affect a baby before and after birth. The use of cocaine may cause preterm birth, as well as possible fetal and/or mother’s death; heroin use causes the same effects and may also cause addiction in the fetus. Ecstasy use may result in long-term learning and memory problems. The use of marijuana during pregnancy may result in underweight babies, resulting in various short- and long-term health problems [American College of Obstetricians and Gynecologists 2007].
4. Pollution. Persistent exposure to environmental pollutants may hinder the development of the fetus even at low levels. Heavy metals (e.g., mercury, selenium, arsenic, lead, cadmium) may be absorbed by a pregnant mother directly through inhalation and skin absorption or indirectly through food and water consumption [Vaillancourt & Surette 2006]. These pollutants are then transferred from the mother to the fetus through the placenta. Heavy metals may have severe health effects on the unborn. Mercury damages the nervous system, lungs, kidneys, vision, and hearing of the unborn and children [U.S. National Academy of Sciences 1993]. Lead affects all organ and systems of the body, particularly the central nervous system. Childhood exposure to lead may affect psychological and reinforce aggressive and criminal behaviour [Reyes 2007]. Cadmium and arsenic may cause lung cancer and toxicity of the liver, kidney, immune, skeletal, cardiovascular, gastrointestinal tract, reproductive and nervous systems. At high doses, manganese may affect early psychomotor development in children [Taylor 2003]. A report published in the Washington Post [29 October 2007] indicates that in China health defects due to pollution have increased 40 percent since 2001.
5. Nutrition. A pregnant mother’s poor nutrition and low pre-pregnancy weight rank second and third for low birth weight risks, after tobacco smoking [National Council of Welfare 1997]. Maternal malnutrition increases the risk of low birth weight, obesity, type 2 diabetes, hypertension and cardiovascular disease in children [Martin-

Gronert & Ozanne 2006]. Poor maternal nutrition has also been associated with a variety of diseases persisting in adulthood, such as osteoporosis, lung diseases, schizophrenia, and metabolic and cardiovascular disorders [ibid.].

In the *nurturing* stage, parental and community involvement help a child acquire basic motor and language skills, learn how to socialize and gain the values that will guide his/her life [McCain et al. 2007]. The 0-5 age range is divided into two parts: infancy (0-2) and early childhood (2-5).

In infancy, three of the most important developments (emotional control, vision and social attachment) occur. Vocabulary develops within the first three years [National Council of Welfare 1997]. A child's normal development requires proper visual, tactile and auditory stimuli, and this development may be facilitated or impeded by factors within the child's social environment [Keating & Mustard 1993].

The factors that influence the fetus continue operating in early childhood. Nutritional deficiencies in infancy can seriously impede brain development and cause learning disabilities [Carnegie Corporation of New York 1994]. Parent substance abuse and mental illness may result in abuse, neglect and poor parenting, and may influence their attention span in learning cognitive tasks [McCain, Mustard & Shanker 2007; Murray, Cooper & Hipwell 2003]. Maternal depression also increases the risk of poor cognitive development by one-and-a-half times in children up to age 5, and by over two times for behavioural problems [Somers & Willms 2002]. Because programs directed at earlier and more frequent screening for such factors may prevent cognitive development issues in infants, they should be treated as investment in human capital.

In early childhood when a child – having acquired some emotional control, visual ability, social attachment and vocabulary – is ready for formal learning, his/her cognitive and emotional development depends crucially on the quality of the relationship with caregivers in a manner that often lasts into adulthood [McCain, Mustard & Shanker 2007; Willms 2002]. During this phase there is rapid development of skills related to attention, problem-solving, planning, understanding quantity, and using symbols – skills which are essential to school success [Berkman et al. 2002; Brown & Pollitt 1996; de Onis et al 1993; Walker et al. 2000]. Optimal child development requires a positive and nurturing family environment for children from conception to kindergarten.

Good health conditions are also essential for psychological development. Asthma, which has been reported in more than one in 10 Canadian children [Health Canada 2002], has been found to affect internalizing behaviour problems [Klennert et al. 2001]. Children at greater psychological risk can have a reduced capacity to perform in school, affecting their potential for acquiring human capital, and also their capacity to utilize the acquired skills over their lifetime. Consistent with the treatment of the business expenses in producing the shell of a computer plus embedded hardware, all government health care expenditures for children 0-5 years should be considered as investment in human capital.



The *acquisition* dimension is the only dimension included in the current approaches to government investment in human capital and focuses strictly on expenditures on elementary, secondary, and post-secondary educational institutions, including adult training programs, all of which are still treated as consumption in the National Accounts. In our analytical framework, the acquisition dimension is broader in scope and includes direct program spending, tax expenditures, internal training programs, financing of other agencies to deliver educational services, training programs delivered by employers and skills acquired outside the formal educational system (e.g., life and work experience). Our framework also treats as investment in human capital expenditures on the creation and dissemination of such knowledge (e.g., research activities and teaching) [Ruggeri and Doucet 2007].

Two separate stages of human capital acquisition through formal education are identified: (a) primary and secondary education, and (b) post-secondary education.

Because most decisions related to *primary and secondary education* are made by agents other than the students, human capital acquisition is affected by a variety of factors that influence a student's support system for learning, such as family socio-economic conditions, community support, and the health status of the student, parents, other family members and overall community. A student's health conditions, which can affect attendance, academic performance and dropout rates [Belli, Bustreo, and Preker 2005; Bridgeland, DiIulio and Burke Morison 2006; U.S. Department of Health and Human Services 2006], include chronic conditions and disabilities (e.g., asthma), health compromising behaviours (e.g., smoking) and obesity [Colditz 1992; Gorstein and Grosse 1994; Koivusilta, Arja and Andres 2003; McDougall et al 2004]. Children with chronic conditions are twice as likely to have learning disabilities as children with no health problems [McDougall et al. 2004].

Choices about *post-secondary education* are made by individuals and represent personal investment. Human capital, however, includes more than skills because personal values, personality traits and other character traits, such as interpersonal skills, oral communication, integrity, dedication, are part of human capital [Hansen and Hansen 2007]. Because human capital is produced and acquired within a social context, we must acknowledge that investment in human capital also includes spending on both skill acquisition and character building, such as families, as well as religious, sports and community organizations. With respect to health expenditures, human capital should include not only the health of those acquiring skills, but also of those enabling the health, learning capacity and opportunities of children and young adults, such as parents and the community at large.

Society gains only when the acquired human capital is made available, and its *availability* in a given jurisdiction involves three choices. First, individuals decide whether they offer their human capital for market activities. Second, they can choose when to exit the labour market, particularly for retirement based on age, poor health or wealth accumulation. Finally, they can select the jurisdiction in which their human capital will be utilized, a decision affected by the factors that influence labour mobility.

For the population under 19 and that portion of the population 19 plus who are acquiring human capital, health care spending is already included in investment. The additional investment in the availability dimension arises from spending that reduces mortality rates for people 19 years and over who are not acquiring human capital fulltime. Health care spending can be considered in part as investment in the availability of human capital when it affects location decisions by residents and non-residents. In this case, availability is affected when chronic physical and mental ailments prevent the consistent performance of required tasks, or when major surgery and subsequent recovery interrupt employment for an extended period of time. These health expenditures are investment because they either help restore the productive function of human capital or improve quality of life. This approach is consistent with the National Accounts treatment of major renovations as investment although they do not produce other goods and services, but improve the quality of life of the owners.

The benefits of human capital to society depend on the *effectiveness* of its use. When employment opportunities are limited, when there is a mismatch between the skills embodied in the available labour force and the skills demanded by employers, and when working conditions or management abilities are not adequate, human capital will not be effectively utilized. This dimension is divided into two components: utilization and performance. The former is affected largely by economic performance, mobility of human resources and efficient labour markets. Health policy plays a role when chronic conditions affect a worker's capability to perform certain tasks and pose risks in the workplace. Chronic health problems may also prevent the affected workers from accessing some work opportunities unavailable to those potential workers. Health spending neutralizing these obstacles is an investment in human capital utilization.

Performance may be affected by absenteeism and under-performance. In either case, when the determining cause is a minor ailment, health care spending is similar to repair and maintenance spending for machinery and equipment and is not treated as investment. It is an investment in human capital if it involves the treatment of a serious illness, akin to a major renovation for buildings.

### *Methods*

Two related data sources are used separately in our estimation. The first is the detailed information contained in the Ontario Public Accounts for fiscal year 2004-05, and the second is the data set on provincial health care spending for 2004 developed by the Canadian Institute for Health Information (CIHI). The latter disaggregates health care spending into 9 categories: (i) hospitals, (ii) other institutions, (iii) physicians, (iv) other professionals, (v) drugs, (vi) public health, (vii), administration, (viii) other current expenditures and (ix) capital. We organized the information from the Ontario Public Accounts as close as possible to the above nine categories in order to facilitate a comparison of the results.



Our first estimation was based on the Public Accounts data. For hospitals, physicians and drugs we applied the allocation parameters shown in Table 1, which summarize the methodology discussed in the previous sub-section. Spending on capital projects was treated entirely as investment. Spending on public health was first distributed on a per capita basis, as done by CIHI, and then distributed on the basis of Table 1. Health policy and research was allocated entirely to investment. Administration costs were disaggregated by program and allocated to investment in the same proportion as investment by the program.

Other institutions comprise three parts. The first part, spending on long-term facilities, was assigned zero investment because it was assumed that spending was entirely for the equivalent of repairs and maintenance. The second part is spending on community care access centres, which was treated in the same manner as spending on physicians. The rest was treated as spending on public health. Other health care spending includes two main components. The first, spending on children and youth, was assigned entirely to investment. The rest was allocated as public health. Small amounts of investment in social plus civic capital were allocated in the case of other institutions, public health, and other health care spending.

**Table 1**  
**Health Care and Human Capital: Effects by Dimension and Age Group**

<b>Human Capital Dimension</b>	<b>Health Spending as Investment</b>
Potential	Pre-conception: Health care expenditures that affect male and female fertility Gestation: 100% of health spending on expectant mothers Nurturing: 100% of health spending on children 0-5 100% of health spending on nurturing mothers A small percentage for nurturing fathers, and nurturing grandparents
Acquisition	Young people 6-18: 100% 19 and over: 100% for those acquiring knowledge and skills A small percentage of health spending for parents
Availability	19 and over: 100% of expenditures for the chronically ill Rest of the population: 100% for major surgery plus a portion of medical and drug expenses
Effectiveness	Same as for availability

The same methodology was used for the estimates based on CIHI data. The difference between the two approaches is the lesser degree of details contained in the CIHI data compared with the Public Accounts. The results are presented in the next section.

## **Results**

Our estimates of the proportion of health care spending by the Ontario government that can be classified as investment, based on the information contained in the Ontario Public Accounts for fiscal year 2004-05, are shown in Table 2.

Table 2 indicates that over 60 percent of spending on health care by the Ontario government may be classified as investment. Nearly all (99.2 percent) is in the form of investment in human capital. The investment intensities differ by type of services. For hospitals, physical capital and health policy and research the entire spending is treated as investment. For the other services, the investment intensities range from 59 percent for public health to about 17 percent for drugs and other institutions.

Table 3 shows similar results when the summary in Table 1 is applied to the CIHI data.

The similarity of the results is not surprising since total spending and its distribution among different services are nearly identical in the two data sources and the same methodology is the more user friendly data from CIHI, an advantage over the Public Accounts that expands as we analyze more than one province.

Table 4 shows the distribution of provincial investment in health care by selected age groups, which is more directly related to the dynamic human capital framework of this paper. The first column shows the investment intensities, measured as the proportion of spending for each group that is classified as investment. Spending on children and youth 0-19 relates to the potential dimension and partly to the acquisition dimension and is assigned entirely to investment in human capital. Spending on the 20-44 age group covers more than one dimension. It is dominated by spending on females, which relates to the production and nurturing stages of the potential dimension, and also to their own human capital acquisition, availability and effective utilization. Most of the spending for these two age groups can be compared to investment in computers and software. For the remaining two age groups, and especially those 65+, investment is mostly of the “major renovations” type.

According to Table 4, the investment intensities are highest for physical capital and the 0-19 age group, and for the age group 20-44. For the rest, they are close to 50 percent. Investment on the age groups 0-19 and 20-44 combined accounts for 25.9 percent of total spending, and 38.7 percent of total investment. When we add the age group 45-64 and physical capital, these shares rise to 41.1 and 63.2 percent, respectively.

**Table 2**  
**Investment as a Share of Government Health Care Spending**  
**in Ontario, 2004-05: Public Accounts Data, \$ Millions**

Item	Spending	Allocated to Investment		Investment as a % of Total
		Human	Social	
Hospitals	13,143.6	13,143.6	0.0	100.00
Other Institutions	4,097.5	637.8	33.3	16.38
Physicians	7,469.8	2,822.1	0.0	37.78
Drugs	3,184.4	528.9	0.0	16.61
Public Health	1,614.1	69.0	137.2	12.77
Health Policy and Research	359.6	359.6	0.0	100.00
Administration	1,154.8	577.4	0.0	50.00
Other Current Spending	1,171.1	883.3	4.5	75.81
Subtotal: Current Spending	32,194.9	19,651.7	175.0	61.58
Capital	528.0	528.0	0.0	100.00
Total Spending	32,722.9	20,179.7	175.0	62.20
Percent of Total	100.00	61.67	0.53	

The extent to which spending on people 65+ is an equipment type investment and which is a “major renovation” cannot be determined with precision because seniors are involved in variety of functions. Some seniors remain active in the labour force after 65; others are performing human capital enhancing functions within their family, such as raising grandchildren; and still others participate in community activities that support social capital. If our estimate of the investment intensity for seniors is cut in half, the share of investment in total health care spending would be reduced to 52.5 percent. Our general conclusion is that between half and two-thirds of Ontario government spending on health care is in the form of investment.

**Table 3**  
**Investment as a Share of Government Health Care Spending**  
**in Ontario, 2004: CIHI Data, \$ Millions**

Item	Spending	Investment in	Investment as a
		Human Capital	% of Total
Hospitals	12,885.4	12,885.4	100.00
Other Institutions	3,250.6	532.4	16.38
Physicians	7,024.8	2,654.0	37.78
Other Professionals	303.3	92.8	30.60
Drugs	3,210.1	506.0	15.76
Public Health	2,401.4	1,252.8	52.17
Administration	464.5	232.3	50.01
Other Current Spending	1,562.7	781.4	50.00
Subtotal: Current Spending	31,102.8	18,937.1	60.89
Capital	1,622.8	1,622.8	100.00
Total	32,725.6	20,559.9	62.83

### ***Conclusions***

By introducing a new methodology, this paper offers a solution to the debate among policy analysts in Canada as to whether government spending on health care ought to be treated as consumption or investment. The first pillar is a set of investment criteria based on the defining properties of physical capital, which can be applied to any form of capital (for its application to natural capital, see Ruggeri 2007) and then combines with a dynamic framework for the analysis of human capital that recognizes four dimensions of human capital: potential, acquisition, availability and effectiveness. This new methodology is applied to two separate data sources on health care spending by the Ontario government for 2004. The results indicate that nearly two-thirds of that spending can be classified as investment.

**Table 4**  
**Provincial Investment in Health Care**  
**by Selected Age Groups, CIHI Data**

Age Group	Investment Intensity Percent	Percent of Total Spending
0-19	100.00	10.16
20-44	81.04	15.76
45-64	49.74	10.40
65+	48.75	21.01
Subtotal		57.34
Physical Capital	100.00	4.96
Administration	50.00	0.71

Our results have important implications for both methodology and public policy. The National Accounts record only spending on physical capital as investment. This practice is at odds with the generally accepted view that spending on education and skill acquisition is also an investment. Our results indicate that this approach is even less justifiable when we acknowledge that more than half of health care spending can be classified as investment.

Our results also put into question the usefulness of focusing research and public policy directed at human capital within the strict context of spending on education. If a large portion of health care spending is an investment in human capital, then human capital policies cannot be effectively developed if decisions about education spending and health care spending are made separately. Since human capital is inextricably embedded in human beings and is produced, acquired and utilized within a social context, if we want to optimize the economic contribution of human capital we need to invest in health care as well as education.

## References

- American College of Obstetricians and Gynecologists. (2007). *Medical Library*, May 21. [www.medem.com](http://www.medem.com)
- Arnold, R. (1992). *Microeconomics*. St. Paul, MN: West Publishing Company.
- Associated Free Press. (2007). "Birth Defects on Rise in China Province." *Washington Post*, October 29.
- Bannock, G., R. Baxter and R. Rees. (1992). *Dictionary of Economics*. London, UK: Penguin Books Ltd.
- Becker, G. (1964). *Human Capital*. New York: National Bureau of Economic Research.
- Belli, P., F. Bustreo and A. Preker. (2005). "Investing in children's health: What are the economic benefits?" *Bulletin of the World Health Organization*, 83(10): 777-784.
- Berkman, D., A. Lescano, R. Gilman, S. Lopez and M. Black. (2002). "Effects of Stunting, Diarrhoeal Disease, and Parasitic Infection During Infancy on Cognition in Late Childhood." *The Lancet*, 359(9306): 564-571.
- Biederman, J. and S. Faraone. (2005). "Attention-deficit Hyperactivity Disorder." *The Lancet*, 366: 237-248.
- Blomqvist, A., P. Wonnacott and R. Wonnacott. (1994). *Microeconomics*. Toronto: McGraw-Hill Ryerson Limited.
- Blundell R., L. Dearden, C. Meghir and B. Sianesi. (1999). "Human Capital Investment: The Returns From Education and Training to the Individual, the Firm and the Economy." *Fiscal Studies*, 20(1): 1-23.
- Bridgeland, J., J. DiIulio and K. Burke Morison. (2006). *The silent epidemic: Perspectives of high school dropouts*. [www.silentepidemic.org/pdfs/thesilentepidemic306.pdf](http://www.silentepidemic.org/pdfs/thesilentepidemic306.pdf)
- Brown, J. and E. Pollitt. (1996). "Malnutrition, Poverty and Intellectual Development." *Scientific American*, 274(2): 38-43.
- Cantwell, D. (1996). "Attention-Deficit Disorder: A Review of the Past 10 Years." *Journal of the American Academy of Child & Adolescent Psychiatry*, 35(8): 978-987.
- Cantwell, D. (1997). "Attention Deficit Disorder in Children." *Psychiatric Times*, 14(1).
- Carnegie Corporation of New York. (1994). "Starting Points: Meeting the Needs of Our Youngest Children." New York: Carnegie Corporation of New York.
- Colditz, G.A. (1992). "Economic costs of obesity." *American Journal of Clinical Nutrition*, 55 (Suppl.): 503-507.
- Connor, S.K. and L. McIntyre. (2002). "The Effects of Smoking and Drinking During Pregnancy." In J.D. Willms ed. *Vulnerable Children: Findings from the National Longitudinal Survey of Children and Youth*, Edmonton: University of Alberta Press.
- de Onis, M., M. Mercedes, J. Akre and G. Clugston. (1993). "The World-Wide Magnitude of Protein Energy Malnutrition: An Overview from the WHO Global Database on Child Growth." *Bulletin World Health Organization*, 71: 703-712.

- Gorstein, J. and R. Grosse. (1994). "The indirect costs of obesity to society." *Pharmacoeconomics*, 5 (Suppl. 1): 58-61.
- Gurak, H. (2006). *An Alternative Growth Model*. Unpublished.
- Hansen, R. and K. Hansen. *What Do Employers Really Want? Top Skills and Values Employers Seek from Job-Seekers*. [www.quintcareers.com/printable/job\\_skills\\_values.html](http://www.quintcareers.com/printable/job_skills_values.html)
- Health Canada. (2002). *Health and the Environment: Assessing Critical Pathways*. [www.hc-sc.gc.ca/sr-sr/alt\\_formats/iacb-dgiac/pdf/pubs/hpr-rps/bull/2002-4-environ/2002-4-environ\\_f.pdf](http://www.hc-sc.gc.ca/sr-sr/alt_formats/iacb-dgiac/pdf/pubs/hpr-rps/bull/2002-4-environ/2002-4-environ_f.pdf)
- Husz, M. (1998). *Human Capital, Endogenous Growth, and Government Policy*. Frankfurt am Main: Peter Lang Publishing Group.
- Keating, D.P. and J.F. Mustard. (1993). "Social economic factors and human development." In D. Ross ed. *Family security in insecure times*. Ottawa: National Forum on Family Security.
- Kiker, B.F. (1966). "The Historical Roots of the Concept of Human Capital." *Journal of Political Economy*, 74(5): 481-499.
- Klennert, M.D., H. Nelson, M. Price, A. Adinoff, D. Leung and D. Mrazek. (2001). "Onset and persistence of childhood asthma: Predictors from infancy." *Pediatrics*, 108(4): e69-e79.
- Koivusilta, L., R. Arja and V. Andres. (2003). "Health behaviours and health in adolescence as predictors of educational level in adulthood: A follow-up study from Finland." *Social Science & Medicine*, 57: 577-593.
- Laroche, M., Mérette, M. and G. Ruggeri. (1999). "On the Concept and Dimensions of Human Capital in a Knowledge-based Economy Context." *Canadian Public Policy*, 25(1): 87-100.
- Lucas, R. (1988). "On the Mechanics of Economic Development." *Journal of Monetary Economics*, 22: 3-42.
- Marshall, A. (1890). *Principles of Economics: An introductory volume*. 1990 reprint of 1920 edition. Philadelphia: Porcupine.
- Martin-Gronert, M. and S. Ozanne. (2006). "Maternal nutrition during pregnancy and health of the offspring." *Biochemical Society Transitions*, 34: 779-82.
- McCain, M.N., J. Mustard and S. Shanker. (2007). "Chapter 1: The long reach of early childhood." *Early Years Study 2: Putting science into action*. Ontario: Council for Early Child Development.
- McDougall, J., G. King, D. De Wit, L. Miller, H. Sungjin, D. Offord et al. (2004). "Chronic physical health conditions and disability among Canadian school-aged children: A national profile." *Disability and Rehabilitation* 26(1): 35-45.
- Mincer, J. (1958). "Investment in Human Capital and Personal Income Distribution." *The Journal of Political Economy*, 66(4): 281-302.
- Murray, L., P. Cooper and A. Hipwell. (2003). "Mental health of parents caring for infants." *Archives of Womens Mental Health*, 6 (Suppl.2): s71-s77.

- Nadder, T.S., M. Rutter, J. Silberg, H. Maes and L. Eaves. (2002). "Genetic Effects on the variation and covariation of attention deficit hyperactivity disorder (ADHD) and oppositional-defiant disorder/conduct disorder (ODD/CD) symptomatologies across informant and occasion of measurement." *Psychological Medicine*, 32(1): 39-53.
- National Council of Welfare. (1997). *Healthy Parents, Healthy Babies*. Ottawa
- National Round Table on the Environment and the Economy. (2003). *Environment and Sustainable Development Indicators for Canada*. Ottawa.
- Organization for Economic Co-operation and Development (OECD). (1996). *Measuring What People Know: Human Capital Accounting for the Knowledge Economy*. Paris.
- OECD. (1998). *Human Capital Investment: An International Comparison*. Centre for International Research and Innovation. Paris.
- OECD. (2001). *The Well-being of Nations: The Role of Human and Social Capital*. Paris.
- Remkes, T. (1993). "Saying no – completely." *The Canadian Nurse*, 89(6): 25-28.
- Reyes, J. (2007). "Environmental Policy as Social Policy? The Impact of Childhood Lead Exposure on Crime." *The B. E. Journal of Economic Analysis & Policy* 7(1).
- Romer, P.M. (1990). "Endogenous technological change." *Journal of Political Economy*, 98(5): S71-S101.
- Ruggeri, G. (2007). "Investment in Natural Capital by the Federal Government in Canada." Policy Studies Centre, Working Paper, January.
- Ruggeri, G.C. and W. Yu. (2001). "On the Dimensions of Human Capital: An Analytical Framework." *Atlantic Canada Economics Association Papers*, 29: 89-102.
- Ruggeri, G. and M. Doucet. (2007). "Government Spending on Health Care as Public Investment." Mimeo.
- Schultz, T.W. (1961). "Investment in Human Capital." *The American Economic Review*, 51(1): 1-17.
- Smith, A. (1776). *The Wealth of Nations*. London: G. Routledge.
- Somers, M.A. and J. Willms. (2002). "Maternal depression and childhood vulnerability." In J.D. Willms ed. *Vulnerable children: Findings from Canada's National Longitudinal Survey of Children and Youth*. Edmonton: University of Alberta Press.
- Stimson, R., J. Western, S. Baum. and Y. Van Gellecum. (2003). "Measuring Community Strength and Social Capital." Proceedings from The European Regional Science Association.
- Tasker, L., D. Mergler, G. Hellier, J. Sahuquillo and G. Huel. (2003). "Manganese, Monoamine Metabolite Levels at Birth, and Child Psychomotor Development." *NeuroToxicology*, 24(4-5): 667-674.
- Teicher, M. (2002). "Scars That Won't Heal: The Neurobiology of Child Abuse." *Scientific American*, March 2003, 286(3): 68-75.



- Thurow, L. (1970). *Investment in Human Capital*. California: Wadsworth Publishing Company.
- U.S. Department of Health and Human Services. (2006). *Child Health USA 2006*. [www.mchb.hrsa.gov/chusa\\_06/popchar/0204sd.htm](http://www.mchb.hrsa.gov/chusa_06/popchar/0204sd.htm)
- U.S. National Academy of Sciences Washington. (1993). *Pesticides in the Diets of Infants and Children*. DC: National Academy Press.
- United Nations. (1997). *Glossary of Environment Statistics, Studies in Methods, Series F, No. 67*. New York: United Nations.
- Vaillancourt, C. and C. Surette (2006). "Effects of Environmental Exposure to Heavy Metals on Pregnant Women and Newborn in Bay of Chaleurs Region of New Brunswick." In J. Ruggeri ed. *The Environment & the Health of Children*, Fredericton: Policy Studies Centre.
- Walker, S., S. Grantham-McGregor, C. Powell and S. Chang. (2000). "Effects of Growth Restriction in Early Childhood on Growth, IQ, and Cognition at Age 11 to 12 Years and the Benefits of Nutritional Supplementation and Psychosocial Stimulation." *Journal of Pediatrics*, 137(1): 36-41.
- Willms, J. (2002). *Vulnerable Children: Findings from the National Longitudinal Survey of Children and Youth*. Edmonton: University of Alberta Press.