

**Government Spending on Health Care as  
Public Investment**

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# GOVERNMENT SPENDING ON HEALTH CARE AS PUBLIC INVESTMENT

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## I. INTRODUCTION

During the past decade, Canadians have been involved in a public debate on the future of the publicly-funded health care system. Although the debate has included a wide ranging list of issues, its main focus has been on the fiscal side and specifically on the capacity of the existing fiscal system to withstand the health care spending pressures arising largely from the accelerated rate of population aging. Because publicly-funded health care is a national program, i.e., a program which is constitutionally the responsibility of provincial governments but is financed partly by the federal government through intergovernmental transfers (the Canada Health Transfer or CHT), the debate has also focused on intergovernmental fiscal relations.

Reforming the publicly-funded health care system and the fiscal arrangements that help finance it was the mandate of a national commission set up by the federal government (Commission on the Future of Health Care in Canada [2002], known as the Romanow Commission) and of a study by the Senate Standing Committee on Social Affairs, Science and Technology [2002]. The issue of the fiscal sustainability of public health care in Canada has been analyzed by several researchers (for example, Robson [2001], Ruggeri [2002], Jackson and McDermott [2004]). The conclusions of these studies show a lack of agreement. The Romanow Commission concluded that “Canada’s health care system has served Canadians well and it is as sustainable as Canadians want it to be” (executive summary, chapter 1), while the report of the Senate Committee concluded that “Canadians believe that the current system is inefficient. Moreover, Canadians are not willing to invest additional money into the system until these inefficiencies are eliminated” (concluding chapter). On the sustainability issue, Robson believes that “Canadians face an immense challenge in making their health care system sustainable while the baby boomers depend on it” (p. 26). Ruggeri’s study “does not support the

notion that, for the government sector as a whole, projected health care spending for the existing quality of health care is fiscally unsustainable” (p. 9). According to Jackson and McDermott, “while it is impossible to predict the level of health spending increase that can be successfully absorbed, the increases projected under (our) baseline scenario may be considered to be sustainable on a couple of bases: historical perspective....and inter-provincial comparisons” (p. 11).

Evaluating the spending pressures on health care that will be generated by population aging and the capacity of the fiscal system to withstand them without the need for higher tax rates is an important exercise. While efficiency improvements in the delivery of health care should be carried out regardless of the results of these evaluations, knowing about future trends in health care spending is essential for the development of programs and policies aimed at maintaining the long-term viability of public funding for health care. However, the primary focus on fiscal viability tended to drown other issues that are important for health policy. One of the unresolved issues which shapes our perception of health care and the development of health policy is whether government spending on health care should be treated as consumption or investment. Under current National Accounts recording and government budgetary decision-making processes, government spending on health care is viewed as consumption, except for the portion that relates to spending on buildings and machinery and equipment. For example, in the National Accounts, building an extension to a hospital to provide a cafeteria for healthy visitors would be recorded as investment while the salaries of the nurses who take care of the sick are treated as consumption. Within the budgeting process of both federal and provincial governments, health care spending is usually included in the "social policy envelope", thus lumping it together with spending on social assistance.

The shortcomings of this approach were exposed by Courchene in his book entitled *A State of Minds [2001]*. According to Courchene, a major problem with the current approach to health policy is that "we tend to view the health care system as falling entirely within the social envelope. Moreover, our collective approach to health care is to emphasize cost containment". He argued that "viewing the health sector solely as a social policy sector will guarantee that it will never receive the requisite infusion of capital" and

suggested that "in the 21st century, maintaining state-of-the-art health care for Canadians requires that we view the health sector as a dynamic economic sector as well as an essential social institution" [Courchene, 2001, pg 196]. A similar view has been expressed by Boadway [2004] who explicitly identified government spending on health care as investment. The view that some health expenditures are an investment is also found in the Public Accounts of the government of Canada. The business line called *health promotion and protection* "recognizes and emphasizes the importance of health throughout the human life cycle ....with a specific recognition of investment in early childhood as a means to better health throughout life: [Public Accounts of Canada, 2005, pg 14-2].

The opposite view is held by Mintz. Acknowledging that "we do not know very much about what aspects of public expenditures are truly investment rather than consumption", Mintz argues that "other public expenditures, on health care, for example, provide what clearly are consumption services" [2004, pg 353]. More recently, this issue has been placed within an intergovernmental fiscal relations framework by the Ontario Institute for Competitiveness and Prosperity [2005]. The Institute expressed a critical view of the current instruments of fiscal federalism because it believes that they encourage consumption in the receiving provinces while providing disincentives to invest in the donor provinces by requiring higher federal taxes. This unsubstantiated conclusion is based largely on the assumption that "consumption expenditures include health and social services; investment expenditures include transportation, communications, housing and education" (p. 21).

While a low key debate on what constitutes public investment is developing in Canada, this debate still lacks a sound conceptual framework and an explicit methodology. An attempt at filling this knowledge gap is made in this paper with respect to government spending on health care. The starting point of our analysis is the acknowledgement that social scientists recognize at least five types of capital: physical, natural, human, civic and social capital [Helliwell, 2002]. The extension of the concept of capital beyond tangible assets, which has already been applied to physical capital through the treatment of spending on computer software as fixed investment, has not been followed by the

development of a standard methodology for all types of capital. Instead, specific, separate, and often ad hoc approaches have been used to classify as investment expenditures other than those on physical capital. This methodological heterogeneity has been a major obstacle to the development of consistent measures of public investment and meaningful comparisons of public investment in the various types of capital.

We attempt to correct this methodological gap by developing a conceptual framework which contains a set of criteria that separate public investment from public consumption based on the main features and properties of physical capital (section II). In Section III we apply these criteria to determine the implications of government spending on health care for human capital. We repeat the exercise for social and civic capital in section IV. We do not deal explicitly with the other two types of capital for two reasons: (a) spending on physical capital is already identified in the National Accounts and no further analysis or calculations are required; and (b) health care spending is directed at human beings and, therefore, does not directly affect natural capital (an evaluation of government investment in natural capital is found in Ruggeri 2007a). Section V discusses some methodological issues in determining which federal government expenditures on health care may be treated as investment in human, social and civic capital. Section VI presents estimates of this investment for fiscal year 2004-05 based on data recorded in the Public Accounts of the Government of Canada. A concluding section provides some summary comments.

## **II. CRITERIA FOR TREATMENT AS INVESTMENT**

The definitions of human, social and civic capital found in the literature (and discussed in sections III and IV of this paper) seem to have been developed independently of those of physical capital. As a result, we lack a set of general criteria for determining which portions of government spending may be treated as investment. In the case of health care, as indicated by the references listed in the introduction above, there is no agreement on whether any portion of health care spending may be considered investment. The first step in our analysis, therefore, is the development of a set of consistent criteria that can be applied uniformly to any type of capital. Two main options are available for selecting the above criteria: (a) develop a general concept of capital that would include physical capital

as well as the other types of capital that have been identified more recently; or (b) use the properties of physical capital as a basis for determining the criteria to be applied to the other types of capital. We selected the second option primarily because the treatment of physical capital is grounded in extensive theoretical and methodological research and there is a well established methodology for its measurement. The first step in selecting the criteria for determining which portion of government spending may be treated as capital is the identification of the special features of physical capital and the methodology for its measurement used in the National Accounts. The information reported below is found in Statistics Canada's publications on the Income and Expenditure Accounts.

### **The Defining Features of Physical Capital**

In developing a new conceptual framework for the measurement of public investment based on physical capital that can serve as a common foundation for all types of capital we started by asking the following questions: What are the defining features of physical capital? What are its uses? How is it measured? Which of these aspects of physical capital should be used as criteria for the other types of capital?

#### *Defining Features*

Physical capital possesses four major features. First, it is a **reproducible** asset in the sense that it can be produced repeatedly in response to decisions by economic agents. It is an asset which is willfully man-made and is produced in a process that involves other capital inputs, materials, and labour services. Second, physical capital may be either a **tangible or an intangible asset**. In the National Accounts, spending on physical capital is called fixed investment and largely involves spending on tangible items such as buildings and equipment. Starting in 2001, fixed investment includes also intangible assets in the form of spending on computer software. A third defining feature of capital goods is their **survivability**. Capital assets are used in the production of other goods and services, but are neither incorporated in the final product nor are they consumed in the production process. They are instrumental in the production of a good, but remain separate from it. A closely related feature is **durability**. Capital assets can be used

repeatedly over an extended period of time because they are not destroyed in the production process.

### *Uses*

Firms acquire physical capital in order to use it to generate a flow of income from the production of other goods and services sold to consumers, government and other firms. The use of physical capital as a factor of production is an intermediate step in a complex process leading ultimately to the generation of utility for consumers. Consumers can obtain utility directly from leisure or indirectly through the consumption of goods and services. An example of direct utility is the enjoyment of a beautiful panorama on a clear day. Often, even the enjoyment of direct utility requires the consumption of goods and services. For example, the site that allows the view of the beautiful panorama may be naturally inaccessible. If a road is built, the site becomes accessible through an investment (the road) which adds to the stock of physical capital. Transportation services then can help facilitate the enjoyment of this particular leisure activity. Thus, while leisure provides the time to enjoy the panorama, the investment in physical capital, which makes the site accessible through the use of transportation services, permits the acquisition of the utility from the viewing.

In economics textbooks, physical capital is portrayed as a physical asset which operates in an impersonal production process where its human connection is limited to the workers that operate it. When we emphasize that the ultimate purpose of the production and use of physical capital is the generation of utility to consumers, we must acknowledge its human foundation (which also applies to all other forms of capital). In fact, both its existence and its uses are dependent on human decisions. Physical capital exists because business owners (human beings acting as economic agents) find it profitable to buy or lease it. It is used to produce goods and services which are demanded by consumers (also human beings acting as economic agents) because they receive utility from their consumption or use. This human foundation is critical in determining which types of government spending can be treated as investment.

In theory, the sources from which utility is derived may serve as criteria for

distinguishing between investment and consumption. Leisure generates utility directly and goods and services generate utility when they are consumed. Capital assets do not generate utility, but produce the goods and services that generate utility when consumed. In practice this distinction is not always straightforward in the conventions used in the National Accounts, as will be discussed in more details in the next subsection. For example, a stand alone refrigerator in a residential home is treated as a durable consumer good while a refrigeration unit built into the same house is treated as investment. Yet both units generate the same flow of "refrigeration" services to the homeowner. These special conventions used in the definition and measurement of physical capital must also be taken into consideration in the determination of what constitutes investment in other types of capital.

### *Measurement*

The details and quotations found in this subsection are from the Glossary attached to Statistics Canada's quarterly and annual publications on the National Income and Expenditure Accounts (catalogue 13-001).

With respect to the measurement of physical capital, two main aspects must be identified: (a) the list of items included in the definition of capital and (b) the manner in which these items are valued.

### *What Is Included in Physical Capital*

According to the National Accounts, investment in physical capital (fixed investment) generally refers to the purchase of capital goods by business and government. It includes three major categories: **residential construction, non-residential construction, and machinery and equipment.**

**Residential construction** includes new housing construction. In the case of owner-occupied homes, individuals are treated as firms that purchase the asset and rent the housing services to themselves as consumers.

**Non-residential construction** includes "industrial, commercial and institutional building



and engineering works such as roads, dams, transmission lines, oil well drilling and mine development". Investment in residential and non-residential construction is not limited to new construction but also includes "conversions resulting in a structural change and major renovations (together referred to as alterations and improvements)". In the case of alterations and improvements, what determines the treatment as investment is not an improvement in the function of a structure (a change that would increase its productivity), but the structural nature and extent of the change (major versus minor renovations).

Investment in **machinery and equipment** refers to "capital expenditures on durable, tangible goods with an expected service life of one year or more, such as furniture, motor vehicles, office machines and equipment not permanently installed". Since 2001 it also includes intangible assets (the purchase of computer software). It should be pointed out that, with respect to investment in machinery and equipment, the classification of a certain item as a consumer good or a capital good is determined by the purpose of the use of a given asset and not by its form or structure. For example, an automobile purchased by an individual is treated as a durable consumer good because it provides transportation services directly to the owner and is not used in the production of other goods and services. The same automobile purchased by a business is treated as a capital good because it is used to produce other services (it is a factor of production) that are sold to consumers.

The allocation of government expenditures is based directly on the methodology employed for private sector spending. Government fixed investment contains all three of the above components of fixed investment. The largest component is non-residential construction, which includes "schools and hospitals, plus construction of highways, bridges, railway tracks, canals, waterworks, sewage systems, dams, hydro or thermal generating plants, telephone lines, oil and gas facilities, etc". Residential construction, such as the construction of a university dormitory, is a very small component of government fixed investment. Investment in machinery and equipment includes "furniture, agricultural machinery, industrial machinery, office machines, automobiles, trucks, other transportation equipment, other machinery and equipment".

## *Valuation*

With respect to the manner in which investment in physical capital is valued in the National Accounts, the following points need to be emphasized.

1. The valuation of spending on fixed investment is based on the selling price of the assets, which includes all costs of production and distribution including normal profits under conditions of perfect competition and additional profits in the presence of market power.

2. Investment in both residential and non-residential construction includes the costs of site preparation, real estate commissions, and “all capitalized costs such as architectural, legal and engineering fees, capitalized interest and own-account work by firms employing their own labour force” and also “installation and delivery cost”.

3. Not all costs incorporated in the price of a capital good are related to its function or performance. For example, site preparation and engineering services are integral components of a structure, but legal and real estate expenses are related to the ownership of the structure and not to its form or function. Major renovations for residential construction may include both functional and aesthetic components. Both generate utility for the owner. The latter, however, does not provide shelter services but delivers utility directly in a manner similar to a piece of furniture. This example indicates that the National Accounts employ special conventions in order to facilitate the measurement of fixed investment (it is impossible to distinguish between functional and aesthetic spending for a building). We must incorporate these conventions if we want to achieve full consistency in the measurement of all types of capital.

4. The recorded value of physical capital includes "capitalized interest charges with which capital projects are financed", a convention that is relevant to the way in which government loans for the acquisition of other types of capital should be

treated.

5. Investment in fixed capital includes both purchases and in-house work. This inclusion is most clearly evident in the case of investment in software, which is divided into three categories: (a) prepackaged software; (b) custom software; and (c) own-account software.

### *Selection of Criteria*

The features, uses and measurement of physical capital discussed above may be used to select the criteria for determining which components of government spending may be treated as investment in general.

With respect to **the main features** of physical capital, we must acknowledge that since 2001, when computer software was included in fixed assets, being a tangible asset is no longer one of its defining characteristics. This recent change in the definition of fixed investment indicates that our concepts and approaches to the measurement of capital are flexible and change over time as economic structures evolve. As we expand the concept of physical capital beyond the traditional notion of tangible assets, we must recognize that we no longer need special justifications for treating spending on intangibles, such as spending on education and social networks, as investment.

The general rule with respect to **the use** of physical capital is that it is a factor of production because it contributes to the production of other goods and services. But this rule has significant exceptions. For example, investment in owner-occupied houses includes expenditures for aesthetic features of the building, which do not deliver shelter services, but provide direct utility to the owner. As another example, incorporating a sculpture in a hospital building serves no health care function, but may deliver direct utility to patients and visitors. Yet, its cost is treated as part of investment in physical capital.

With respect to **the measurement** of physical capital, two points need stressing. First, the

conventions are not always consistent with the underlying principles, particularly true in the case of equipment. Two pieces of equipment that serve the same function are treated differently depending on whether they are incorporated into a structure. Second, the recorded value of a capital asset includes (a) services in the production of physical capital, some of which have no relationship to the function of the asset; (b) the cost of financing the production or purchase of a capital asset; and (c) major alterations and improvements, even when they do not affect the function of the capital asset in producing goods and services.

Using the above elements of physical capital, we suggest that a government's expenditures may be treated as investment when it meets all of the following criteria:

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

Once an asset is defined as a capital good, any direct or indirect government expenditure related to its production, sale, installation and financing should be treated as investment. These criteria are applied to human capital in section III and to social and civic capital in section IV.

### **III. HEALTH CARE SPENDING AS INVESTMENT IN HUMAN CAPITAL**

This section develops the conceptual framework for determining the extent to which government spending on health care may be treated as investment in human capital. It is divided into two parts. The first part deals with traditional approaches to human capital while the second part presents the elements of a new approach (a more detailed discussion is found in Ruggeri [2007b], which is used as the main source for this section).

## A. Traditional Approaches

This part is divided into two components, the first dealing with concepts and definitions and the second with measurement issues.

### *Definitions*

The main elements of what we currently consider human capital were already identified more than 200 years ago by Adam Smith. In *The Wealth of Nations* [1776: I.x.9 and I.x.17] he established a direct connection between human and physical capital: both involve large expenses and both carry the expectation of higher returns. Smith's line of thinking was picked-up by Marshall [1890], who treated human capital as personal wealth in the sense of the ability to raise a person's earning capacity.

The concept of human capital was revived in the 1960s to explain earning differentials among workers with different levels of education. Since then, the concept of human capital has evolved but has not led to a commonly accepted definition. Instead the literature on human capital presents us with a variety of definitions, each stressing specific aspects. The modern definitions of human capital may be separated into four groups. The definitions in the first group focus on workers' skills in explaining earnings differentials [Mincer, 1958; Schultz, 1961; Becker, 1964; Kiker, 1966; Thurow, 1970; Bannock, 1992; Arnold, 1992]. The second group contains definitions that focus strictly on education and skills acquisition and their role in fostering economic growth [Lucas, 1988; Romer, 1990; Bolmqvist, Wannacott, and Wannacott, 1994; Gurak, 2006; Husz 1998]. The third group also emphasizes the importance of education in economic growth, but stresses the embodiment of education in human beings [OECD, 1996; 1998; 2001; UN, 2001; NRTEE, 2003]. The final group includes definitions that recognize innate abilities and other attributes of human beings in addition to formal education [Laroche, Merette, and Ruggeri, 1998; Blundel, Dearden, Meghir, and Sianesi, 1999]. The definitions in this last group have their roots in Marshall's writings where it is stressed that "we may define *personal wealth* so as to include all those energies, faculties, and habits which directly contribute to making people industrially efficient [1890, pg 57].

That efforts devoted to finding a broadly accepted definition of human capital are still ongoing is shown by the evolution of the definitions used by the OECD. The 1996 OECD definition stresses three aspects of human capital: (a) it is acquired knowledge; (b) it is a factor of production; and (c) it is used in both market and non-market activities. The inclusion of the production of "goods, services and ideas" in non-market activities clouds the distinction between capital goods and consumer goods (the indirect-direct utility dichotomy discussed earlier). The 1998 definition tries to clarify this ambiguity by replacing the terms "production" and "market and non-market circumstances" with the term "relevant to economic activity," a term that indicates a limitation to production, thus excluding personal consumption uses. At the same time, the definition extended the concept of human capital beyond "knowledge", which is often used to indicate skills, to include "competences and other attributes," some of which, such as personal values like honesty, are not related to the term knowledge as commonly understood in relation to human capital. The 1998 definition also stresses the human connection in human capital by emphasizing the embodiment of these skills, competences and attributes in human beings. The 2001 definition combines the broader list of components found in the 1998 definition and the broader view of its purpose found in the 1996 definition. Therefore, it includes in the definition of human capital the knowledge and human attributes that produce goods and services or generate direct utility to the individual.

The definitions of human capital found in the first three groups discussed above have two major shortcomings: (a) they implicitly sever the conceptual relationship to physical capital, and (b) they are cast within a static framework (adults acquiring skills and special attributes). An element of dynamics is introduced in the definitions in the last group where the acquisition of knowledge and skills is explicitly related to the innate abilities of an individual. This explicit connection extends the time frame of the concept of human capital, not just forward in the sense of lifelong learning, but also backwards prior to a child's birth as innate abilities are developed in the womb. This dynamic element has important implications for the measurement of public investment in human capital. If the knowledge and skills that may be acquired by an individual are affected by his/her innate

abilities, if these innate abilities depend both on genetic factors and the capacity and willingness of an expectant mother to carry a healthy pregnancy, if the development of these abilities depends on the nurturing that the newborn receives in his/her infancy and early childhood, and if the use of acquired human capital in on-market activities after retirement generates social benefits, then public investment in human capital can no longer be limited to government spending on education and training, but must also include a variety of other expenditures, some of which have traditionally been treated as consumption (e.g., social programs).

The implications of this dynamic element were further explored by Ruggeri and Yu [2001], who suggested that human capital is best analyzed within a framework that (a) covers an individual's entire lifespan; (b) involves decisions by different agents along an individual's life journey; and (c) include interactions between various components of public policy and private decisions. They do not offer a new definition of human capital. Instead, they analyze the stages of development as an individual progresses from infancy to retirement and identify four dimensions of human capital: potential, acquisition, availability, and effectiveness.

The *potential* dimension starts with the primary source of human capital, the children who have the ability to acquire skills as they grow. Ruggeri and Yu [2001] identify two stages of this dimension: (a) the *production* of the economic agents who may later acquire human capital; and (b) *nurturing* in infancy and early childhood when the learning capacity embodied in a child at birth is validated or degraded by factors and institutions beyond their control. As pointed out by Ruggeri [2003, p. 178], this dimension of human capital emphasizes the need to analyze human capital "within a dynamic framework that links more than one generation in a process of birth, growth and death, through the intermediation of various social structures and networks". It also highlights the links between human capital and social capital, an issue that will be addressed in the next section of this paper.

The *acquisition* dimension is equivalent to the traditional definition of human capital as it

focuses on the acquisition of knowledge and skills. This dimension can also be divided into two stages, depending on the freedom of choice by an economic agent. The first stage includes the period when learning decisions are largely made by individuals and institutions other than the individual acquiring human capital (elementary school and to a lesser extent secondary school). The second stage reflects the free choice of an economic agent to acquire skills, given his/her economic conditions and other opportunities and constraints (post-secondary education and adult training). While the traditional approach to this dimension is confined to the acquisition of skills, we extend its scope to incorporate also values and attitudes, in line with the thinking of Marshall.

Human capital becomes a factor of production when it is made available for use in market (narrow definition) and non-market activities (broad definition). The *availability* of human capital in a given jurisdiction does not depend exclusively on the production of potential human capital and the acquisition of skills in that jurisdiction for a variety of reasons. First, some skills are acquired strictly for personal pleasure. Second, the knowledge and experience of skilled workers is withdrawn from the labor market when workers retire because of age, poor health, or accumulated wealth (including incentive programs) that allows early retirement. Third, labour mobility ensures that the skills acquired in a jurisdiction may be utilized in another.

The final dimension captures the fact that the availability of human capital does not guarantee its *effective utilization*. Some of the available human capital may not be utilized due to the lack of employment opportunities and obsolescence, and some of the utilized human capital may be underemployed, thus reducing its potential contribution.

Placing human capital within a dynamic lifetime framework facilitates the identification of the factors that influence it in each of the above four stages. The links between public policy, private decisions or outcomes and human capital for each of the four dimensions are shown in Table 1. For the potential dimension, most of the factors affecting human capital are "social" in nature and include "social programs" like social services and health care that are generally treated as consumption. Even the acquisition dimension is affected



by some social programs, especially those aimed at reducing income inequality, because the ability of an individual to acquire skills and knowledge depends partly on his/her personal and family economic conditions. The availability of human capital is affected by various elements of government policy, such as macroeconomic policy and trade policy, that are usually formulated for other purposes. At the private decision level, availability is also affected by policies normally not considered as determining factors for human capital, such as the level of a person's or a family's wealth and other policies that affect the choice between home production and market production. Effectiveness is also influenced by a variety of government policies - primarily macroeconomic policy that affects labour market performance and labor market policies - and private sector conditions, such as the quality of management and workplace conditions.

Table 1 indicates that public investment in human capital extends beyond the current measures of government spending on buildings and equipment and the widely accepted measure of spending on education and skill development. In particular, it suggests that health policy influences human capital in all four stages. More details on the connection between health policy and human capital are discussed later in this section, following a brief survey of the literature on the traditional measurement of human capital.

### *Measurement*

In the literature one can identify three approaches to the measurement of human capital: (a) **the cost-based approach**; (b) **the output-based approach**; and (c) **the income-based approach**. All three approaches deal with the acquisition dimension only.

The **cost-based approach** measures, in two stages, the cost of the inputs in the acquisition of human capital. Since inputs are ingredients into the production of a final product, the first stage requires a clear identification of the final product and the selection of the inputs to be included in the measurement. In the case of human capital we must include all the items that are part of the process that helps individuals acquire knowledge, skills and related competencies and attributes. The second stage develops estimates of the costs of these inputs.

<b>Table 1. Dimensions of Human Capital, Public Policy and Private Decisions</b>		
<b>Public Policy</b>	<b>Human Capital Dimension</b>	<b>Private Decisions</b>
Social Policy Health	Potential	Fertility Rates Mortality Rates Parents Lifestyles Social Support Networks
Education Policy Redistribution Policy Health	Acquisition	Private Returns to Education Individual & Family Economic Conditions
Macroeconomic Policy Trade Policy Tax Policy Health	Availability	Immigration Emigration Family Responsibilities Wealth
Macroeconomic Policy Labour Policy Health	Effectiveness	Skill Choice Employer Practices Management Quality

There is no common approach to the identification of the relevant inputs and their cost. Kendrick [1976] and Eisner [1989] estimated the stock of human capital in the US by calculating the depreciated value of investments in education, general training, health and safety, and also in child rearing and mobility. Judson [2002] used a variation of this approach by replacing historical costs with replacement values, in a manner similar to the approach used in the measurement of physical capital. A general analytical framework for measuring investment in human capital from the cost side is found in Stroombergen, Rose and Nana [2002], who separated these costs into three categories: employer investments, individual and family investments, and government investments.

The **output-based** approach focuses on the skills that are acquired with the expenditures incurred by individuals, governments and employers. One strand of this approach focuses on various indicators of cognitive abilities and other attributes of individuals. The OECD is running three major projects in this field: the International Adult Literacy Survey, the Cross-Curricular Competencies Project, and the Human Capital Indicators Project. Indicators of cognitive abilities include literacy, numeracy and science skills. Other

important attributes of individuals that are considered to be relevant to human capital are problem solving, team work, practical cognition and computer familiarity. Another strand tries to summarize output-based human capital in a single indicator of human capital, which usually combines a selected measure of the population, such as the working-age population or the labour force (the quantity component), and the skills it has acquired (the quality component). Given the difficulties in measuring skills and abilities other than those acquired through formal education, studies based on the output-based approach focus simply on the measurement of formal education.

Output-based approaches measure human capital in two steps. The first step selects the age range to be included in the measure of output. The most common range is the one that encompasses the labour force, namely, from 15 to 64 years of age [Lau, Jamison and Luat, 1991; Psacharopoulos and Arrigada, 1986; 1992; Kyriacou, 1991; Koman and Marin, 1997; Laroche and Merette, 2000]. The National Roundtable on the Environment and the Economy [NRTEE, 2003] confined its target group to those in the age range from 25 to 64 years of age. Ruggeri and Zou [2005] suggested an age range from 19 to 69 to account for three trends, namely, the rising level of the average years of schooling of the young population, longer life expectancy at 65, and the steady process of elimination of mandatory retirement.

The second step measures the level of skills embodied in the population of the selected population, often approximated by an estimate of years of schooling. In these calculations step, a distinction is made with respect to educational levels. Generally, those who did not complete high school are assigned 9 years of schooling, high school graduates are given 12 years of schooling, people with some secondary education are assumed to have completed 14 years of education and those with a university degree are assigned 18 years of education to account for both undergraduate and graduate degrees. Human capital, measured by the average level of education of the selected population, is finally calculated as the weighted average of the years of schooling associated with the selected educational levels, where the weights are the relative shares of the population assigned to each educational level.

The weighting scheme in the output-based approaches assumes that productivity differentials among workers with different levels of education are proportional to their years of schooling regardless of the quality of education embodied in a person. When we relax this assumption and use market outcomes to measure education-based earnings differentials we move to the **income-based approaches**. In this approach to the measurement of human capital the aggregation involves people with different earning power instead of people with different levels of education. Therefore, this approach requires a specific function for the relationship between education levels and earnings. Different forms of this relationship are incorporated in the human capital measures estimated by Jorgenson and Fraumeni [1989; 1992], Mulligan and Sala-i-Martin [1997], Koman and Marin [1997, 1999], Laroche and Merette [2000], Wei [2004].

The approach used in this paper is a modified version of the cost-based approach. It is narrower with respect to the number of contributors to the financing of human capital as it is confined to government expenditures on health care. It is also broader in coverage because it includes all government health care expenditures that meet the relevant criteria extracted from the properties of physical capital. A detailed analysis of this approach is presented in the second part of this section.

## **B. A New Approach**

The traditional approaches to the concept and measurement of human capital have two major shortcomings: (a) they are grounded in a static framework; and (b) they are not linked to the concept and measurement of physical capital. These shortcomings prevent the development of consistent estimates of government investment.

This subsection addresses these shortcomings by using the dynamic framework discussed above and by using the criteria for investment selected earlier and derived from the main features, uses and measurement of physical capital. We first explain the specific links with physical capital and then provide details on the implications of using a dynamic framework for determining the extent to which government spending on health care is an

investment in human capital.

### *Links to Physical Capital*

In section II we developed a set of criteria for investment based on the main elements of physical capital. Identifying human capital with reference to physical capital is not a novel idea and it dates back more than 200 years with the work of Adam Smith [1776] who emphasized that physical and human capital are fixed capital because both require large expenses and both generate the expectation of profit. He also made it clear that the comparison is between a machine and a skilled worker, i.e., the combination of an individual and his/her skills. In applying these criteria we focus particularly on two components of physical capital, namely, computers and residential structures.

Let us start with the computer. This is a capital asset composed of three parts: (a) a shell that holds all components together in a suitable box; (b) the hardware that provides the operating capacity (processor, hard drive and similar parts); and (c) the software which allows the computer to perform its tasks. From a human capital perspective, a human being may also be separated into three components. The first component is a physical shell, the body without the brain, which is a tangible and reproducible part. Like the computer shell, by itself it cannot perform any task. The second component is the brain which, like computer hardware, is partly tangible (its mass) and partly intangible (the connections that make it function). It has the capacity to make the entire body operate and perform tasks. This operation, however, depends on the acquisition of skills. As a computer, shell plus hardware, is incapable of performing any task without the appropriate software, so body and brain cannot function without acquired skills. These skills, however, can be acquired because of the innate abilities of human beings to learn and to act.

There are also significant differences between computers and human beings. From a human capital perspective, the fundamental difference is that each of the three components are reproducible separately for a computer but not for a human being. For

the latter, both the equivalent of the computer shell and hardware are reproduced jointly as one piece. Moreover, whereas software is generic in the sense that it is interchangeable among computers, skills are specific to a given individual because they are fully embodied. Finally, the capacity of a computer to perform tasks is fully determined by the specifications of its hardware and software. In the case of human beings, genetics and society also provide strong imprints. However, the special 'attributes', including the set of personal values that guide a person's decisions, are developed within a social context and through an internal process that is unique to each individual. Both computers and human beings depreciate over time and are also subject to obsolescence. However, machines have a scrap value at the end of their useful life while human beings do not.

Human beings differ from computers in two other important aspects: (a) emotions; and (b) spiritual dimensions. While computers may require periodic physical maintenance and updates to its software packages, human beings have physical, intellectual, emotional and spiritual needs. Whether or not all these needs are satisfied in a balanced manner affects their health status, their acquisition of human capital, and the effectiveness of its utilization. These issues are discussed in more detail in Ruggeri [2007b].

Once the comparison between computers and human beings in terms of human capital has been established, the next step involves an analysis of how the purchase of a computer is recorded as investment in the National Accounts. These measurement conventions can then be applied to human capital.

The treatment of computers and software purchased by business and government as investment in machinery and equipment is an implicit recognition that the tangible investment would not be useful in production without the incorporation of the intangible component software. The following features of this type of fixed investment are worth stressing. First, the purchase price paid by business and government includes the cost of tangible components and intangible services. Second, the purchase price includes costs related to the shape of the equipment, which are not always necessary for the proper functioning of the equipment. Some components of a computer may serve both functional

and aesthetic purposes (e.g., flat screen versus conventional screen) while others may serve only aesthetic purposes. Third, investment in this type of equipment includes both the purchase of a new computer and major changes that affect its function. As a general rule, an item that is expected to be in production for more than one year and costs more than \$1,000 is treated as capital. Therefore, the purchase of a hardware component needed to expand the capabilities of an existing computer system would be treated as investment if it met the above requirements. Since 2001, all three categories of software – prepackaged, custom and own-account – are part of fixed investment. As pointed out by Jackson [2002, pg 2], "software investment here covers organizations' capital plus non-capital spending, essentially treating all of their software purchases and own-account development costs as capital outlays, irrespective of how these outlays are treated in their books". Repair and maintenance of software, however, is not included in investment.

We now turn to residential structures. These structures are treated as fixed investment whether they are rented or owner-occupied. In the latter case, an individual plays two roles: as the owner he/she is treated as a firm that sells housing services to himself/herself as a consumer. These housing services, however, cannot be sold separately from the structure. Similarly, an individual is the owner of the human capital that he/she has acquired. These services may be sold in the labour market or may be purchased directly by the individual (the self-employed). As in the case of the residential structure, these services cannot be sold separately from the structure, in this case the body and mind of the individual. In either case, what is being sold is the use of the equipment or structure for a specified amount of time. The comparison with residential structures helps clarify an important methodological and measurement issue: expenditures on the acquisition of knowledge and skills should be treated as investment regardless of whether the acquired human capital is used for market or non-market activity. As mentioned earlier, aesthetic components incorporated into a structure as well as major renovations largely for aesthetic purposes are treated as investment. The same treatment should be given to major medical procedures that improve a person's quality of life. How can we justify classifying as investment major home renovations that increase a person's comfort and mobility within the house but treating as consumption a hip replacement? While in

practice the distinction between human capital acquisition for investment purposes or for consumption purposes would be difficult to make, the comparison with residential structures indicates that it would be conceptually unwarranted. This conclusion has important implications for the treatment of public spending on health care, as will become evident later in this paper.

Traditional measures of human capital, regardless of the approach used, focus on the acquisition dimension only. The computer analogy is consistent with the Ruggeri and Yu [2001] four dimensions of human capital, which include body, innate abilities, and acquired skills. It is the inclusion of all three parts that allows a full scale determination of what investment in human capital is and expands the scope of government spending on human capital beyond spending on education. Given the relevance of the Ruggeri-Yu classification for a dynamic approach to the concept and measurement of human capital, we will use the four dimensions of human capital - potential, acquisition, availability, and effectiveness - as the foundation for determining which government expenditures on health care that may be treated as investment in human capital.

#### *Dimensions of Human capital: Potential*

This is the fundamental building block in the analysis of human capital because without the production of children there would be no human capital. Even when a country's increase in its labour force is entirely in the form of immigration, these adults were first children somewhere in the world. The first step in the analysis is the determination of the age range associated with this dimension. We have assumed that the *potential* dimension covers the period from conception to age five. For analytical purposes we have also divided this dimension into two sub-periods: *production and nurturing*. The first sub-period starts at conception and ends at birth while the second sub-period starts at birth and ends at age five.

***Production.*** Using the day of conception as the starting point for the analysis of human capital does not address the moral issue of when life begins. It simply recognizes that,



from a human capital perspective, the process of producing a child starts at the time of conception, however this may take place. Without this initial act, there will be no child and no potential human capital. This treatment is similar to that of any piece of machinery. It starts being part of what eventually will be counted as investment when business spends money on the concept and design of that machine.

Starting at the point of conception means that government expenditures on human capital are not limited to direct spending on the individual who acquires human capital, but include the expenditures associated with the entire process of pregnancy and child birth. During the gestation period, the development of the unborn is totally dependent on the conditions and behaviour of the mother. During this stage, the health status of the mother is the most crucial factor. Five major elements of a mother's conditions during pregnancy are particularly influential in determining the health status of a new born child: (a) tobacco use; (b) alcohol consumption; (c) drug use; (d) exposure to environmental pollution; and (e) nutrition.

*Tobacco.* The effects of smoking during pregnancy on the health of infants are well-documented. According to the National Council of Welfare [NCW 1997, pg 5], "a survey of the medical literature in French and in English from 1970 to 1984 suggested that cigarette smoking was by far the biggest risk factor for low birth weight in developed countries". Fetal exposure to nicotine may restrict its growth by impairing circulation of blood between the uterus and the placenta and by reducing the supply of oxygen to the fetus. Maternal smoking during pregnancy may also lead to (a) spontaneous abortion or miscarriage; (b) diminished lung function; (c) abnormal implantation of the placenta in the lower uterine segment; (d) partial or total premature separation of a normally implanted placenta; and (e) premature rupture of membranes.

A study on the effects of smoking and drinking during pregnancy using Canada's Longitudinal Survey of Children and Youth was conducted by Connor and McIntyre [2002]. With respect to tobacco use during pregnancy, the authors found that: (1) babies born to smokers are often underweight and suffer a variety of health problems, and (2)

after birth, these children are likely to suffer from long-term problems such as increase in behavioural disorders (hyperactivity, anti-social behaviours), score lower on cognitive and development tests, and show higher incidence of idiopathic mental retardation.

In a review of previous studies on *in utero* effects, the Early Years Study 2 report [McCain, Mustard, and Shanker, 2007] states that pregnancy and delivery complications, such as toxemia or eclampsia, prematurity, and exposure to alcohol and cigarettes during pregnancy, appear to be environmental factors that can alter the brain development in early life, rendering the child vulnerable to Attention Deficit Hyperactivity Disorder (ADHD) [Biederman and Faraone, 2005]. In turn, ADHD is associated with other behavioural problems, including difficulties at school, family conflict, poor occupational performance, psychiatric disorders, substance abuse, and antisocial behaviour [Biederman and Faraone, 2005; Cantwell, 1996; 1997; Nadder, Rutter, Silberg, Maes, and Eaves, 2002; Teicher, 2002].

*Alcohol.* Maternal alcohol consumption during pregnancy has negative effects on the health of the unborn even at low levels of consumption because alcohol cannot be easily eliminated from a mother's systems and enters the fetus in the same concentration found in the mother.

With respect to drinking, the findings indicate that children exposed to alcohol *in utero* are more likely to suffer from Fetal Alcohol Effects (FAE) and, worse, from Fetal Alcohol Syndrome (FAS). Symptoms of the latter include facial abnormalities, pre- and post-natal growth deficiencies, learning disabilities, behavioural problems, and delayed development. FAE effects, though less severe, are still serious and include "hyperactivity, behavioural problems, learning disabilities, and a general inability to function normally in society" [NCW, 1997, pg 9].

In a review of the literature on FAS/FAE, Doucet, Levac, and Ruggeri [2006] point out that FAS is currently the third leading cause of mental retardation in children, with 100 cases in Canada each year [Remkes, 1993; Health Canada, 1996]. This prevalence is even higher among children of Aboriginal descent living on reserve, as the substance abuse

rate amongst Aboriginal peoples is up to five times higher than the national average [Fournier and Crey, 1997]. Even though researchers are unsure of the amount of consumed alcohol it would take for a pregnant mother to affect the fetus, it is imperative that FAS and FAE are recognized as completely preventable causes of developmental delays in children and birth defects in infants [Connor and McIntyre, 2002]. Hence prevention and intervention programs targeted at mothers at-risk prior to the child's birth should be considered as an investment in the child's future human capital.

*Drugs.* Serious effects on the health of the new born are also caused by the use of drugs during pregnancy. According to the Medical Library [www.medem.com], a mother's drug use may affect a baby before and after birth. For example, the use of marijuana during pregnancy may result in smaller babies with a higher probability of having health problems. The use of cocaine may cause an early separation of the placenta from the uterus and cause preterm birth and possible fetal and/or mother death. The use of heroin causes the same effects and, in addition, may cause addiction in the fetus. The use of LSD may cause birth defects while the use of ketamine and PCP may result in smaller babies with poor muscle control. Glues and solvents may cause birth defects in babies, amphetamines may cause placental abruption and even fetal death and ecstasy may result in long-term learning and memory problems.

As reported by McCain and colleagues [2007] in the Early Years 2 study, numerous studies of the past 20 years have shown that abuse, neglect, or parenting compromised by depression or substance abuse influences the development of a child's brain and biological pathways. It has been shown that children raised in an abusive home, or with a severely depressive or addicted caregiver tend to experience high anxiety, and eventually start associating anxiety with other social interactions outside the home. By the time the child has reached the age of school entry, it is much harder to undo the damage done in order to help the child disassociate anxiety with social interactions. This anxiety can in turn affect the child's ability to focus on the learning tasks at hand, and can impact on his or her academic achievement.

*Pollution.* That environmental factors affect a child's health even before birth is well-known. Even *in utero* low level but persistent exposure to environmental pollutants creates development risks for the fetus. Of particular concern is the exposure during pregnancy to heavy metals, such as mercury, selenium, arsenic, lead and cadmium. An analysis of the effects of these heavy metals on the newborn is found in Vaillancourt and Surette [2006]. They show first that these contaminants may enter a mother's body directly through inhalation and skin absorption or indirectly through food and water consumption. They show that these pollutants are transferred from the maternal blood to the fetus through the placenta. As pointed out by the U.S. National Academy of Sciences [NAS, 1993], the fetus is more vulnerable than an adult to this contamination transferred through the mother's blood because (a) an immature, porous blood-brain barrier allows greater chemical exposure to the developing brain; (b) children have lower levels of some chemical-binding proteins, allowing more of a chemical to reach "target organs"; and (c) a baby's organs and systems are rapidly developing and thus are often more vulnerable to damage from chemical exposure. Their research found that mercury can damage the nervous system, the lungs, the kidneys, vision and hearing. Lead, whose passage to the fetus is not attenuated by the placenta, can affect any organ and system of the body, particularly the central nervous system of the unborn and of children. Cadmium may cause lung cancer, toxicity of the liver, kidney, immune, skeletal, cardiovascular, gastrointestinal tract, reproductive and nervous systems. Similar effects may be caused by arsenic. At high doses, manganese may cause brain damage in humans. According to Takser et al. [2003], environmental exposure to manganese *in utero* may affect early psychomotor development in children.

*Nutrition.* According to the National Council of Welfare [NCW, 1997], poor nutrition and low pre-pregnancy weight are second and third in the rank of risks for low birth weight, after tobacco smoking. The channels through which maternal nutrition during pregnancy generates these adverse effects are shown in Figure 1, which is reproduced from Figure 1 in Martin-Gronert and Ozanne [2006].

**Figure 1. Schematic Representation of the Effects of Maternal Nutrition on the**

<b>Health of the Offspring</b>		
Maternal under-nutrition	Other maternal or placental abnormalities	Maternal over-nutrition
Fetal exposure to under-nutrition	Fetal programming	Fetal exposure to over-nutrition
Low Birth Weight	Obesity/Age  Increased susceptibility to type 2 diabetes, hypertension, cardiovascular disease	Normal/high birth weight

A list of the disorders and diseases that may be associated with fetal malnutrition is shown in Table 2, which reproduces table 1 in Martin-Gronert and Ozanne [2006]. The literature survey conducted by Martin-Gronert and Ozanne led them to conclude that "the ability of the mother to provide nutrients and oxygen for her baby is a critical factor for fetal health and its survival....Only recently has evidence from epidemiological and animal studies emerged suggesting that fetal responses to the intrauterine environment may underly the prevalence of many chronic diseases of adulthood" (p 779).

<b>Table 2. Metabolic Disorders and Diseases of Adulthood that Have Been Associated with Nutritional Imbalances during Fetal Life</b>	
<b>Metabolic Disorders</b>	<b>Cardiovascular Disorders</b>
B-cell Dysfunction Dislipidaemia Glucose Intolerance Insulin Resistance Obesity Type 2 Diabetes Osteoporosis Chronic Obstructive Lung Disease Polycystic Ovary Syndrome	Hypertension Atherosclerosis Stroke Coronary Heart Disease Breast Cancer Chronic Renal Failure Schizophrenia

The use of low birth weight as a primary indicator of pregnancy outcome and government-financed prenatal nutrition programs were criticized in an earlier paper by

Kramer [1998]. While suggesting that public funds would be better spent for research "on the causes and prevention of adverse pregnancy outcomes", Kramer acknowledges that (a) "preterm infants are at increased risk for infant deaths, short- and long-term pulmonary, ophthalmologic and neurologic morbidity, and delayed psychomotor development"; and (b) "term infants who are small for their gestational age are at a much lower risk for death and short-term morbidity", but "such infants may be at increased risk for type 2 diabetes, hypertension, and coronary artery disease when they reach middle age" (p. 663).

To mitigate the negative effects of poor nutrition during pregnancy, the federal government in the US introduced in 1974 the Special Supplementary Food Program for Women, Infants, and Children (commonly known as WIC). An evaluation of this program by leading business executives [Budget Committee, 1991] concluded that:

- Participants in the program had a reduced risk of low birth weight and infant mortality,
- Women in the program are much more likely to seek adequate prenatal care and to ensure that their children are immunized against disease.

All the negative health influences on the fetus mentioned above will have a detrimental effect on all four dimensions of human capital. This means that the factors that affect a mother's physical and emotional conditions during pregnancy have relevance for human capital and the government programs addressing these conditions are ultimately investments in human capital.

***Nurturing.*** Following a live birth, a child enters the second sub-period within the potential human capital dimension: nurturing. We have used the age range 0-5 for this sub-period to separate early childhood from the beginning of compulsory education. As government funded pre-school programs become more common, this range may be adjusted.

Research tells us that this sub-period covers the most important years in a person's life [McCain et al., 2007]. These are the years when a child not only acquires the basic motor and language skills, but also learns how to socialize with adults and other children and acquires the set of values that will serve as a guide to his/her life. Although nurturing is a direct parental responsibility, ultimately it becomes a community endeavour. For analytical purposes, this sub-period may be divided into two parts: infancy (0-2) and early childhood (2-5).

*Infancy.* This is probably the most crucial period in a child's life because its organs are in the development stage, particularly the brain. The windows of learning opportunities in a child are identified in Table 3, which is reproduced from table 2 of the National Council of Welfare [1997, pg 14].

Motor development	Prenatal to 5+ years
Emotional control	Birth to 2 years
Vision	Birth to 2 years
Social Attachment	Birth to 2 years
Vocabulary	Birth to 3 years
Second Language	Six months to 10 years
Math/logic	One to 4+ years
Music	Three years to 10 years

This table shows that three of the most important developments - emotional control, vision and social attachment - take place within the first two years of a child's life and another one (vocabulary) occurs within the first three years. For these development to take place at a normal rate a child needs the appropriate visual, tactile and auditory

stimuli. As pointed out by Keating and Mustard [1993], "it is now recognized that children must be stimulated through visual, tactile and auditory and other stimuli to develop fully. Thus factors in our social environment that impair these crucial stimuli for children during the sensitive periods of neural development could lead to cognitive and behavioural handicaps later in life".

All the factors identified earlier with the health of the expectant mother and the fetus are also relevant in the early years. Of particular importance is poverty and its influence through nutrition. As pointed out by the Carnegie Corporation of New York [1994], "poor nutrition in infancy, for example, can seriously interfere with brain development and lead to learning disabilities and mental retardation".

Another important factor is the mental health of the parents caring for infants and young children. Infants are totally dependent on their caretakers for their health and well-being; from birth, infants engage socially with their parents or guardians and are sensitive to the quality of their communication [Murray, Cooper, and Hipwell, 2003]. Parent stress and mental illness can impair the quality of the communication between caregiver and infant. Murray and colleagues found that depression in parents in the UK caused a lack of contingency in parents' responses, which can affect an infant's sense of connections between his/her behaviour and the events occurring in his/her environment. This connection is a fundamental aspect of learning abilities in infants. In addition, the researchers found the insensitive or unresponsive parental behaviours caused by depression can interfere with the child's ability to develop the capacity to sustain attention. Depressive parents can also exhibit hostility and markedly intrusive behaviours, which may cause infant distress; this can interfere with the child's cognitive memory functions. Finally, Murray and colleagues found that parental depression reduces the level of parental imitation of the infant's expressions during interactions; this in turn has been linked to having an adverse effect of a child's ability to make distinctions between one's self and others.



Studies conducted on Post Partum Depression (PPD) in mothers have also found extensive long-lasting impacts on child cognitive and emotional development [Beck, 1998; Logsdon, Somers and Willms, 2002; Wisner, and Pinto-Foltz, 2006]. According to Logsdon and colleagues' [2006] definition of PPD, mothers must experience at least five of the following symptoms, on a daily basis, for a minimum period of two weeks:

“depressed mood, often accompanied or overshadowed by severe anxiety, markedly diminished interest or pleasure in activities, appetite disturbance, usually loss of appetite with weight loss, sleep disturbance, most often insomnia and fragmented sleep, even when the baby sleeps, physical agitation (most commonly), or retardation, fatigue, decreased energy, feelings of worthlessness or excessive or inappropriate guilt, decreased concentration or ability to make decisions, recurrent thoughts of death or suicidal ideation” (p. 654).

Children over one year of age with PPD mothers have been shown to exhibit attachment issues [Murray, 1992], antisocial behaviours such as temper tantrums, and issues with sharing [Uddenberg and Engleson, 1978] as well as poorer cognitive performance with significant deficits still detected at age 4 [Coqill, Caplan, Alexandra, Robson, and Kumar, 1986].

Using NLSCY data from the 1994-95 cohort, Somers and Willms [2002] found that for children up to age 5, maternal depression increased the odds of poor cognitive development by one and a half times, and by over two times for behavioural problems. These cognitive development problems throughout infancy and early childhood have also been connected to problems once children start school. Studies have found children of depressed parents tend to experience higher anxiety [Alpern and Lyons-Ruth, 1993; Essex, Klien, Miech, and Smider, 2001], as well as higher rates of conduct disorders and hyperactive symptoms in boys [Sinclair and Murray, 1998].

Since new mothers have been shown to be unlikely to seek treatment for maternal depression due to social stigma and being unaware of the symptoms [Flynn, Davis, Marcus, Cunningham, and Blow, 2004], many of PPD cases go undetected. It is therefore imperative to invest in earlier and more frequent screening for such symptoms in order to

effectively intervene and prevent infant cognitive development issues which are caused by untreated PPD in mothers.

### *Early Childhood*

This is the last stage of the potential dimension. The factors that affected an infant's development are still operating in early childhood. The difference is that, having acquired some emotional control, visual ability, social attachment and some vocabulary, the child is now ready for some formal learning.

A research report on early childhood development by McCain and colleagues [2007] found that “brain development begins soon after conception and continues after birth. The changes that take place in the brain in the early years of life ensure that an infant becomes highly attuned to the environment into which she [or he] is born” (p. 18). According to their review on neurological research, experiences in early life influence the formation of critical pathways and processes in brain development, which in turn influence a person’s learning and behaviour, as well as biological processes which affect physical and mental health. The quality of the relationship between a child and caregiver is a pivotal one in regards to cognitive and emotional development in children, and is also long-lasting, often into adulthood.

During the preschool period (ages 3 to 6 years), rapid development in the frontal lobe and prefrontal cortex underlie the development of skills related to attention, problem-solving, planning, understanding quantity, and using symbols. These skills are essential to a child’s success in school. An astonishing estimated 40% of children in non-industrialized countries under the age of 5 have been shown to have stunted development [de Onis, Monteiro, Akré, and Clugston, 1993; Brown and Pollitt, 1996; Walker, Grantham-McGregor, Powell, and Chang, 2000; Berkman, Lescano, Gilman, Lopez, and Black, 2002]. It is therefore imperative to focus on enabling a positive and nurturing environment for children in order to ensure optimal early child and cognitive development.

Health in early childhood is also very important in relation to psychological development. Klinnert and colleagues [2001] found that children with asthma are at a greater psychological risk than children without asthma. Children with chronic asthma tend to experience higher internalizing behaviour problems, which in turn can affect a child's capacity to focus in school. A connection to maternal depression and childhood asthma was also found, hence re-establishing the importance of early health prevention and intervention.

A 2002 Health Canada report has shown that the incidence of asthma in Canadian children has increased by over 400% in the past 25 years. In 2006, Environment Canada reported that more than 1 in 10 Canadian children were diagnosed with asthma; they also found a connection between poor air quality and asthma incidence. This emphasizes how interconnected the risk factors for poor health in children really are, and how important it is to target more than what is currently being considered as investment in health in order to prevent poor childhood cognitive development.

A connection between social capital and cognitive development and performance has also been shown. Runyan and colleagues [1998] studied 667 children between the ages of and 5 and their caregivers, obtained from four datasets of the Longitudinal Studies of Child Abuse and Neglect Consortium (LONGSCAN). Both behavioural and cognitive development outcomes were examined. Their social capital index consisted of the following components: church attendance, perception of personal social support, support within neighborhood, no more than two children in the family. Results showed that social capital was strongly associated with child well-being; the presence of any social capital indicator increased odds of doing well by 29%, while any two increased the odds by 66%. The researchers also discussed about how social capital can have an impact on children's well-being even during the preschool years; during this period, parents' social capital mostly confer the benefits to their children, just as children benefit from their parents' financial and human capital.

Previous studies have also found a link between social capital and lower school dropout rates [Coleman, 1988; Smith, Beaulieu, and Israel, 1992; Parcel and Menaghan, 1993]. In addition, Sameroff, Seifer, Baroces, Zax, and Greenspan [1987] found that social capital was an important factor in reducing a child's cumulative environmental risk, which is connected to predictive cognitive development and intelligence scores in children. It is therefore important to consider social capital as an investment in human capital, especially for those parents who have access to fewer financial and educational resources.

The factors that determine the success in this endeavour were analyzed by researchers at CRISP using a longitudinal data set for Canada. In the concluding chapter, Willms [2002, pg 359-77] emphasizes that:

1. "the most important factors (affecting a child's vulnerability) are parenting skills, the cohesiveness of the family unit, the mental health of the mother, and the extent to which parents engage with their children (p. 366).
2. "these features affect and are affected by the neighbourhood, the school, and the wider community (p.366).
3. Poverty does increase the risk of vulnerability, when it interacts with the above factors. "The majority of vulnerable children do not live in poor families, and about two-thirds of children living in poor families have cognitive and behavioural problems that are in the average range or better" (p. 361).

The overall conclusion for policy purposes is that "we need a seamless, universal system of support for families, from conception to kindergarten, designed to promote learning and human development" (p. 371).

From a human capital perspective, the purpose of all private and public expenditures related to a child from the day of conception (the potential dimension of human capital) have the purpose of producing and nurturing an economic agent capable of acquiring and

later utilizing a variety of skills. In the comparison with physical capital, this dimension is equivalent to the expenses incurred in producing the shell of a computer plus the embedded hardware. This means that all government health care expenditures for children in their first five years of life should be considered an investment in human capital.

### **The Acquisition of Human Capital**

This is the dimension associated with the traditional notion of investment in human capital. Even in this case where there is widespread agreement that government spending represents public investment, though it is still classified as consumption in the National Accounts. Moreover, only a portion of total expenditures on human capital acquisition are recorded in official publications. Both Statistics Canada and the Financial Management System (FMS) report on education statistics which only expenditures by elementary, secondary and post-secondary educational institutions, including spending on adult training programs.

In reality, the scope of government support for human capital acquisition is much broader. First, it includes both direct program spending and tax expenditures. The extent and level of these tax expenditures has increased in recent years and it has become considerable in magnitude. Second, there are elements of human capital acquisition in each department in the form of internal training programs. Third, there are departments that, while not directly involved in the delivery of educational services, finance the delivery of these services by other agencies. It is necessary, therefore, to analyze the expenditures by each department to determine which programs may be treated as investment in the acquisition of human capital in addition to the standard measurement of spending by formal educational institutions. Fourth, estimates of human capital are based largely on skills acquired through formal education. But there are many skills and special attributes that are acquired outside the formal education system, which may include non-profit organizations subsidized by the government.

A special aspect of human capital must also be recognized at this stage, namely, the

connection between the acquisition and the creation of knowledge. While the focus of human capital analysis is on the acquisition of skills, particularly in the output-based and income-based measures, we must acknowledge that it is not possible to acquire knowledge before it is created. This connection is implicitly incorporated in the input-based measures, which include the total expenditures by formal educational institutions. In the case of post-secondary education, for example, spending on the salaries of professors includes both their classroom teaching and their research activities. The knowledge created by their research activities is shared narrowly in the class-room and broadly through publication in books and scholarly journals and through public lectures. This means that public investment in human capital must include explicitly both expenditures on the creation and the acquisition of knowledge. From a health perspective, the implication is that government spending on health care that affects both the creation, dissemination and acquisition of knowledge must be treated as an investment in human capital.

Skills are acquired through three channels. The most obvious channel is through formal education delivered by educational institutions. In fact this channel is often the only one considered when human capital is measured on the basis of output-based approaches. Skills are also acquired through special training programs offered by employers. Finally, even in the absence of formal or semi-formal educational programs, a person can acquire or improve skills through the work experience itself, "learning by doing" as a worker progresses through a career in a given field or in different fields.

The acquisition of skills depends on the availability of learning opportunities and the ability and willingness of an individual to invest in them. This choice depends both on the health and economic conditions of that individual. Poor health not only interferes with the capacity to acquire skills, but it may reduce the expected return to investment in human capital if it is viewed by the individual as an impediment to the full utilization of the acquired skills.

As we did for the potential dimension of human capital, we may distinguish two separate

stages of the acquisition stage: (a) primary and secondary education; and (b) post-secondary education. The fundamental difference between these two stages is that only in the latter does an individual have broad freedom of choice in acquiring human capital.

### *Primary and Secondary Education*

This is partly a continuation of the nurturing stage of the potential dimension because most of the decisions about learning are made by agents other than those acquiring human capital. Therefore, in this stage the acquisition of human capital is affected by a variety of factors. They include (a) the family's socio-economic conditions; (b) community support; and (c) health conditions. With respect to the later, it is important to emphasize that a student's ability to learn is affected not only by his/her health status, but also by the health status of the parents or other family members, and the overall health status of the community, which affects the social support system. A student's health condition may affect the decision to remain in school (dropout rates) and the commitment/ability to learn when in school.

According to the U.S. National Center for Health Statistics, a 2004 survey on school dropouts found that, regardless of income, those who did not finish high school reported worse health than their peers who did finish high school [U.S. Department of Health and Human Services, 2006]. Another study found that school dropouts are more likely to be in poor health, unemployed, and living in poverty than high school graduates [Bridgeland, DiIulio, and Burke Morison, 2006].

Work by Belli, Bustreo, and Preker [2005] showed that poor health in children has been linked to low levels of school attendance and performance in primary school, as well as increased dropout rates. Subsequently, these factors impact on a child's future earning and productivity potential, hence reiterating the importance of investing in children's health in order to ensure quality cognitive growth.

With respect to the health conditions of a student that affect his/her ability to learn, several health factors may be identified. McDougall and colleagues [2004] conducted a

study on chronic physical health conditions and disabilities in Canadian children, using 1994-95 NLSCY data composed of 22, 831 children between the ages of 6 to 11 years of age. According to their findings, 30.3% of children had one or more chronic physical health conditions and/or impairments, with asthma and bronchitis being the prominent ones. Such children were shown to be significantly more likely to have experienced mental health conditions, learning disabilities, missed school days, and receive special education than children without chronic health conditions. Specifically, children with chronic conditions were found to be twice as likely to have learning disabilities than children with no health problems. Children with activity-limiting conditions/impairments (e.g., difficulty in executing activities such as self-care) were found to be almost twelve times as likely to have learning disabilities than children with no health problems. School absenteeism was found to be twice as high for children with activity-limiting conditions/impairments than children with no health conditions.

A study conducted by Koivusilta, Arja, and Andres [2003] found that the majority of health behaviours are correlated with educational achievement; that is, students with health-compromising behaviours tended to have lower educational levels as adults than those with health-enhancing behaviours. According to their results, smoking was the strongest predictor of educational achievement; moderate physical activity and a healthy diet also had a significant, but lower, association, with achievement.

In addition, obesity has been correlated to a loss in productivity resulting from disability and premature death, as obesity has been shown to exacerbate a variety of diseases such as diabetes, gallbladder disease, and cardiovascular disease [Colditz, 1992; Gorstein and Grosse, 1994]. In addition, psychological and social impediments have been shown to be experienced by obese individuals. For instance, many obese individuals experience reduced social interactions and activities, as well as discrimination from their peers, negative self-image, educational underachievement in children, and absenteeism from jobs [Rein and White, 1979; Kuskowska-Wolk and Rössner, 1990; Lissen and Sorensen, 1993]. These factors impede an individual's potential for social growth, as well as their chances for educational and financial success. These results showcase the important



impact a child's health has on his or her human capital potential and acquisition, and eventually impacts on his or her productivity and effectiveness within the work force.

### *Post-secondary Education*

For this stage of the acquisition dimension, the individual has a large degree of choice and the acquisition of human capital now becomes truly a personal investment. In this respect, it is important to make a distinction between skills and personal values and to emphasize that both are part of human capital. The skills that employers desire are not confined to technical ability. National employer surveys in the United Kingdom indicate that employers are looking at potential employees with four types of skills: (a) self-reliance skills (self-awareness, pro-activity, willingness to learn, self-promotion, networking); (b) people skills (team work, interpersonal skills, oral communication, leadership); (c) general skills (problem-solving, flexibility, IT/computer literacy, numeracy); (d) specialist skills [Hawkins, 1999]. Of equal importance are the values, personality traits and personal characteristics of prospective workers. According to Hansen and Hansen [2007] employers stress ten sets of personal values: honesty/integrity/morality, adaptability/flexibility, dedication/work ethic, tenacity, dependability/reliability/responsibility, loyalty, positive attitude/motivation/energy/passion, professionalism, self-confidence, self-motivation, willingness to learn.

The importance of these personal values and qualities should not be underestimated. As individuals acquire higher levels of skills, they also acquire the capacity to do more economic damage by misusing these skills, and a major deterrent to this misuse is the set of personal values that make up a person's conscience. Indications of the social cost of the misuse of highly specialized skills are given by the scandals at various corporations that have led senior officials to be incarcerated. The importance of these personal values underscores the fact that the human capital is both produced and acquired within a social context, therefore, investment in human capital cannot be limited to the expenditures on the acquisition of skills through formal education, but must include expenditures that affect both skill acquisition and personal attributes that are valued by employers. Families broadly defined to include close relatives, religious organizations, sports organizations

and other organizations are part of the factors that help character building.

Focusing on health spending, investment in the acquisition of human capital includes spending on the health of those who acquire and those who deliver human capital. It also includes health care spending on the parents because of the direct link between their health and the health and learning capacity and opportunities for their children. It also includes some of the general spending on health care because a healthy community is able to provide a better caring and supporting learning environment for children and young adults.

### **The Availability of Human Capital**

The factors that affect the availability dimension of human capital may be divided into two categories: (a) those that determine the population of working age; and (b) those that determine which portion of (a) is available for work.

In a given year, the population of working age is determined by the total population at the beginning of the period, the net inflow or outflow of people (in- and out-migration), and the resulting age structure of the population. Health care spending affects the domestic component of the population only to the extent that it reduces mortality rates. For those who are part of the potential and acquisition of human capital, health care spending has already been included in investment. The additional investment, therefore, arises from spending that reduces mortality rates for people 19 years and over who are not engaged full time in the acquisition of human capital. It is not clear how health care spending affects immigration and emigration. If an efficient and high quality publicly-funded health care system is viewed as an important factor in the location decision by both residents (less likely to move away) and non-residents (more inclined to locate) then health care spending may be considered in part as an investment in this component of the availability of human capital.

For a given population of working age – people 15 years of age and over – availability is

determined by the proportion that makes themselves available for work. How we determine availability is also affected by whether we focus on market activity only, or whether we include non-market activities, such as volunteering.

With respect to the decision to participate in the labour force we may identify five separate determining factors: (a) forced exit because of health; (b) forced exit because of age; (c) voluntary exit for personal reasons other than age and health; (d) voluntary exit because of age (except for health); and (e) voluntary exit because of the lack of employment opportunities (hidden unemployment). The health factor affects availability only to the extent that it involves chronic physical and mental ailments that prevent the performance of the required tasks on a regular basis, or major surgery and the associated recovery which may interrupt employment for an extended period of time. Expenditures on both of these factors are an investment in the same manner as expenditures for major improvements of a building. The latter helps restore the productive function of human capital while the former may simply improve the quality of life.

The above conclusions also apply to persons over the age of 65. If they are still part of the labour force, then their age is irrelevant as they are no different for the purpose of our analysis than younger workers. If they have chosen to exit the labour force, spending for major surgery and chronic illnesses is still an investment, but not to enhance productive activity, but to improve their quality of life and perhaps contribute to social/civic capital.

In our view, the issue of whether spending for major surgery and for chronic illnesses for those who have chosen not to participate in labour force activity, especially seniors, is not whether it should be considered investment, but whether it is investment in human capital. Here, the treatment of major renovations for buildings serves as a useful criterion. In the case of owner-occupied buildings, major renovations serve largely the purpose of improving the quality of life of the owners. They generate direct utility to the owners in the same manner as do home appliances. Yet these expenditures are treated as investment in residential construction in the National Accounts in the same manner as the construction of a new factory. By the same token we can treat spending on major surgery

and chronic illnesses of those who are or would be in the labour force, but for those illnesses, as investment in human capital.

### **The Effectiveness of Human Capital**

This is a dimension of human capital that has received little attention in the literature. This neglect is perhaps due to the idea that the utilization of human capital is a result of market forces and does not involve government expenditures. In reality, government policy has important ramifications in this area. This dimension of human capital may be divided into two components: utilization and performance. The former is affected largely by policies other than health care (e.g. monetary policies affect economic performance and unemployment levels, fiscal policies that affect inter-governmental fiscal relations, and labour policies that affect the efficient operation of the labour market). Health policy may also play a role. While chronic ailments affect the availability of human capital (a supply side effect), they may also affect its utilization (demand side). Some workers with chronic health conditions may still be willing to work, but may be unable to perform certain tasks. Even when they are capable and willing to perform the task required by a particular job, their health condition may be considered an unacceptable risk by prospective employers. In either case, some avenues of employment are not available to those potential workers because of their poor healthy conditions. Health spending that neutralizes these potential obstacles to employment is an investment in the utilization of human capital.

Performance is affected by a person's health conditions through two main channels. First, poor health may prevent workers from going to work (absenteeism). Second, less severe health conditions may prevent workers from performing their tasks properly (under-performance). For example, a bout of flu may prevent a worker from going to work, but a common cold may not. However, the common cold may reduce the worker's performance, as would be the case of someone employed at a call centre, where clear communication is paramount. In the case of people involved in the educational system, health conditions may affect both human capital utilization and human capital

acquisition. If the replacement for the absentee worker cannot deliver the same performance, human acquisition will suffer. The same result will occur if the employee continues to perform his/her task, but at a lower level of performance due to the ailment. More serious negative effects on human acquisition will occur if the employee's sickness is contagious and leads to absenteeism and lower capacity by those acquiring human capital.

That absenteeism is largely caused by poor health conditions and that its costs to society are quite high are well-known facts. What is not clear is whether health care spending that reduces the health causes of absenteeism should be treated as an investment. If these expenditures are treated as being equivalent to repair and maintenance, they would not meet the criteria for investment. If they are treated as major renovations, they would be investment.

## **Summary**

A summary of the channels through which health affects each dimension of human capital is shown in Table 4. The first dimension of human capital includes: (a) the production of the human "shell" (body and brain); (b) the protection and development of this shell during the nurturing period (0-5); and (c) the acquisition of basic human skills (the basic elements of the software embodied in human beings). It may be compared to the production of a computer with a minimum of built-in software in order to allow it to perform basic tasks. In this dimension, some health care spending represents investment in human capital even before conception because conception requires fertile partners. While recognizing that it may be difficult to identify health care spending aimed at fertility, we must acknowledge that conceptually such spending is an investment in human capital.

During the production period, the evolution of the initial egg-sperm combination into a human being takes place within the body of the expectant mother and is heavily influenced by her health status and behaviour. Therefore, all health care spending on

expectant mothers should be considered an investment in human capital as should all health care expenditures related to childbirth. All health care spending on mother and child during the nurturing period should also be treated as investment in human capital. What proportion of health care spending on fathers in the same period is an investment is not as straightforward. During the mother's pregnancy, the health of the father has no direct effect on the health of the unborn, but may have indirect effects to the extent that it influences the safety and health of the mother. The health of the father is more relevant during the nurturing stage as it may directly affect the development of the child. Similarly, the health of grandparents may be an investment during the gestation period, if they are in a position to influence the health of the expectant mother, and during the nurturing stage in cases where grandparents or caregivers are the guardians.

<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 children 0-5, 100% of health spending on nurturing mothers, a small percentage for nurturing fathers and grandparents.
Acquisition	Young people 6-18: 100%  A small percentage of health spending for parents 19 and over: 100% for those acquiring knowledge and skills.
Availability	19+: 100% of expenditures for the chronically ill.  Rest of the population: 100% for major surgery plus a portion of medical and drug expenses.
Effectiveness	As for availability.

The period from age 6 to age 18 is fundamental to the formation of a human being and the development of human capital. Having developed the basic motor and language skills,

a child now develops to early adult size, expands the capacity of the brain, acquires new skills in a variety of formal and informal contexts, forms a conscience, acquires the special "attributes and competencies" referred to in some definitions of human capital, and learns the socialization skills that will help him/her function in society and as a member of a work team. Therefore, all health care expenditures for those involved in the early acquisition period (6-18) should be treated as an investment in human capital as are all expenses incurred in bringing a computer with basic software to market. During this period, children and adolescents are still dependent on their parents, therefore, their capacity to acquire human capital is influenced by the economic conditions, health status and behaviour of their parents. Health care spending on parents, therefore, supports the acquisition of human capital by children and a portion of that spending should be treated as an investment.

After completion of high school, decisions about human capital acquisition are made by the individual, although they may still be influenced by the availability of educational programs and the parents' financial resources. This stage is equivalent to the development of software, which includes all the costs incurred in its production, including the firm specific costs of health care insurance for its employees. Therefore, the health care costs of these students should be treated as investment in human capital.

For fully trained workers, health care expenditures are no longer related to the acquisition of human capital and their inclusion as investment is not as obvious. Availability for productive activities is affected by chronic ailments and major surgery. Therefore, expenditures on these health conditions should be considered investment in human capital. Other expenditures may be viewed as repair and maintenance and treated as consumption. A similar conclusion is reached for the effectiveness dimension. Chronic ailments may prevent willing workers from performing some tasks or even from being considered for certain jobs because they represent an additional cost for employers. Interruptions in employment due to major surgery or recurring illnesses may slowdown a worker's progress through his/her career, thus reducing the private and social return to human capital. Therefore, health expenditures that reduce these impediments to the utilization and performance of human capital should be treated as investment.

The same conclusions apply to seniors. If they are in the labour force, then age is irrelevant for the purpose of our analysis. If they have chosen to exit the labour force, health spending on major surgery is an investment no different than spending on the major renovations of a home. The case for treating health care spending on seniors as an investment is strengthened when we include social and civic capital. Seniors have an above-average larger voter turnout, and they are major contributors to voluntary organizations both in terms of services offered and financial contributions. In addition, seniors contribute to human capital development within their families by providing free or low-cost baby-sitting services, by raising grandchildren who cannot be nurtured by their parents, and by providing financial help to their children and grandchildren through inheritance and *inter-vivos* bequests [Oxford Institute of Ageing, 2007]. Similar conclusions apply to adults under 65 years of age for volunteerism.

We can now transform the dimensions of human capital into age categories for determining how health care spending is an investment. Children and adolescents in the age range 0-18 are in the nurturing and acquisition stage and all health care spending on their behalf is an investment in human capital. For adults in the age range 19-64, several categories may be identified. First, for those who are fully engaged in the acquisition of human capital, health care spending is an investment, as it was in the previous category. Second, for females of child-bearing age (who are not acquiring human capital), health care spending is an investment for several reasons: (a) they may be carrying a pregnancy; (b) they may be nurturing one or more children; (c) they may be in the labour force (major surgery or chronic illness); (d) they may be employed, or they may be involved in more than one of the above categories, thus partaking in more than one dimension of human capital. The same rationale applies for women who are under 65 and out of childbearing age (except for the pregnancy rationale). For men in the age range 19-64 (who are not acquiring human capital), part of health care spending is still an investment if they are in the labour force (availability, major surgery or chronic illness) or they are employed. For individuals 65 and over, health care spending is an investment if they are in the labour force (availability, major surgery or chronic illness), are employed, or are out of the labour force (major surgery and chronic illness, equivalent to major alterations



to a residence).

Health care spending also has a direct impact on human capital, which is independent of the spending that affects the health of a person. A portion of what is classified as health care spending is in the form of health care research. Spending on doctor and nurse training in hospitals has already been included in the education component. What should we do with research done directly by government or contracted out? This is the same issue raised by the financial support for research in general, listed in the FMS as spending by research establishments.

The input-based measures of human capital do not make a distinction between the production and the acquisition of knowledge. We cannot acquire knowledge of things unknown. For the producer of knowledge, production and acquisition are simultaneous. When this knowledge is shared, others may acquire it. Its production, however, is the output of human capital and adds to human capital. That's why no distinction is made in the input-based measures of human capital between university spending on salaries of professors for their teaching services and for their research services. Therefore, spending on research, in our case health-related research, wherever it may be conducted, is an investment in human capital. It finances the utilization of human capital to produce knowledge that is then acquired by others.

#### **IV. SOCIAL AND CIVIC CAPITAL**

This section presents a brief discussion of the last two types of capital: social and civic capital. While there is extensive literature on the subject, the discussion in this section is limited because, as will be shown later, the proportion of federal government spending on health that can be assigned to these two types of capital is not large.

Civic and social capital are intertwined in a manner that makes it difficult to develop a clean separation. In fact, in the relevant literature, civic capital is often treated as a

component of social capital. This inter-connection is noted in the similarities of the definitions of the two types of capital. Generally, definitions of social capital stress the importance of networks, norms and trust. For civic capital, the definitions generally stress the capacity of entire communities to form collective decision making mechanisms.

For social capital a broad definition is that of Coleman [1994].

*Social capital is any aspect of informal social organizations that constitutes a productive resource for one or more actors. The term "capital" implies a resource or factor input that facilitates production, but is not consumed or otherwise used up in production. The other half of the concept, "social" refers in this context to aspects of social organizations, ordinarily informal relationships, established for non-economic purposes, yet with economic consequences. Social capital is inherently social, and most forms of social capital come into being through the combined actions of several or many people. The decisions of each have consequences for all.*

For civic capital, a comprehensive definition is that of Potapchuck and Crocker [1999].

*Civic capital is the collective civic capacities of a community, the currency supporting collaborative strategies that pursue innovative programs and forge new relationships among stakeholders to build a future with better results for its children, families, and neighbourhoods. It is what a community produces when it:- shares and is motivated by a compelling vision of the future;- has deep reservoirs of trust among diverse stakeholders that enables inclusive and collaborative decision making;- creates an infrastructure of organizations and initiative that develops the capacity of stakeholders to deepen their work and build connections among programs;- meaningfully engages the public to build political will that drives community transformation forward;- builds a system of supports that nurtures leaders, provides training and resources where needed, and catalyzes continued efforts.*

The relationship between social and civic capital is shown in Figure 2, which is based on the analytical framework suggested by Stimson et al. [2003]. Figure 2 breaks down networks into two components: norms and structures. Each of them may, in turn, be classified as being formal or informal. The combination of norms and structures then leads to four types of networks: an informal one, two mixed ones, and a formal one. The informal network is a combination of informal structures and informal norms. This type of network is typical of social capital. Formal networks are composed of formal norms

and formal structures. This category is 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. There may be some debate on which of these structures are civic capital and which are social capital. In our calculations we assigned government spending on all these mixed networks as investment in social capital. While this assignment is partly arbitrary and may affect the allocation of public investment between social and civic capital, it does not change the estimation of the combined social-civic capital total.

<b>Figure 2. Civic and Social Capital: Norms and Structures</b>		
<b>Norms</b>	<b>Structures</b>	
	<b>Formal</b>	<b>Informal</b>
<b>Informal</b>	Informal Networks (informal structures plus informal norms)	Mixed Networks (formal structures plus informal norms)
<b>Formal</b>	Mixed Networks (informal structures plus formal norms)	Formal Networks (formal structures plus formal norms)

All the networks identified in Figure 2 possess the basic properties that qualify for inclusion in the general class of capital. These networks 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.

With respect to property (a), we already established in section 2 that the absence of a tangible feature is not an impediment for being classified as fixed capital. The extension of the treatment of computer software as physical capital to the concept of human capital can also be applied to the norms and values that are incorporated in any of the social structure that we call civic or social capital. Computer programs, in fact, can be developed and used only by applying specific norms. The parallel with computers can be extended to networks. These networks are made of software and hardware and serve the purpose of connecting various computers for the purpose of facilitating communication and producing services that could not be produced by each computer separately.

Similarly, social networks are composed of software (the norms and values) and a combination of hardware (the members of the organization) and software (the acquired skills). The main function of these networks is to exchange information, facilitate collective decisions and coordinate collective action. The performance of these functions generates services that could not be produced separately by its members. The link with physical capital is explicitly identified in Coleman [1994]. With respect to the use of capital, he justifies the use of the term "capital" on the grounds that social organizations, and even informal social relationships, are "a resource or factor input that facilitates production". While they may be "established for non-economic purposes" they generate "economic consequences". For the purpose of this paper, which focuses on health care spending, we treat any government spending directed at creating, supporting and strengthening organizations that promote and support the mental and physical health of Canadians as investment in civic and human capital.

## **V. METHODOLOGY**

In this paper, estimates of what portion of federal government spending on health care may be treated as investment in physical, human, social and civic capital are derived for both direct spending and tax expenditures. Some of the methodological issues associated with these estimates are discussed in this section.

### **A. Direct Spending: General Issues**

Our calculations are based on the budgetary expenditures of the federal government for fiscal year 2004-05 as recorded in the Public Accounts. Each Ministry or separate Agency breaks down its activities into separate areas, where each area includes a variety of programs aimed at a specified objective. For each area, total budgetary expenditures are divided into three major categories: (a) capital expenditures; (b) operating expenses; and (c) transfers. Capital expenditures include only spending on fixed capital as defined in the National Accounts. Operating expenses are direct spending by the federal

government for items other than fixed capital. Transfers contain two major categories: (a) grants and contributions to individuals and private sector organizations, including business and non-profit organizations; and (b) grants to other governments. Grants to other governments are either unconditional, as in the case of equalization payments, or conditional. The latter usually take the form of payments under cost-shared arrangements for selected programs or projects. In our calculations, unconditional transfers are excluded because there is no specific expenditure attached to them since provinces can use these funds according to their spending priorities. Conditional transfers, on the other hand, are for specific spending programs which are clearly identified in the Public Accounts. Some of the transfers are for capital projects, therefore, they are investment in physical capital which is not recorded in the "capital expenditures" category of federal spending in the Public Accounts. In our calculations, these expenditures on fixed investment are added to the "capital" category to derive the total value of health spending for physical capital.

In the Public Accounts, expenditures by "business line" are presented on both a gross and a net basis, where the latter is the difference between gross expenditures and revenues netted against expenditures. Departments and Agencies are involved in spending and collecting revenues, separately from the general revenues collected by the Canada Revenues Agency. These revenues are largely in the form of returns on investment and the sale of goods and services. In the Public Accounts, revenues from the latter source are deducted from the gross expenditures to derive the value of net spending. Through this procedure, the activities that generate these revenues are implicitly treated as "private sector" activities because the associated expenditures are not a burden on taxpayers. For example, if the Department of Agriculture and Agri-food performs testing services for livestock and charges a fee that covers the full cost of the services, the net budget for this service is zero and no tax burden is imposed on taxpayers. In the Public Accounts, total spending by Ministry is recorded on a net basis. We follow that procedure in our calculations. The revenues to be netted against expenditures are recorded for each "business line". Instead of calculating the gross total and then deducting the relevant revenues, we deduct those revenues directly from operating costs because they are the

relevant expenditures for this adjustment. There is no revenue associated with transfers. Capital items may be involved in the production of some of the goods and services that generate revenues, but it would be impossible to determine their contribution.

The category of expenditures called "transfers" provides details on the purpose of those transfers. In some cases this information allows an unambiguous allocation. In other cases, the expenditure may involve investment in more than one type of capital, but the information is not sufficient to determine the relative shares. In these cases, the estimation of the total investment does not involve arbitrary decisions, but the allocation among different types of capital does. Still in other cases, transfers involve a combination of investment and consumption. A more detailed discussion of transfers is found in the next sub-section and detailed estimates are shown in appendix Table A-1.

The most difficult task is that of allocating operating expenses. These are Ministry or Agency expenditures, largely in the form of wages and salaries, which may involve direct investment (e.g., internal training programs) or indirect investment (e.g., components of the costs associated with investment already identified under capital spending, but not included in value of that investment because there is no selling price). The question in that case is: which portion of operating expenses should be treated as indirect investment? This adjustment is necessary to maintain consistency with private investment for which all operating costs are included in the sale price of the capital good. The Public Accounts provide a description of the purposes of each "business line", which helps determine the allocation of expenditures between investment and consumption but does not eliminate entirely the researcher's discretion in the allocation process.

### **B. Direct Spending: Specific Issues**

In the Public Accounts of the government of Canada one finds health-related expenditures in three departments: Health, Indian and Northern Affairs, and Veterans Affairs. For the latter two departments, health expenditures are only in the form of transfers. For the former department, expenditures include capital spending, operating

expenses and transfers. Capital expenditures are an investment in physical capital and were included entirely in this category. The treatment of transfers and operating expenses requires some explanation.

### *1. Transfers*

In the department of *Veterans Affairs*, there is only one health-related transfer. It is called “contributions to veterans, under the Veterans independence program, to assist in defraying costs of extended health care not covered by provincial health programs”. These veterans are out of the labour force and not engaged in the acquisition of human capital. Therefore, a partial allocation of these transfers to investment can be justified only by the criterion equivalent to “major renovations’ for building construction. We assumed that one-third of these expenditures meet this criterion and assigned this share of this transfer to investment.

A single item is also found in the department of *Indian and Northern Affairs*. It is called “contributions to the Government of the Northwest Territories and the Government of Nunavut for health care for Indians and Inuit”. We treat this as a conditional grant from the federal government and include it in our calculations of federal health spending. These funds are used directly for the health of Indians and Inuit in these two Territories. We approximated the shares of consumption and investment by the allocation of total provincial health spending developed in a separate study [Ruggeri, Doucet and Watson, 2007], which shows that about two-thirds of provincial government spending on health care can be assigned to investment.

The department of Health has a long list of specific grants and contributions to individuals and organizations, which is shown in appendix Table A-1. For analytical purposes, this list can be aggregated into four categories, with the relative shares shown in brackets): Research (37.9%), First Nations and Inuit (34.7%), physical capital (3.9%), and other (23.5%).

Expenditures on health research are an investment in human capital for two reasons. First, they involve the generation of knowledge in a manner that does not differ substantively from spending on universities. The full costs of the health research performed by health-related departments and researchers at universities is included in input-based measures of human capital. It would be inconsistent to treat similar research conducted by a government department or agency as consumption. Second, its ultimate effect is to benefit human capital in all its stages throughout a person's lifetime. These expenditures, therefore, are investment in a capital asset for the purpose of benefiting another capital asset. We assigned 100% of these expenditures to human capital.

Spending on the construction and equipment of health care facilities is already treated as investment in the National Accounts. We followed this convention and assigned them entirely to physical capital.

Transfers directed at First Nations and Inuit comprise three major categories (with relative shares in brackets): delivery of services (63.8%), control of program (29.7%), physical capital (6.1%), and research (0.4%). The allocation of the last two categories is straightforward. Grants for construction of health care facilities are assigned entirely to physical capital, and transfers for research are assigned entirely to human capital. Grants for control of health services were generally allocated in equal proportion to human capital, social plus civic capital and consumption. A variety of allocations were used for delivery of services. In some cases (e.g., Indian residential school mental health aboriginal head start on-reserve program), the grants were assigned entirely to human capital. In other cases (e.g., early intervention for aboriginal children) the transfers were allocated in equal proportion to human capital and social plus civic capital because the grants also help strengthen "incorporated local or regional non-profit aboriginal organizations and institutions". In all other cases, the grants were allocated in equal shares to human capital, social plus civic capital, and consumption.

Transfers for activities other than research, construction, and Aboriginal people, include a variety of programs with different degrees of investment components. For this category



the allocation between investment and consumption was done on an item by item basis based on the description found in the Public Accounts. Most of the transfers in this category were assigned to consumption.

## *2. Operating Expenses*

If we were dealing with a business engaged in the exclusive production of a capital asset, all the operating expenses would be a component of capital as they would be incorporated into the selling price of the capital good. While the selling price would be recorded as investment, the value of this investment could also be calculated by adding all the production and distribution costs plus profits. In the case of a publicly financed capital good there is no selling price, therefore, its value as an investment must be calculated as the sum of its costs, as it is in the case of public investment in physical capital. In theory, one should assign a share of operating costs equal to the share of investment in total spending for the delivery of health services. A complication with federal government health spending is that it does not deliver any services. Instead it provides grants to individuals, public and private organization and other governments for health-related activities. As mentioned earlier, in Canada these grants are largely for health research and for health services to be provided by other government and agencies to First Nations and Inuit. Another complication is that some of the operating expenses are for activities related to political issues rather than research or service delivery or financing. For example, the preparation of briefing books for the Minister of Health in preparation for negotiation with his/her provincial counterparts regarding health-related intergovernmental fiscal arrangements is neither research, as defined in the context of human capital, not delivery or direct financing of health services. We could not find any objective criteria for determining the share of operating expenses to be assigned to consumption in the form of "political services". Therefore, we used rough approximations, applied however to each component of operating expenses, as recorded in the Public Accounts, rather to the total. While the results of this disaggregated approach may not involve the use of less discretion than for the total, it allows a better understanding of the issues associated with the allocation of operating expenses between

investment and consumption.

The business line called *health care policy* “supports policy development, analysis and communications related to leadership on all areas of Canada’s health system”. This component of the Department of health contains a large share of “political activities”. For that reason we assigned to investment in human capital only half of the operating expenses. We applied the same percentage to the business lines *information and knowledge management* and *departmental management and administration*. The activities of the business lines *First Nations and Inuit health* and *health promotion and protection* are more closely related to the delivery of health services for Canadians. Therefore, for these two programs we used a higher share, specifically 75% and assigned it entirely to human capital.

For the agencies under the authority of the Ministry of Health we used the following allocation (all to investment in human capital). One half of the operating expenses of the Canadian Institute of Health Research, the operating expenses for “material safety data sheet compliance” under the Hazardous materials Information Review Commission, and half of the operating expenses of the Patented medicine Prices Review Board.

### *C. Tax Expenditures*

Details on tax expenditures are found in the annual report by the federal department of Finance entitled *Tax Expenditures and Evaluations* [Department of Finance, 2007] separately for the Personal Income Tax (PIT), Corporate Income Tax (CIT) and the Goods and Services Tax (GST). Separate categories under the heading of “Health” are found only for the PIT and the GST and these will be the ones included in our calculations.

For the PIT four tax expenditures are identified under the “health” heading: (a) child disability benefit; (b) disability tax credit; (c) non-taxation of business-paid health and dental benefits; and (d) the combination of the medical expense tax credit and the

refundable medical expense supplement. The first two tax expenditures result from a health condition but are the equivalent of cash transfers. Therefore, they are not health-improving expenditures and will not be included in our calculations.

The combined medical expense tax credit is a tax break for health-related expenses already incurred. These expenses are largely for drugs and for services not covered by Medicare. Some of these expenses are for potential and acquisition of human capital (in which case they would be entirely an investment) and others are partly for consumption. As an approximation we used half of the value of these credits as an investment. While business expenditures (and the associated PIT tax expenditure) are for employees and their families, a large portion is for what may be considered repair and maintenance, which is considered an investment. Therefore, we included as investment only one-third of this tax expenditure.

The GST also includes four tax expenditures under the heading of "health": (a) rebates for hospitals; (b) exemption for health care services; (c) zero-rating of medical devices; and (d) zero-rating of prescription drugs. The first tax expenditure is an internal accounting item. Since hospitals are publicly financed, for a given level of services they provide, imposing the GST on them would require higher government contributions. The rebates are equivalent to the extra funding necessary to finance the GST that would be paid by hospitals. Therefore, this item is excluded from our calculations. Medical devices are needed in cases of serious health conditions or the aftermath of major operations, therefore, the elimination of the GST is treated entirely as an investment as it is the purchase of medical equipment by hospitals. The cost of prescription drugs is entirely an investment for the first two dimensions of human capital and partially for the other two dimensions. A similar rationale applies to the tax break they receive. Accordingly, we assigned to investment the same share determined for the category drugs in the provincial health care expenditures [as estimated in Ruggeri, Doucet and Watson, 2007]. A similar rationale can be applied to the exemption for health care services. Since these are services that are not covered by Medicare, we do not have the necessary information to determine accurately the share that should be assigned to investment. As a rough approximation we

assumed an equal share for investment and for consumption.

#### *D. Special Issues*

Two special issues need to be addressed before using the above criteria in the measurement of government investment: (a) the treatment of externalities and (b) the allocation of a given expenditure to different types of capital. When the government uses tax revenues to finance a capital project, society incurs a cost equal to the sum of the amount spent and the economic losses from the efficiency effects of the higher taxation needed to finance that investment. Society also receives an expected return equal to the sum of the direct return and the benefits of positive externalities (or the costs of negative externalities). Accounting for positive and negative externalities is part of the value of the investment to society not of the determination whether an expenditure is consumption or investment. The full costs and benefits of a public investment must be considered when we perform cost-benefit analysis to determine whether it is profitable for society to undertake the additional investment. In this paper our concern is not with the value to society of public investment, but with the allocation of a given level of public spending between investment and consumption. Therefore, the issue of externalities does not enter into our analysis. This is not to say that the evaluation of externalities from government activity is a trivial exercise. On the contrary, the broader our measurement of public investment is, the larger is the potential for externalities and the more relevant their evaluation. But this evaluation is a totally different exercise than the one performed in this paper.

In some cases, government expenditure may be an investment in more than one type of capital. Since the amount assigned to all types of capital cannot exceed the sum spent, it is necessary to select the portions to be assigned to different types of capital. Let us consider for example, the case where the government provides a grant to a non-profit organization to build and operate a facility that helps children with severe emotional problems. The funds for the construction of the facility will be assigned to physical capital. The funds for the operation of the facility have a social capital component (they

strengthen a social institution) and a human capital component (specifically potential and acquisition of human capital, depending on the age of the children). In such cases, we assigned the operating expenditures to these two categories of capital, generally in equal proportions.

## **VI. ESTIMATES**

This section presents estimates of federal government investment in health. Programs aimed at the health of Canadians are delivered by three Ministries (Department and the associated Agencies). Each Ministry is discussed separately and then the results will be combined at the end.

### **A. Direct Spending**

#### *1. Ministry of Health*

Details of the expenditures by the Ministry of health are found in Appendix Tables A-1 and A-2. A summary of the results is presented in Table 5, which shows information on the three components of spending used in the Public Accounts.

**Transfers.** The long list of transfers can be aggregated into four main categories: research, First Nations and Inuit, physical capital, and other. Research accounts for 37.9% of transfers and is totally allocated to human capital. The lion's share of research transfers is represented by grants to the Institute for Health Research. Transfers related to First Nations and Inuit are the second largest category and account for 34.7% of transfers. Of this total, 71.1% represents investment (38.1% for human capital and 33.0 for the combination of social and civic capital). A small portion of the transfers (3.9% of the total) were directed at the construction of health care facilities. The rest, which accounted for 23.5% of total transfers, is largely in the form of consumption (72.4%).

For all transfers, the last row of Table 5 shows that nearly three-quarters (73.0%) are in the form of investment. Within the investment component, 75.0% is for human capital, 19.6% for the combination of social and civic capital and only 5.4% for physical capital.

**Operating Expenses.** Details on operating expenses are found in Appendix Table A-2. In Table 5 these expenditures have been aggregated into three major categories: programs directed at First Nations and Inuit, other departmental programs, and spending by Agencies. The first category represents an even larger share of total expenditures (46.1%) than it did for transfers. An additional 51% is accounted for by other departmental programs, which include health care policy, health promotion and protection, information and knowledge management, and departmental management and administration. Expenditures by ministry's agencies accounted for only 2.6% of operating expenditures.

**Physical Capital.** Spending on physical capital (other than spending through transfers) is a minute component of spending by the Ministry of Health

Looking at the Ministry as a whole, we find the following distribution of spending: more than two thirds is in the form of investment (68%) and less than one-third is consumption (32%). Most of the investment by the Ministry of Health is for human capital (86.0%). Investment in physical capital, the only component of spending currently treated as investment in the National Accounts, represents only 2.2% of total Ministry spending and 3.2% of total investment as estimated in this paper.

<b>Table 5. Summary of Health Investment by the Ministry of Health: 2004-05, \$000s</b>						
	<b>Physical Capital</b>	<b>Human Capital</b>	<b>Social + Civic Capital</b>	<b>Non- Capital</b>	<b>Sum</b>	<b>% of Total</b>
<b>Transfers</b>						
Research		834,539			834,539	37.90
First Nations & Inuit		290,821	252,076	220,637	763,534	34.68
Physical Capital	86,423				86,423	3.92
Other		79,305	63,482	374,802	517,589	23.50
Total	86,423	1,204,665	315,558	595,439	2,202,093	100.00
Percentage of Total	3.92	54.71	14.33	27.04		
<b>Operating Expenses</b>						
First Nations & Inuit		603,254		301,627	904,881	46.31
Department, Other		589,913		407,221	997,135	51.04
Agencies		26,680		25,120	51,800	2.65
Total		1,219,847		733,969	1,953,816	100.00
Percent of Total		62.43		37.57		
Physical Capital	3,922				3,922	
Total Ministry	90,345	2,424,512	315,558	1,329,408	4,159,823	
Percent of Total Ministry	2.17	58.28	7.59	31.96	100.00	

## *2. Other Ministries*

Spending on health is found also in the Ministry of Indian and Northern Affairs and in the Ministry of Veterans Affairs. As shown in Table 6, in both Ministries it is only in the form of transfers and it represents a very small portion of total spending. For the former, health spending represents 0.6% of total spending and two-thirds of it is in the form of investment in human capital. For the latter, health spending represents 4.1% of total spending, one-third of which is for investment in human capital.

<b>Table 6. Health Investment In Other Ministries: 2004-05, \$000s</b> (Spending by Category)				
<b>Indian &amp; Northern Affairs</b>				
	<b>Physical Capital</b>	<b>Human Capital</b>	<b>Civic &amp; Social Capital</b>	<b>Total</b>
Transfers		28,578	14,289	42,867
Total (Health)		28,578	14,289	42,867
Total			4,933,590	
Percentage of Total		0.58		
<b>Veterans Affairs</b>				
	<b>Physical Capital</b>	<b>Human Capital</b>	<b>Civic &amp; Social Capital</b>	<b>Total</b>
Transfers		76,905	153,811	230,716
Total (Health)		76,905	153,811	230,716
Total			1,863,076	
Percentage of Total		4.13		

The summary of our estimates for all three Ministries involved in health spending are shown in Table 7. The last row shows that two thirds of total federal government direct spending on health is in the form of investment. Investment in human capital alone accounts for over half of total spending by those Ministries. Physical capital accounts for only 2% of total spending.



<b>Table 7. Summary of Health Investment for Direct Spending: 2004-05, \$000s</b>					
<i>Ministry Spending by Category, \$000</i>					
	<b>Physical Capital</b>	<b>Human Capital</b>	<b>Civic &amp; Social Capital</b>	<b>Non- Capital</b>	<b>Total</b>
<b>Health</b>					
<i>Transfers</i>	86,423	1,204,665	315,558	595,439	2,202,093
<i>Operating Expenses</i>		1,219,847		733,969	1,953,816
<i>Physical Capital</i>	3,922				3,922
<i>Total</i>	90,345	2,424,512	315,558	1,329,408	4,159,823
<b>Indian &amp; Northern Affairs</b>					
<i>Transfers</i>		28,578		14,289	42,867
<i>Total</i>		28,578		14,289	42,867
<b>Veterans Affairs</b>					
<i>Transfers</i>		76,905		153,811	230,716
<i>Total</i>		76,905		153,811	230,716
<b>All Ministries</b>					
<i>Above</i>	90,345	2,529,994	315,558	1,497,508	4,433,406
<i>Percent of Total</i>	2.04	57.07	7.12	33.77	

## **B. Tax Expenditures**

As mentioned in the previous section, tax expenditures on health are found in the personal income tax (PIT) and the Goods and Services Tax (GST). Details on those tax expenditures are found in Table 8.

The selected two items of tax expenditures under the personal income tax (PIT) have a value of 3.1 billion. Of this total, 73% was from the non-taxation of business-paid health benefits and 27.3% from the medical expense credit/supplement. Nearly 40% of this total was assigned to investment in human capital.

The selected three items of GST tax expenditures had a value of \$4.1 billion, one-third more than the PIT tax expenditures. Of three selected items of GST tax expenditures, 46% was for the exemption of health care services, 42% for the zero-rating of prescription drugs and 12% for the zero-rating of medical devices. Nearly half of GST tax expenditures were assigned to investment in human capital. The combined value of

PIT and GST tax expenditures for health care amounted to \$7.2 billion. Forty-four percent of this total may be considered investment in human capital.

<b>Table 8. Tax Expenditures for Health: 2004, \$000s</b>						
	<b>Physical Capital</b>	<b>Human Capital</b>	<b>Civic &amp; Social Capital</b>	<b>Non- Capital</b>	<b>Total</b>	<b>% of Total</b>
<b>PIT</b>						
<i>Medical Expenses Credit/Supplement</i>		420,000		420,000	840,000	27.26
<i>Non-taxation of Business –paid Healthy benefits</i>		746,667		1,493,333	2,240,000	72.74
<i>Total</i>		1,167,667		1,913,333	3,081,000	
<i>Percent of Total</i>		37.90		62.10		
<b>GST</b>						
<i>Exemption of Health Care Services</i>		327,500		327,500	655,000	46.18
<i>Zero-rating of Medical Devices</i>		170,000			170,000	11.81
<i>Zero-rating of Prescription drugs</i>		307,500		307,500	615,000	42.71
<i>Total</i>		805,000		635,000	1,440,000	
<i>Percent of Total</i>		55.90		44.10		
<b>PIT &amp; GST</b>						
<i>Total</i>		1,972,667		2,128,333	4,101,000	
<i>Percent of Total</i>		43.71		56.29		

## VII. CONCLUSIONS

There is a low key debate among some academics and policy analysts in Canada on whether government spending on health care should be treated as consumption, as it is currently done in the National Accounts, or as investment in human and social and civic

capital. One reason for the lack of a resolution of this debate is that there is no consistent methodological framework for classifying expenditures on these three categories of capital. This paper addressed this methodological gap by developing a set of criteria based on the features, purposes, and measurement of physical capital and by placing human capital within a dynamic framework that extends throughout a person's entire lifespan.

This new methodology was applied to federal government spending on health care in 2004-05 as recorded in the Public Accounts and to the special tax expenditures for health incorporated into the personal income tax and the goods and services tax. The analysis identified three federal departments that deliver health care services: the department of Health, the department of Indian and Northern Affairs, and the department of Veterans' Affairs. The results indicate that we can classify as investment 68% of the expenditures by the department of Health. The proportion for the other two departments is very small and ranges from 1% to 4%. Most of the investment by the department of Health (86%) is in the form of investment in human capital. The results also show that 38% of personal income tax expenditures and 44% of goods and services tax expenditures can be treated as investment in human capital.

## APPENDIX

### Grants and Contributions

	<b>Physical Capital</b>	<b>Human Capital</b>	<b>Civic &amp; Social Capital</b>	<b>Non-Capital</b>	<b>Total</b>
Non-Profit International Organizations			2,100		2,100
Canadian Patient Safety Institute		8,000			8,000
Health Council of Canada		4,724			4,724
World Health Organization		50	50		100
International Commission on Radiological Services		5			5
Blood Safety research and development, and surveillance		6,731			6,731
Persons and agencies to support health promotion projects, research, training and skill development		17,022	17,022		34,044
National cancer institute: breast cancer research initiative		3,000			3,000
Canadian strategy on HIV		19,808			19,808
National health products research		672			672
Medical marijuana research		857			857
Canada health infoway		25,000		75,000	100,000
Post-doctoral Fellowships		234			234
Women's Health Program		2,667			2,667
Research & Demonstration in public health		147	147		294
Non-Profit organizations		42,147	42,147		84,294

for early intervention for children					
Early intervention for aboriginal children		14,318	14,318		28,636
Innovative alcohol & drug treatment programs		1,770	1,770		3,540
Federal tobacco control strategy		8,216			8,216
Canadian centre for substance abuse		1,204	1,204		2,408
Drug Strategy Community					
Initiatives Fund		1,348	1,348		2,696
Indian & Inuit Community		106,902	106,902	106,902	320,760
Indian bands, associations, groups		68,413	68,413	68,413	205,240
Indian & Inuit non-insured health services		43,316	43,316	43,316	129,949
Aboriginal Health Institute		196			196
First Nations & Inuit control of health services		14,750	14,750		29,500
Universities & colleges for increased Indian & Inuit participation in programs in health services		2,912			2,912
Contributions to NL for health care delivery to Indian & Inuit communities		389		195	583
Contributions to Indian & Inuit associations for consultations on health issues		1,804	1,804	1,804	5,412
Construction of hospitals, etc.	49,023				49,023
Aboriginal head start on-reserve program		37,556			37,556
Indian residential school mental health		994			994
Contribution to Ontario for Health Centre	37,400				37,400
Contributions to CIHI		2,230			2,230
Health Research Program		2,945			2,945

First Nations & Inuit promotion & prevention		239	239		478
Programs to improve access to health for official languages minority communities		7,400		7,400	14,800
Integrated Indian & Inuit communities		2,140		2,140	4,280
Persons & agencies for research and demonstration in the field of public health		17	17		34
Payments to provinces and territories for hepatitis C		50,000			50,000
CIHR		704,689			704,689
Other				290,122	290,122
Total	86,423	1,204,665	315,558	595,439	2,202,085
Percentage of total	3.92	54.71	14.323	27.04	100.00

**Business Line**

<b>Table X-2. Allocation of Non-Transfer Expenditures: Department of Health</b>					
<i>Spending by Category, \$ 000s</i>					
	<b>Physical Capital</b>	<b>Human Capital</b>	<b>Civic &amp; Social Capital</b>	<b>Non- Capital</b>	<b>Total</b>
Health Care Policy		27,621		55,241	82,862
Health Promotion & Protection	563	420,624		210,312	630,936
First Nations & Inuit Health	345	306,254		301,627	904,881
Information & Knowledge Management		40,373		40,373	80,746
Management & Administration	3,013	101,255		101,295	203,110
CIHR		21,641		21,641	43,282
Hazardous materials Information Review Commission		2,540		980	3,50
Patented Medicine Prices Review Board		2,499		2,499	4,998
<b>Total</b>	<b>3,922</b>	<b>1,319,847</b>		<b>733,969</b>	<b>1,957,738</b>
<b>Percentage of Total</b>	<b>0.20</b>	<b>62.31</b>		<b>37.49</b>	<b>100.00</b>

## References

- Public Accounts of Canada. (2005). "2004-2005 Estimates: Parts I and II: The Government Expenditure Plan and The Main Estimates". Ottawa: Government of Canada.
- Alpern, L., & Lyons-Ruth, K. (1993). "Preschool children at social risk: chronically and timing of maternal depressive symptoms and child behavior problems at school and at home". *Development and Psychopathology*, 5, 371–387.
- Arnold, R. A. (1992) *Microeconomics* (2<sup>nd</sup> ed.). St. Paul, MN: West Publishing Company.
- Bannock, G., Baxter, R. E., & Rees, R. (1992). *Dictionary of Economics* (5<sup>th</sup> ed.). London, UK: Penguin Books Ltd.
- Becker, G. S. (1964). *Human Capital*. New York: National Bureau of Economic Research.
- Beck, C. T. (1998). "The effects of postpartum depression on child development: A meta analysis". *Archives of Psychiatric Nursing*, 12, 12–20.
- Belli, P. C., Bustreo, F., & Preker A. (2005). "Investing in children's health: What are the economic benefits?". *Bulletin of the World Health Organization*, 83(10), 777-784.
- Berkman, D. S., Lescano, A. G., Gilman, R. H., Lopez, S. L., & Black, M. M. (2002). "Effects of Stunting, Diarrhoeal Disease, and Parasitic Infection During Infancy on Cognition in Late Childhood". *The Lancet*, 359(9306), 564-571.
- Biederman, J., & Faraone, S. V. (2005). "Attention-deficit Hyperactivity Disorder". *The Lancet*, 366, 237-248.
- Blomqvist, A., Wonnacott, P., & Wonnacott, R. (1994). *Microeconomics* (4<sup>th</sup> ed.). Toronto, ON: McGraw-Hill Ryerson Limited.
- Blundell R., Dearden, L., Meghir, C., & Sianesi, B. (1999). "Human Capital Investment: The Returns From Education and Training to the Individual, the Firm and the Economy". *Fiscal Studies*, 20(1), 1-23.
- Boadway, R. (2004). "What Do We Get for Public Indebtedness?". In C. Ragan & W. Watson, *Is the Debt War Over? Dispatches from Canada's Fiscal Frontline* (pp. 133-162).



- Bridgeland, J. M., Dilulio, J. J., & Burke Morison, K. (2006, March). *The silent epidemic: Perspectives of high school dropouts*. Retrieved May 28, 2007, from <http://www.silentepidemic.org/pdfs/thesilentepidemic306.pdf>
- Brown, J. L., & Pollitt, E. (1996). "Malnutrition, Poverty and Intellectual Development". *Scientific American*, 274(2), 38-43.
- Cantwell, D. P. (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. P. (1997). "Attention Deficit Disorder in Children". *Psychiatric Times*, 14(1).
- Environment Canada. (2006). *Children's Health and the Environment in North America: A First Report on Available Indicators and Measures: Country Report: Canada*. Retrieved March 18, 2006, from [http://www.cec.org/files/PDF/POLLUTANTS/CountryReport-Canada-CHE\\_en.pdf](http://www.cec.org/files/PDF/POLLUTANTS/CountryReport-Canada-CHE_en.pdf).
- Colditz, G. A. (1992). "Economic costs of obesity". *American Journal of Clinical Nutrition*, 55 (Suppl.), 503-507.
- Coleman, J. S. (1988). "Social capital in the creating of human capital". *American Journal of Sociology*, 94, 95-120.
- Coleman, J. S. (1994). "The rational choice perspective in economic sociology". In N. J. Smelser & R. Swedberg (Eds.), *The Handbook of Economic Sociology*. New Jersey: Princeton University Press.
- Connor, S. K. & McIntyre, L. (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, AB: University of Alberta Press.
- Coqill, S. R., Caplan, H. L., Alexandra, H., Robson, K. M., & Kumar, R. (1986). "Impact of maternal postnatal depression on cognitive development of young children". *British Medical Journal*, 292, 1165-1167.
- Courchene, T. (2001). *A State of Minds: Toward a Human Capital Future for Canadians*. Montreal: Institute for Research on Public Policy.
- de Onis, M., Monteiro, C., Akre, J. & Clugston, G. (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.

- Department of Finance, Government of Canada. (2007). *"Tax Expenditures and Evaluations"*. Ottawa, Annual.
- Doucet, M., Levac, L., & Ruggeri, G. C. (2006) "The Social Cost of Unhealthy Children: Concepts and Application to Atlantic Canada". In G. C. Ruggeri (ed) "The Environment & the Health of Children". Fredericton: Policy Studies Centre.
- Eisner, R. (1989). *The Total Incomes System of Accounts*. Chicago: University of Chicago Press.
- Essex, M. J., Klien, M. H., Miech, R., Smider, N. A. (2001). "Timing of initial exposure to maternal major depression and children's mental health symptoms in kindergarten". *British Journal of Psychiatry*, 179, 151–156.
- "Fixing Fiscal Federalism" (2005). *Ontario Institute for Competitiveness and Prosperity, Working Paper 8*.
- Flynn, H. A., Davis, M., Marcus, S. M., Cunningham, R., & Blow, F. C. (2004). "Rates of maternal depression in pediatric emergency department and relationship to child service utilization". *General Hospital Psychiatry*, 26, 316-322.
- Fournier, S. & Crey, E. (1997). *Stolen from our Embrace: The Abduction of First Nations Children and the Restoration of Aboriginal Communities*. Vancouver: Douglas and McIntyre, Ltd.
- Glossary, National Income and Expenditure Accounts, Catalogue no. 13-001* (2002). Ottawa: Statistics Canada.
- Glossary of Environment Statistics, Studies in Methods, Series F, No. 67*. (1997). New York: United Nations.
- Gorstein, J., & Grosse, R. N. (1994). "The indirect costs of obesity to society". *Pharmacoeconomics*, 5(Suppl. 1), 58-61.
- Gurak, H. (2006). *An Alternative Growth Model*. Unpublished.
- Hansen, R. S. & Hansen, K. *What Do Employers Really Want? Top Skills and Values Employers Seek from Job-Seekers*. Retrieved June 9, 2007, from [www.quintcareers.com/printable/job\\_skills\\_values.html](http://www.quintcareers.com/printable/job_skills_values.html).
- Hawkins, P. (1999). *The Art of Building Windmills: Career Tactics for the 21st Century*. The Graduates Into Employment Unit (GIEU).
- Health Canada. (2002). *Health and the Environment: Assessing Critical Pathways*. Retrieved February 23, 2006, from [http://www.hc-sc.gc.ca/sr-sr/alt\\_formats/iacb-dgiac/pdf/pubs/hpr-rps/bull/2002-4-enviro/2002-4-enviro\\_f.pdf](http://www.hc-sc.gc.ca/sr-sr/alt_formats/iacb-dgiac/pdf/pubs/hpr-rps/bull/2002-4-enviro/2002-4-enviro_f.pdf)

- Healthy Parents, Healthy Babies* (1997). National Council of Welfare.
- Helliwell, J. (2002). *Globalization and Well-Being*. Vancouver, UBC Press.
- Husz, M. (1998). *Human Capital, Endogenous Growth, and Government Policy*. Frankfurt am Main: Peter Lang Publishing Group.
- Jackson, C. (2002). "Capitalization of Software in the National Accounts". *Income and Expenditure Accounts technical series*. Ottawa: Statistics Canada.
- Jackson, H., & McDermott, A. (2004). "Health-Care Spending: Prospect and Retrospect". *Finance Canada Analytical Note*. Ottawa: Finance Canada.
- Health Canada. (1996). *Joint Statement: Prevention of fetal alcohol syndrome (FAS) and fetal alcohol effects (FAE) in Canada*. Retrieved March 15, 2006, from <http://www.ccsa.ca/fasstmnt.htm>
- Jorgenson, D.W., & Fraumeni, B. M. (1989). "The Accumulation of Human and Non-Human Capital, 1948-1984." In R. E. Lipsey & H. S. Tice (Eds.) *The Measurement of Savings, Investment, and Wealth* (pp. 227-282). Chicago: The University of Chicago Press.
- Jorgenson, D. W. & Fraumeni, B. M. (1992). "Investment in Education and U.S. Economic Growth." *Scandinavian Journal of Economics*, 94(Suppl.), S51-70.
- Judson, R. (2002). "Measuring Human Capital Like Physical Capital: What Does It Tell Us?". *Bulletin of Economic Research*, 54, 209-331.
- Keating, D. P., & Mustard, J. F. (1993). "Social economic factors and human development". In D. Ross (Ed.), *Family security in insecure times* (pp. 87-105). Ottawa: National Forum on Family Security.
- Kendrick, J. W. (1976). *The Formation and Stocks of Total Capital*. New York: Columbia University Press.
- Kiker, B. F. (1966). "The Historical Roots of the Concept of Human Capital". *Journal of Political Economy*, 74(5), 481-499.
- Klennert, M. D., Nelson, H. S., Price, M. R., Adinoff, A. D., Leung, D. Y. M., & Mrazek, D. A. (2001). "Onset and persistence of childhood asthma: Predictors from infancy". *Pediatrics*, 108(4), e69-e79.
- Koivusilta, L., Arja, R., & Andres, V. (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.

- Koman R., & Marin, D. (1997). "Human Capital and Macroeconomic Growth: Austria and Germany, 1960-1992". *Centre for Economic Policy Research. Discussion Paper No. 1551*. London.
- Koman R., & Marin, D. (1997). "Human Capital and Macroeconomic Growth: Austria and Germany, 1960-1997 – An Update". *Institute for Advanced Studies, (HIS). Economics Series, 69, 25*.
- Kramer, M. S. (1998). Maternal nutrition, pregnancy outcome and public health policy. *Canadian Medical Association. 159(6)*, pp. 663-665.
- Kuskowska-Wolk, A., & Rössner, S. (1990). "Decreased social activity in obese adults". In S. Baba & P. Zimmet (Eds.), *World data book of obesity* (pp. 265-269). New York, NY: Excerpta Media.
- Kyriacou, G. (1991). "Level and Growth Effects of Human Capital: A Cross-Country Study of the Convergence Hypothesis". *C.V. Starr, Working Paper, 91-26*.
- Laroche , M., & Mérette, M. (2000). Measuring Human Capital in Canada. *University of Ottawa, Canada*.
- Laroche, M., Mérette, M., & Ruggeri, J. (1999). "On the Concept and Dimensions of Human Capital in a Knowledge-based Economy Context". *Canadian Public Policy, 25(1)*, 87-100.
- Lau, L. J., Jamison, D. T., & Louat, F. (1991). "Education and Productivity in Developing Countries: An Aggregate Production Function Approach". *PRE Working Paper Series No. 612*. Washington, D.C.: The World Bank.
- Lissen, I., & Sorensen, T. A. (1993). "School difficulties in childhood – risk of overweight and obesity in young adulthood: A ten year prospective population study". *International Journal of Obesity, 17*, 169-175.
- Logsdon, M. C., Wisner, K. L., & Pinto-Foltz, M. D. (2006). "The impact of Postpartum Depression on mothering". *Journal of Obstetric, Gynecologic and Neonatal Nursing, 35(5)*, 652-658.
- Lucas, R. (1988). "On the Mechanics of Economic Development". *Journal of Monetary Economics, 22*, 3-42.
- Marshall, A. (1890). *Principles of economics* (9<sup>th</sup> ed.). New York: Macmillan for the Royal Economic Society, 1961.
- Martin-Gronert M. S., & Ozanne, S. E. (2006). "Maternal nutrition during pregnancy and health of the offspring". *Biochemical Society Transitions, 34*, 779-82.

- McCain, M. N., Mustard, J. F., & Shanker, S. (2007). "Chapter 1: The long reach of early childhood". In *Early Years Study 2: Putting science into action* (pp. 17-58). Toronto, ON: Council for Early Child Development.
- McDougall, J., King, G., De Wit, D. J., Miller, L. T., Sungjin, H., Offord, D. R., et al. (2004). "Chronic physical health conditions and disability among Canadian school-aged children: A national profile". *Disability and Rehabilitation*, 26(1), 35-45.
- American College of Obstetricians and Gynecologists. (2007). *Medical Library*. Retrieved May 21, 2007, from <http://www.medem.com>.
- Mincer, J. (1958). "Investment in Human Capital and Personal Income Distribution". *The Journal of Political Economy*, 66(4), 281-302.
- Mintz, J. (2004). "Is the Debt War Over? What Have We Learned?". In C. Ragan & W. Watson (Eds.), *Is the Debt War Over? Dispatches from Canada's Fiscal Frontline* (pp. 351-359).
- Mulligan, C. B. & Sala-i-Martin, X. X. (1997). "A Labour-Income-Based Measure of the Value of Human Capital: An Application to the States of the United States". *Japan and the World Economy*, 9, 159-199.
- Murray, L. (1992). "The impact of postnatal depression on infant development". *Journal of Child Psychology and Psychiatry*, 33, 543-561.
- Murray, L., Cooper, P., & Hipwell, A. (2003). "Mental health of parents caring for infants". *Archives of Womens Mental Health*, 6(Suppl.2), s71-s77.
- Nadder, T. S., Rutter, M., Silberg, J. L., Maes, H. H., & Eaves, L. J. (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 Round Table on the Environment and the Economy (2003). *Environment and Sustainable Development Indicators for Canada*.
- 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.
- OECD (2001). *The Well-being on Nations: The Role of Human and Social Capital*. Paris

- Parcel, T. L., & Menaghan, E. G. (1993). "Family social capital and children's behavior problems". *Social Psychology Quarterly*, 56, 120-135.
- U.S. National Academy of Sciences Washington. (1993). "Pesticides in the Diets of Infants and Children". DC: National Academy Press.
- Potapchuck, W. R. & Crocker, J. P. (1999). "Exploring the Elements of Civic Capital". *National Civic Review*, 88(3), 175-201.
- Psacharopoulos, G., & Arrigada, A. M. (1986). "The educational composition of the labor force: An international comparison". *International Labor Review*, 125(5), 561-574.
- Psacharopoulos, G., & Arrigada, A. M. (1992). "The educational composition of the labor force: An international update". *Journal of Educational Planning and Administration*, 6(2), 141-159.
- Rein, A. A., & White, P. L. (1979). "Obesity: Its risks and hazards". In G. A. Braz (Ed.), *Obesity in America* (pp. 117-120). Washington, DC: National Institute of Health.
- Remkes, T. (1993). "Saying no – completely". *The Canadian Nurse*, 89(6), 25-28.
- Robson, W. B. P. (2001). "Will the Baby Boomers Bust the Health Budget?" *Commentary No. 148*, C.D. Howe Institute.
- Romanow, R. J. (2002). "Final Report: Building on Values: The Future of Health Care in Canada". *The Commission on The Future of Health Care in Canada*.
- Romer, P. M. (1990). "Endogenous technological change". *Journal of Political Economy*, 98(5), S71-S101.
- Ruggeri, G. C. (2002). "Population Aging, Health Care Spending and Sustainability; Do We Really Have A Crisis?". *Caledon Institute of Social Policy*.
- Ruggeri, G. C. (2003). "Atlantic Canada in the Knowledge-Based Age". Fredericton: Policy Studies Centre.
- Ruggeri, G. C. (2007a). "Investment in Natural Capital by the Federal Government in Canada". *Policy Studies Centre, Working Paper, 2007-01*.
- Ruggeri, G. C. (2007b). "Federal Government Investment in Human Capital". Mimeo.
- Ruggeri, G. C. & Weiqiu Y. (2001). "On the Dimensions of Human Capital: An Analytical Framework". *Atlantic Canada Economics Association Papers*, 29, 89-102.

- Ruggeri, G. C. & Zou, Y. (2005). "From Labour Surplus to Potential Labour Supply Constraints in Atlantic Canada". *Atlantic Canada Opportunities Agency*.
- Ruggeri, G. C., Doucet, M., & Watson, B. (2007). "Provincial Investment in Health Care". Mimeo.
- Runyan, D. K., Hunter, W. M., Socolar, R. R. S., Amaya-Jackson, L., English, D., Landsverk, J., et al. (1998). "Children who prosper in unfavorable environments: the relationship to social capital". *Pediatrics*, 101(1, part 1 of 2), 12-18.
- Sameroff, A. J., Seifer, R., Baroces, R., Zax, M., & Greenspan, S. (1987). "Intelligence quotient scores in 4-year old children: Social-environmental risk factors". *Pediatrics*, 79, 343-350.
- Schultz, T. W. (1961). "Investment in Human Capital". *The American Economic Review*, 51(1), 1-17.
- The Health of Canadians – Federal Role: Interim Report. (2002). "Senate Standing Committee on Social Affairs, Science and Technology". Ottawa.
- Sinclair, D., Murray, L. (1998). "The effects of postnatal depression on children's adjustment to school: teacher reports". *British Journal of Psychiatry*, 172, 58–63.
- Smith A. (1776). *The Wealth of Nations*. London: G. Routledge.
- Smith, M. H., Beaulieu, L. J., & Israel, G. D. (1992). "Effects of human capital and social capital on dropping out of high school in the South". *Journal of Research in Rural Education*, 8, 75-87.
- Somers, M. A., & Willms, J. D. (2002). "Maternal depression and childhood vulnerability". In J. D Willms (Ed.), *Vulnerable children: Findings from Canada's National Longitudinal Survey of Children and Youth* (pp. 211-228). Edmonton, AB: University of Alberta Press.
- Carnegie Corporation of New York. (1994). "Starting Points: Meeting the Needs of Our Youngest Children". New York: Carnegie Corporation of New York.
- Stimson, R., Western, J., Baum, S., & Van Gellecum, Y. (2003). "Measuring Community Strength and Social Capital". Proceedings from The European Regional Science Association.
- Stroombergen, A., Rose, D., & Nana, G. (2002). *Review of the Statistical Measurement of Human Capital*. Wellington: Statistics New Zealand.

- Takser, L., Mergler, D., Hellier, G., Sahuquillo, J., & Huel, G. (2003). "Manganese, monoamine metabolite levels at birth, and child psychomotor development". *NeuroToxicology*, 24, 667-674.
- Teicher, M. H. (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.
- Uddenberg, N., & Engleson, I. (1978). "Prognosis of postpartum mental disturbance. A prospective study of primiparous women and their 4 and ½ year old children". *Acta Psychiatria Scandanavica*, 58, 201-212.
- U.S. Department of Health and Human Services. (2006). *Child Health USA 2006*. Retrieved May 28, 2007, [http://www.mchb.hrsa.gov/chusa\\_06/popchar/0204sd.htm](http://www.mchb.hrsa.gov/chusa_06/popchar/0204sd.htm)
- Vaillancourt, C. & Surette, C. (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. P., Grantham-McGregor, S. M., Powell, C. A., & Chang, S. M. (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.
- Wei, H. (2004). *Measuring Human Capital for Australia: Issues and Estimates*. Australian Bureau of Statistics.
- Willms, J. D. (2002). *Vulnerable Children*. Edmonton: University of Alberta Press.



