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The Measurement of Output and Productivity in the Health Care Sector in Canada: An Overview

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Abstract

To achieve efficient allocation of resources in the health care sector, accurate measures of health care output and productivity are essential. According to official estimates of productivity produced by Statistics Canada, labour productivity in the business sector of the health care (excluding hospitals) and social assistance industry declined 0.28 per cent per year between 1994 and 2003. Estimates of productivity produced by the CSLS, based on official Statistics Canada employment and real GDP figures, show that labour productivity in the health care and social assistance industry declined by 0.69 per cent per year between 1987 and 2006. It is widely recognized that official output and productivity figures may seriously underestimate the true contribution of the health care sector to real output, and more importantly to the economic well-being of Canadians. Alternative approaches show that price indices for health care output may be overestimated and, therefore, quality improvements may not be accurately captured by estimates of real health care output. More resources are needed to further investigate the alternative approaches discussed in this report and develop better output measures that adjust for outcomes directly related to health care spending.

Résumé

Afin de réaliser une allocation efficace des ressources dans le secteur de la santé, il est essentiel de disposer de mesures exactes de la production et de la productivité pour ce secteur. Selon les données officielles sur la productivité produites par Statistiques Canada, la productivité dans le secteur privé de l'industrie des soins de santé (sauf les hôpitaux) et assistance sociale a diminué de 0.28 pourcent par année entre 1994 et 2003. Les données sur la productivité produites par le CENV, qui sont construites à partir de données officielles de Statistique Canada sur l'emploi et le PIB réel, montre que la productivité dans l'industrie des soins de santé et assistance sociale a baissé de 0.69 pourcent par année entre 1987 et 2006. Il est notoire que les données officielles sur la production et la productivité sous-estiment grièvement la vraie contribution du secteur de la santé au PIB réel et, plus important encore, sa contribution au bien-être économique des Canadiens. Des approches alternatives démontrent que les indices de prix pour la production du secteur de la santé sont peut-être surestimés et que, incidemment, les améliorations dans la qualité des soins ne sont peut-être pas capturées de façon exacte par les données sur la production réelle du secteur de la santé. Des ressources supplémentaires sont nécessaires pour continuer le développement des approches alternatives discutées dans ce rapport et pour assurer le développement de meilleures mesures de production qui tiennent compte des résultats reliés directement aux dépenses de santé.

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Executive Summary

The Canadian health care sector is an increasingly important part of the Canadian economy, particularly in the context of an aging population. The purpose of this report is to stimulate debate on how to develop better measures of health care sector output and productivity for Canada.

Recent international research has focused on the measurement issues associated with non-market activities. This research has focused on the health care sector, as many countries devote a significant, and growing, proportion of expenditures to this sector. In 2006, Canadian expenditure on health care accounted for 10.2 per cent of nominal GDP. The main issue involved with measuring the output of the health care sector is that there are often no market transactions where quantity and price can be observed. Further, what constitutes the "output" of the health care sector remains debatable.

Key Highlights:

- The current approach to the measurement of health care sector output in Canada relies largely on the use of volume of inputs to the health care sector as a proxy for volume of outputs. As other countries, notably EU member states, implement output volume indicators for the health care sector in their national account figures, the comparability between Canadian and international data on the health care sector becomes less reliable. Research by Eurostat and statistical agencies in the United Kingdom as well as the United States provide the motivation as well as a detailed framework for this type of work to begin in Canada.

- According to official Statistics Canada estimates, real GDP in the health care and social assistance industry grew by 1.93 per cent per annum compared to 2.86 per cent per annum for real GDP in the total Canadian economy in the period 1984-2003.

- Nominal GDP in the health care and social assistance industry has been growing by 5.80 per cent per annum compared to 5.27 per cent per annum for the total Canadian economy between 1984 and 2003.

- Prices in the health care and social assistance industry increased at an average rate of 3.79 per cent per annum compared to 2.34 per cent per annum for the total Canadian economy between 1984 and 2003.

- Productivity, measured as real GDP per worker based on official Statistics Canada employment and real GDP figures, in the health care and social assistance industry over the 1987-2003 period fell, on average, by 0.76 per cent per year.

Average real GDP per worker in Canada increased by 1.14 per cent per year over that same period.

- Life expectancy in Canada has risen by 5.3 years over the 1979-2004 period. Females have seen an increase in life expectancy at birth of 3.8 years over the 1979-2004 period while males have seen an increase of 6.8 years over that same period.

- The true contribution of the health care sector to the well-being of the Canadian population, estimated using health outcome indicators, is likely not being captured in current estimates of health care output and productivity.

- The definition of health output remains inconsistent as there is no consensus on what actually constitutes the output of the health care sector. There is debate on whether improvements in health outcomes, such as life expectancy, should be included in measures of health output. Additionally, constant changes in medical care technologies make it difficult to measure real health care sector output.

- Approaches that quality-adjust health care output for health outcomes find that health care output and productivity are being underestimated by the largely input-based approach currently used by Statistics Canada.

In light of the evidence, this report concludes that Statistics Canada should devote more effort to develop better estimates of output and productivity in the health care sector. Additionally, better documentation of procedures and methodologies used by Statistics Canada to develop real measures of health output are needed. The construction of a satellite health account, to exist alongside current national account estimates of the health care sector, would allow for extended exploration of output and productivity measurement concepts that could ultimately improve official productivity estimates for the health care sector.

The Measurement of Output and Productivity in the Health Care Sector in Canada: An Overview

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The Measurement of Output and Productivity in the Health Care Sector in Canada: An Overview[1]

Introduction

To achieve efficient allocation of resources in the health care sector, accurate measures of health care output and productivity are essential.[2] Efficiency in the health care sector is especially relevant to Canadians because of Canada's aging population. Health care resources allocated to the elderly are disproportionately larger than health care resources allocated to any other age group. Additionally, in 2006, total health care expenditures accounted for over 10 per cent of Canadian GDP.[3] With the aging population, it is highly probable that this number will continue to increase.

It is widely recognized that, on an international scale, the conventional national accounting approach to measuring output of the health care sector excludes the value of improvements in the health status of populations. As Nordhaus (2003:10) has pointed out:

> "It is little understood outside the priesthood of national accountants that there is no serious attempt to measure the "real output" of the health care industry. The techniques used to measure the price and quantity of health care are highly defective, and there are *no* attempts to account for improvements in the length of life into current measures of living standards."

The report is written for stakeholders in the Canadian health sector and those interested in trends in Canadian health sector output and productivity as well as those interested in alternatives to measuring health care output. The purpose of this report is to stimulate debate on how to develop better measures of health care sector output and productivity for Canada. This report provides a technical discussion of national accounting for the health care sector which includes discussions of prices, employment, real output, nominal output, and productivity. This report does not debate the philosophy concerning the manner in which more efficient care can be delivered. It focuses purely on measurement issues in the health care sector and seeks to determine whether the measured falling productivity in the Canadian health care sector is a statistical artefact of the data or a real phenomenon.

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[1] This report is a revised version reflecting comments from both the September 18, 2007 Task Group on Healthcare Productivity Meeting hosted by the Canadian Medical Association (CMA) and the October 30, 2007 CSLS-CMA Conference on Improving Measures of Health Care Output and Outcomes in Canada. The presentations from the CSLS-CMA Conference, as well as a conference summary, are posted on the CSLS website at www.csls.ca. We would like to thank Nick Neuheimer from the Canadian Medical Association, Michael Wolfson from Statistics Canada, and Anna Ansmits for comments on earlier drafts of the report. All responsibility for errors lies with the authors.

[2] Efficiency refers to the ratio of output produced to the maximum attainable output for a given level of input. Productivity refers to the ratio of outputs to inputs.

[3] The terms 'output' and 'GDP' will be used interchangeably in this report. Output therefore refers to value added not gross output, unless otherwise indicated.

The current approach to the measurement of health output in Canada relies largely on the use of volume of inputs to the health care sector as a proxy for volume of outputs. The problem that arises with the use of an input method is that estimated productivity growth will be, by definition, zero. Yet, policy decisions regarding efficient allocation of resources are often based on productivity estimates. Methods that attempt to directly measure the volume of output and also account for quality changes can capture productivity growth that the input based method can not. Health outcomes can play an important role in the quality adjustment of output, and some argue that it is the most important indicator of health care quality. Adjusting health outputs for health outcomes is a complex procedure since it must be applied at a very detailed level of medical procedures and health services. Additionally, overall health outcomes, such as life expectancy, are obviously not satisfactory measures of the output of the health care sector in itself as there are numerous factors, in addition to health care, that can affect the health of a person. These factors include lifestyle choices, environment, and education, among others.

According to estimates of real output and labour inputs produced by Statistics Canada, labour productivity (measured as real output per worker) in the Canadian health care and social assistance industry fell 0.69 per cent per year over the 1987-2006 period (Table 7).[4] It is widely recognized, including by Statistics Canada officials, that these numbers may seriously underestimate the true contribution of the health care sector to real output, and more importantly to the economic well-being of Canadians. Additionally, underestimates of health care output and productivity likely result in underestimates of overall Canadian output and productivity.

The report will be divided into five main sections. The first section will provide an overview of current international research and discussion concerning the measurement of health care sector output. The second section will review the estimates of output and employment of the health care sector currently produced by Statistics Canada, and productivity estimates derived from these figures. These include both nominal and real output estimates as well as the price indices for the health care sector. This section will also provide a brief overview of the sources and methodologies used by Statistics Canada to obtain these data.

The third section will provide data on health outcomes in Canada. This includes data on longevity, quality of life, human function and overall well-being of the population. This section will also present Canadian health outcome indicators in an international context.

The fourth section will survey the literature on alternative methods, that go beyond the input-based approach, to measuring and valuing the output of the health care sector. The first approach to obtaining better estimates of the output of the health care sector is a utility-based approach that attaches value to improvements in health status. The second approach is a production-based approach which relies on data at the disease/condition level to ultimately obtain accurate and quality-adjusted measures of

[4] Tables can be found in Appendix II at the end of the paper.

output at the aggregate level. In practice, however, it is challenging to produce a robust quality-adjusted estimate of output.

The fifth section will discuss the issues that arise when the health care sector, a largely non-marketed sector, is measured in a conventional national accounting framework. This section will discuss the challenges associated with obtaining aggregate indicators of the health care sector and alternatives to monetizing health care sector output.

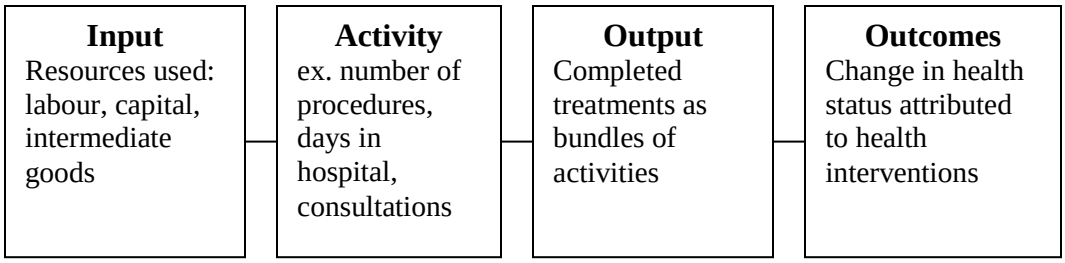
I. International Guidance in Health Care Output Measurement

The measurement of health care output, and the output of other non-marketed sectors such as education and public defence, have always presented a challenge for national accountants. There are numerous issues associated with the measurement of health care output and productivity. Since health care is largely non-marketed, prices and outputs are not easily observed. Further, there is debate concerning what constitutes the output of the health care sector since it is a diverse sector that provides a range of goods and services. Additionally, the health care sector has experienced significant quality improvements due to technological change that are not easily captured in price and output estimates.

Recent international discussion on this subject has focused on developing improved methods and procedures to measure the output of the health care sector and other non-marketed sectors in a national accounting framework. One of the goals of improved methods and procedures for measuring output in these sectors is to ensure comparability of national account figures across countries. In 2000, the OECD published *A System of Health Accounts* which proposes a comprehensive and flexible set of health accounts that can be used to meet the needs of health care policy-makers as well as enhance international comparability of health data. In 2001, Eurostat, the statistical office of the European Union, published the *Handbook of Price and Volume Measures of National Accounts*. The Eurostat *Handbook* provides detailed definitions of output by industry, an evaluation of available data by industry, and a ranking of the preferred methods to measure output by industry. The *Atkinson Report: Measurement of Government Output and Productivity for the National Accounts* (2005) (known as the *Atkinson Report*) provides a detailed review of public service output and productivity measures in the United Kingdom. Both of these reports provide detailed sections discussing these topics as they relate specifically to the health care sector. In 2005, the University of York, in cooperation with the Atkinson Report, provided a detailed review of output and productivity measures for the United Kingdom's National Health Service (NHS). In addition to European agencies who have made substantial progress in this area, the OECD, the National Academy of Sciences (NAS) in the United States, and the United States Bureau of Economic Analysis (BEA) are contributing to research on improved measures of health output and productivity. The following section will provide an overview of European guidance with regards to the measurement of health output.

The Eurostat *Handbook of Price and Volume Measures of National Accounts* (2001) makes the distinction between inputs, activities, outputs and outcomes for individual services (Exhibit 1). This terminology has been widely adopted in international discussions of measuring health care in the national accounting framework, and this report will adopt it as well. In the health care sector, inputs include labour, capital and intermediate goods and services. These inputs are combined in the form of activities. Activities include the number of physician visits, the number of hospital days or the number of procedures performed. Output of the health care sector is the combination of activities that result in a completed treatment. For example, a completed knee replacement would be considered health care output while the activities needed for that unit of output could include consultations, diagnostic tests, operative procedures, and after-care treatment from other health services. The outcome of the health care sector is the improved health and overall well-being of a person attributed to health care interventions.

Exhibit 1: Terminology for the Health Care Sector



The Eurostat *Handbook* recommends that the volume of output be measured and quality-adjusted by counting activities classified by Diagnostic Related Groups (DRG).[5] In the Eurostat *Handbook*, methods for measuring quality-adjusted output volume are ranked as either A (preferred), B (less satisfactory but acceptable), or C (unacceptable) methods. An A method is one which satisfies the following four criteria: (i) provides complete coverage of the product, good or service; (ii) weights outputs by the cost of production; (iii) accounts for quality changes; and (iv) maintains conceptual consistency between the indicator and the national accounts concept, that is the indicator measures outputs rather than activities. If one or more of the criteria is not met, the method becomes a B method or a C method as it moves further away from an A method. The precise definition of A, B and C methods are specific to products and industries. However, the use of inputs as proxies for output volumes is consistently regarded as an unacceptable method for measuring output volumes, i.e. a C method. With the release of the Eurostat *Handbook* in 2001, the European Commission implemented regulation that all European Union (EU) member states were to remove C methods from their national accounting practices by the end of 2006.

Both the *Atkinson Report* (2005) and Dawson et al. (2005) note weaknesses with the approach outlined by the Eurostat *Handbook* and suggest improvements. First, the

[5] A Diagnostic Related Group (DRG) is a patient classification system that differentiates patients into groups that are homogeneous in resource utilization.

output method suggested by Eurostat does not provide a direct measure of output, as defined in the Eurostat *Handbook* (2001). It is suggested that output be measured as a whole course of treatment rather than a measure of activities. This type of measure requires the identification of the activities delivered to a patient with a particular condition. The challenge with this type of method is that numerous institutions will be involved with a single treatment for a condition, therefore linking the activity to a patient's condition will be difficult. The *Atkinson Report* (2005) and Dawson et al. (2005) acknowledge that this method will be a long term goal as current data do not allow for this type of measurement. Therefore, activities will need to be used as proxies for health care sector output in the short term.

Second, Eurostat recommends weighting output by cost of production, which may or may not equal the marginal valuation of output. The *Atkinson Report* and Dawson et al. (2005) suggest that more research is needed on gathering data regarding the effects of health interventions on health status so that output can be weighted by the marginal value of output. This type of weighting is important since current methods imply that a relative increase in expensive treatments will increase output while a relative increase in cost reducing treatments with the same health outcomes will result in lower output (Dawson et al., 2005: 108).

Third, when making quality-adjustments based on DRG Eurostat makes the assumption that higher cost treatments indicate higher quality. The *Atkinson Report* suggests that quality adjustments should be made based on health outcomes achieved due to medical intervention. This approach focuses mainly on measures such as quality adjusted measures of life expectancy. Dawson et al. (2005) suggest that health outcomes are only one of many aspects of health care quality. Notably, data on waiting times, patient satisfaction indicators, and re-admission rates can be used to quality-adjust measures of output. From 2001 to 2004, the average annual growth rate of health output in United Kingdom hospitals was 4.34 per cent when not adjusted for quality, and 5.69 per cent when adjusted for clinical errors (proxied by incidences of blood stream infections), re-admission rates, and patient satisfaction. Furthermore, both reviews emphasize that quality adjustments must also be made to the inputs to the health care sector. For example, labour input should be adjusted for any change in the level of skilled workers. The average annual growth rate for labour productivity in the United Kingdom health care sector between 1998 and 2004 was 0.17 per cent when output was not quality adjusted, 0.46 per cent when output was quality-adjusted, and -0.04 per cent when both output and labour input were quality adjusted.

In June of 2006, Eurostat sent a questionnaire to all EU member states, as well as some non-EU OECD countries, regarding price and volume measurement practices for non-market health and education services (Gallais and Malherbe, 2006).[6] The purpose of the questionnaire was to determine whether EU member states had removed C methods

[6] Of the 27 EU member states who were sent the questionnaire, 24 responded to the questionnaire, and three non-EU countries also responded: New Zealand, Australia, and the United States. The United States responded to the survey based on research that was ongoing and had yet not been adopted in the national accounting figures.

from their accounting practices, in addition to gaining an international perspective on progress in health and education volume measurement. The questionnaire covered four topics: stratification, quantity indicators, weighting, and quality indicators. In terms of stratification, most countries followed the recommended Eurostat stratification of the health care sector into four categories: hospital services, medical practice services (which includes medical specialist services and general practitioner services), dental services, and other human health services. There was significant variation in the types of quantity indicators used by the surveyed countries for different health care services. Some used the method recommended by Eurostat, while others used a mix of approaches. The majority of countries who responded to the survey weighted health care services based on costs, which is the recommended method. In terms of quality adjustments for health output, there was also variation in methods used by the surveyed countries. Six of the EU member states used quality adjustments based on Diagnostic Related Groups. In contrast, the United States indicated that it would use quality adjusted life years (QALYs) to quality adjust output.

As EU member states implement output volume indicators for the health care sector in their national account figures, the comparability between Canadian and European data on the health care sector becomes less reliable. Research by Eurostat and statistical agencies in the United Kingdom provide the motivation as well as a detailed framework for this type of work to begin in Canada.

II. Current Estimates of Canadian Health Care Sector Output, Employment and Productivity

There are at least three approaches to the measurement of resources allocated to the health care sector:

- The expenditure approach uses expenditures on health care related products and services in both the private and pubic sector as a measure of the resources allocated to the health care sector.

- The economic footprint approach utilizes the concept of a multiplier effect to determine the total resources allocated to and used by the health care sector.

- The output approach uses output, based on the North American Industry Classification System (NAICS), as a measure of resources allocated to the health care sector. As stated previously, Statistics Canada relies largely on an input based method to derive measures of health care output.

Total Canadian health expenditures, in current dollars, increased from 8.2 per cent of nominal GDP in 1984 to 10.2 per cent in 2006 (Table 13). During this period, nominal health expenditures in Canada increased at an average rate of 6.5 per cent annually. In 2006, public health expenditures in Canada accounted for 70 per cent of total health expenditures while private health expenditures accounted for 30 per cent. The 70/30 split between public and private health expenditures has remained relatively constant for the

1984-2006 period. It should be noted that the health expenditure approach gives a significantly larger valuation of the resources allocated to the health care sector compared to the output approach. The expenditure approach include intermediate goods and services, as well as drugs, while the output approach includes only the value added of the health care sector.

The economic footprint approach extends the scope of the health care sector beyond health expenditures to include all industries involved in the supply side of the health care sector. Areas outside the narrowly defined health care sector which may contribute to improved health outcomes include pharmaceutical industries, private health insurance administration, public health activities and university-based health research. The economic footprint approach finds that increased spending on health care results in increased government revenue and other income that offsets increased spending. For example, it is estimated that two thirds of government spending on health care is recoverable in the form of increased revenues and reduced Employment Insurance and other transfer payments. In 2005, it is estimated that spending on health care services resulted in a multiplier effect of 1.5 on other domestic sectors in that year (Rylska and Sonnen, 2006).

This report focuses on the output approach as it is the only measure of the resources allocated to the health sector, of the three measures mentioned above, that is relevant for discussions of productivity. The first part of this section outlines the sources and methodologies used by Statistics Canada to collect data on health care output. The second part of this section provides the definition of the Canadian health care sector used by Statistics Canada. The third part of this section discusses the trends in output, employment, and productivity in Canada based on official Statistics Canada estimates for the health care and social assistance industry.

A. Overview of Sources and Methodologies Used in Estimating Canadian Health Care Sector Output

Canada's health care industries in the System of National Accounts straddle the business and non-business sectors of the economy. The health care sector accounts for about six per cent of real output, of which more than 60 per cent is in the non-business sector, mainly government. The measurement of output in health care is not straightforward due to the delivery, funding and regulation of government authorities. Secondly, constant advances in medical care technologies make it difficult to measure real output due to changes in medical services. In this section of the report we examine the sources and methods for estimating gross output, value added output (GDP) by industry, and adjusting for price changes to measure constant price gross output and GDP for health care industries.

In the non-market economy, which includes most hospitals and government run health care institutions, the value of output is largely determined by the value of inputs – costs of labour, capital, energy, materials and services. In effect, this approach results in a zero rate of productivity growth. Furthermore, the contribution of capital investment as

a factor of production in GDP is treated differently between the private and public sectors.

The output of the health sector in the Canadian economy is best articulated in the Input-Output Accounts which provide the most detailed structure of the Canadian economy. These accounts are produced annually at the national and provincial levels. The health care sector industries include: Offices of Physicians, Offices of Dentists, Miscellaneous Ambulatory Health Care Services, Nursing and Residential Care Facilities and Hospitals.

Summary Table 1: Major Data Sources for Health Output

Industry	Nominal Gross Output	Nominal GDP	Deflator
Office of Physicians	CIHI National Health Expenditure Trends	CRA Administrative T-1 and T-2 files	CIHI Payment Schedule Index
Office of Dentists	CIHI National Health Expenditure Trends	CRA Administrative T-1 and T-2 files	STC Consumer Price Index for Dental Care
Other Ambulatory Care Services	CIHI National Health Expenditure Trends	CRA Administrative T-1 and T-2 files	STC Consumer Price Index for paramedical practitioners, laboratories and private duty nurses
Hospitals	CIHI Annual Hospital Survey	CIHI Annual Hospital Survey CRA Administrative T-4 files, STC Capital Stock estimates	CIHI Annual Return of Health Care Facilities Hospitals Survey plus CIHI resources intensity data
Nursing and Residential Care Facilities	STC CCHS Surveys	CRA Administrative T-4 files, STC Capital Stock estimates	Provincial rates by type of care and STC Consumer Price Index for special care facilities

Note: Canada Revenue Agency (CRA), Statistics Canada (STC), and Canadian Institute for Health Information (CIHI).

The measurement of constant price, or real, GDP in the Input-Output Accounts is derived through a double deflation method by adjusting for price changes in industry outputs (the goods and/or services an industry produces) and the intermediate inputs which consist of energy use, and materials and services purchased from other industries or imported). Real output in the health sector, delivered through the private or public

sector, attempts to measure the quantity of services in the health care sector. This, in itself, is challenging in that technological change and government policies constantly alter the landscape. Furthermore, the measurement of constant price output in the System of National Accounts is a function of both quantity and quality change. In that context, the measure of output in the health care sector is further complicated by the issue of factoring health outcomes into the output measures for some types of health services. Summary Table 1 provides an outline of the major data sources used in measuring output of the health care sector. Appendix I provides a more detailed discussion of these sources and methodologies.

B. Definition of the Canadian Health Care Sector

Statistics Canada categorizes the Canadian health sector according to the North American Industry Classification System (NAICS). The NAICS replaced the 1980 Standard Industrial Classification System (SIC80), but this change had minor impact on the health care sector. This classification system groups both health care and social assistance under one single industry heading which represented 10.8 per cent of total Canadian employment and 5.7 per cent of total Canadian real GDP in 2006. The health care sector, excluding social assistance, represented 8.2 per cent of total Canadian employment in 2006. Unfortunately, output of the social assistance industry can not be extracted from the aggregate health care and social assistance data provided by Statistics Canada. Therefore, productivity estimates can not be calculated for the health care sector excluding social assistance. The health care and social assistance industry grouping is further divided into four main industries: ambulatory health care services; hospitals; nursing and residential care facilities; and social assistance (Exhibit 2).

Ambulatory health care services include offices of health practitioners such as physicians and dentists as well as out-patient care centres, medical and diagnostic laboratories, and home health care services. These services accounted for 23.0 per cent of total employment in the health care and social assistance industry in 2006. Hospitals include both general medical and surgical hospitals as well as specialty hospitals, such as psychiatric and substance abuse hospitals. Employment in hospitals accounted for the largest proportion of total employment in the health care and social assistance industry at 35.2 per cent. Nursing and residential care facilities include nursing care facilities, community care facilities for the elderly as well as mental health and substance abuse facilities. These facilities account for the smallest proportion of total employment in the health care and social assistance industry at 17.0 per cent. Social assistance includes individual and family services, relief services, vocational rehabilitation services and child day-care services. These services account for 24.8 per cent of total employment in the health care and social assistance industry.

The health care and social assistance industry can be further divided into the business and non-business sectors. The non-business sector of the health care and social assistance industry accounts for 62 per cent of total employment in the industry in 2006 (Table 9).

Exhibit 2: North American Industry Classification System (NAICS) for the Health Care and Social Assistance Industry (NAICS code 62)

62 Health Care and Social Assistance (10.8% share of total economy employment in 2006)

- **621** Ambulatory Health Care Services (23.0% share of total industry employment in 2006)
  - **6211** Offices of Physicians
  - **6212** Offices of Dentists
  - **6213** Offices of Other Health Practitioners[7]
  - **6214** Out-Patient Care Centres
  - **6215** Medical and Diagnostic Laboratories
  - **6216** Home Health Care Services
  - **6219** Other Ambulatory Health Care Services
- **622** Hospitals (35.2% share of total industry employment in 2006)
  - **6221** General Medical and Surgical Hospitals
  - **6222** Psychiatric and Substance Abuse Hospitals
  - **6223** Specialty (except Psychiatric and Substance Abuse) Hospitals
- **623** Nursing and Residential Care Facilities (17.0% share of total industry employment in 2006)
  - **6231** Nursing Care Facilities
  - **6232** Residential Development Handicap, Mental Health and Substance Abuse Facilities
  - **6233** Community Care Facilities for the Elderly
  - **6239** Other Residential Care Facilities[8]
- **624** Social Assistance (24.8% share of total industry employment in 2006)
  - **6241** Individual and Family Services
  - **6242** Community Food and Housing, and Emergency and Other Relief Services
  - **6243** Vocational Rehabilitation Services
  - **6244** Child Day-Care Services

Sources: Statistics Canada. 2003. *North American Industry Classification System Canada 2002*. Statistics Canada Catalogue no. 12-501-XPE. Ottawa. 811 p.; Statistics Canada Labour Force Survey.

[7] Other Health Practitioners include: Chiropractors; Optometrists; Mental Health Practitioners (except Physicians); and Physical, Occupational and Speech Therapists and Audiologists.

[8] Other Residential Care Facilities include: Transition Homes for Women; Homes for Emotionally Disturbed Children; and Homes for the Physically Handicapped or Disabled.

C. Trends in the Health Care and Social Assistance Industry in Canada

This section will first discuss trends in output, both real (1984-2006)[9] and nominal (1984-2003), in the health care and social assistance industry. Second, it will discuss trends in employment obtained from the Statistics Canada Labour Force Survey. Third, it will provide unofficial estimates of productivity calculated by the CSLS for the 1987-2006 period, and official estimates of productivity for the business sector provided by Statistics Canada for the 1994-2003 period. The unofficial productivity estimates are derived from official Statistics Canada output and employment figures. Statistics Canada only publishes official productivity estimates for the business sector of the health care services (excluding hospitals) and social assistance industry for the period 1994-2003.

1. Output

In practice, there are numerous methods of measuring output in the health care sector. For example, in some areas of the health care sector output is marketed and therefore nominal output data are available, which can then be deflated by prices or costs to obtain a measures of real output. When output is not marketed, labour inputs may be used as a proxy for output. Alternatively, for non-market output, direct volume measures of activities and services may be used if appropriate documentation exists. Since Statistics Canada does not clearly document the methodology used to measure output in each sub-industry of the health care sector, we are unable to determine the importance of these different methods of measuring output, and therefore unable to accurately interpret productivity measures.

Real GDP in the health care and social assistance industry has grown approximately one per cent slower, on average, than total economy real GDP in the 1984-2003 period. In this period, the health care and social assistance industry's real GDP grew by 1.93 per cent per annum compared to 2.86 per cent per annum for the total economy (Table 1, Chart 1).[10] The majority of this slow growth rate is attributed to hospitals, which have shown an average annual real GDP growth rate of 1.02 per cent. The combined growth of real GDP in health care services (excluding hospitals) and social assistance was more than double that of hospitals at 2.60 per cent per annum. While the health care industry (excluding hospitals) has been growing at a rate similar to the rest of the economy, according to official estimates, output of the Canadian economy has been growing more than twice as fast as hospital output since 1984.

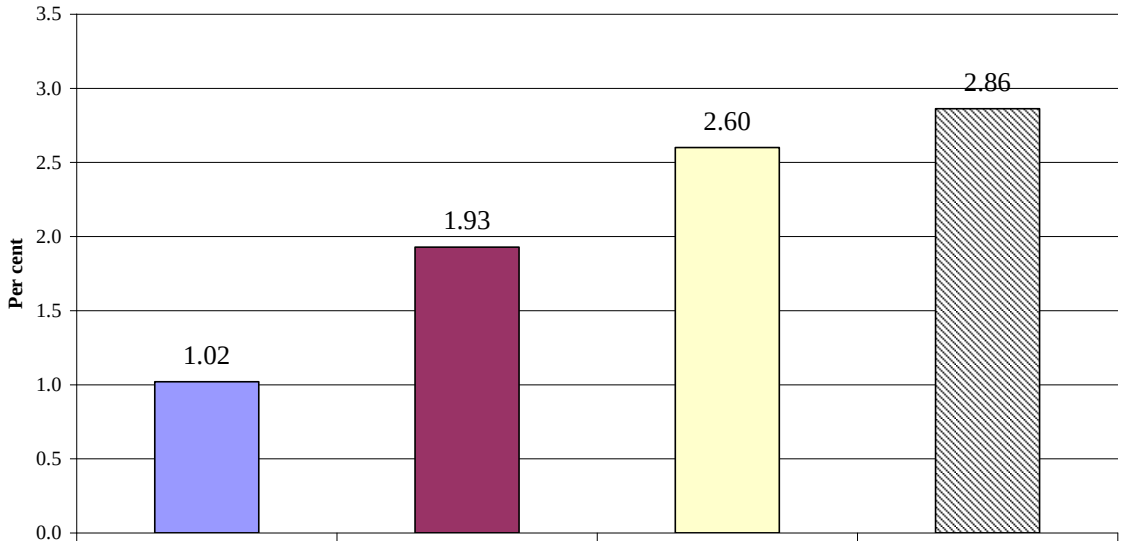
Statistics Canada does not publicly release an estimate of output in the health care sector that excludes social assistance. It remains unclear whether health care data should include social assistance as social assistance includes: individual and family services;

[9] Real output data are available up to 2006, but 1984-2003 data are used in the analysis to allow for comparison with nominal output data which are only available up to 2003.

[10] For the 1984-2006 period real GDP in the health care and social assistance had an almost identical growth rate to that of the 1984-2003 period, growing by 1.91 per cent per year while the total economy grew by 2.86 per cent per year. The hospital industry grew by 1.10 per cent per year, and the health care services (excluding hospitals) and social assistance industry grew by 2.50 per cent per year.

community food and housing, and emergency and other relief services; vocational rehabilitation services; and child day-care services. Consequently, it is not possible to obtain an output estimate for only the health care sector.

Chart 1: Real GDP in the Health Care and Social Assistance Industry in Canada, 1984-2003 (average annual growth rates, 1997 dollars)



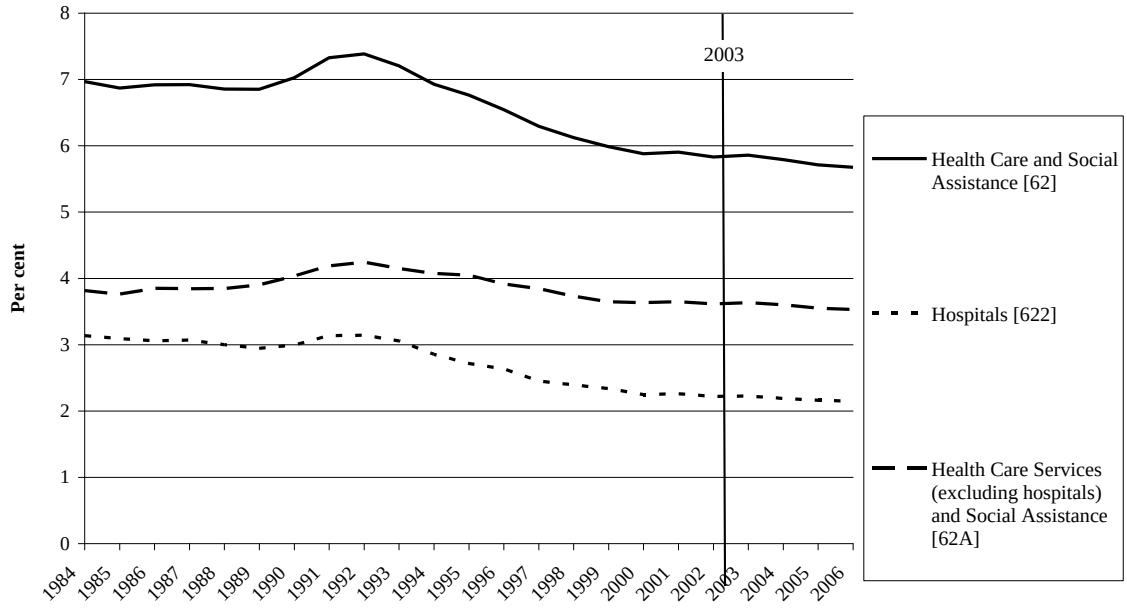
Source: Table 1

Following from the growth patterns, there has been a steady decline in the relative importance of the health care and social assistance industry as a share of real GDP in Canada since 1992, as can be seen in Chart 2. This decline has largely been driven by a decrease in the real GDP of hospitals as a share of total economy real GDP. Between 1984 and 2006 hospitals' share of total Canadian real GDP decreased by 0.98 percentage points while other health care services (excluding hospitals) and social assistance only experienced a decrease of 0.28 percentage points.

In contrast to the relatively slower growth of real GDP in the health care and social assistance industry compared to the total Canadian economy, nominal GDP in the health care and social assistance industry has been growing, on average, somewhat faster than total economy nominal GDP. The health care and social assistance industry's nominal GDP has been growing at 5.80 per cent per annum compared to 5.27 per cent per annum for the total economy between 1984 and 2003 (Table 2, Chart 3).[11]

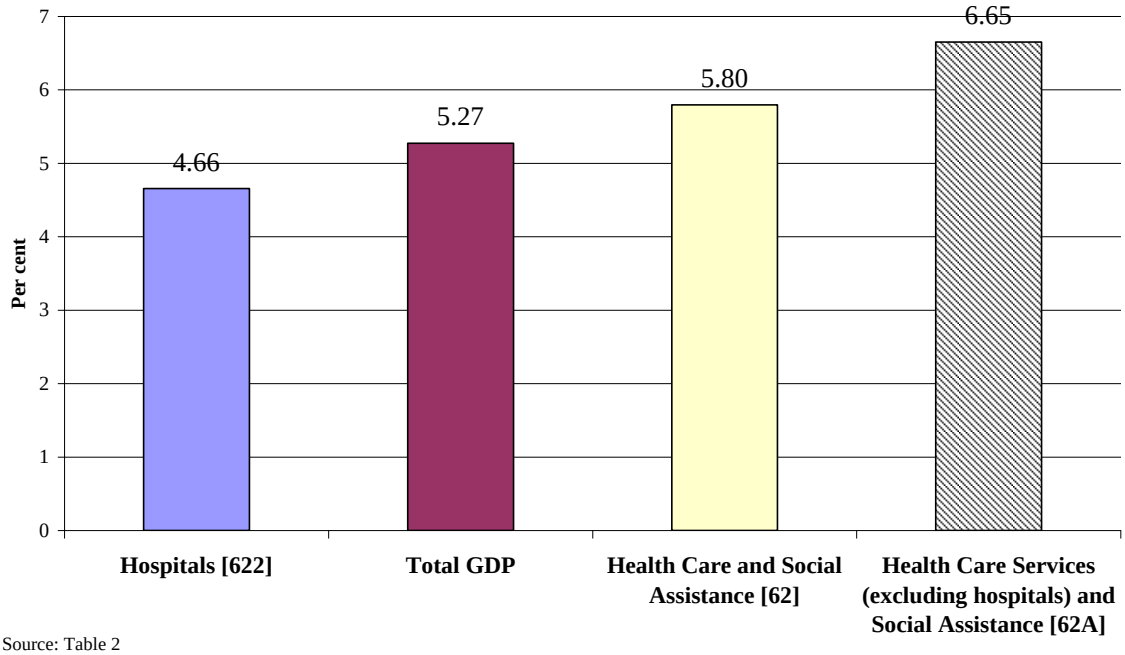
[11] Unfortunately, current dollar output estimates by industry are only available to 2003.

Chart 2: Health Care and Social Assistance Real GDP as Shares of Total Economy Real GDP in Canada, 1997 dollars, 1984-2006



Source: Table 1

Chart 3: Nominal GDP in the Health Care and Social Assistance Industry in Canada, 1984-2003 (average annual growth rates)

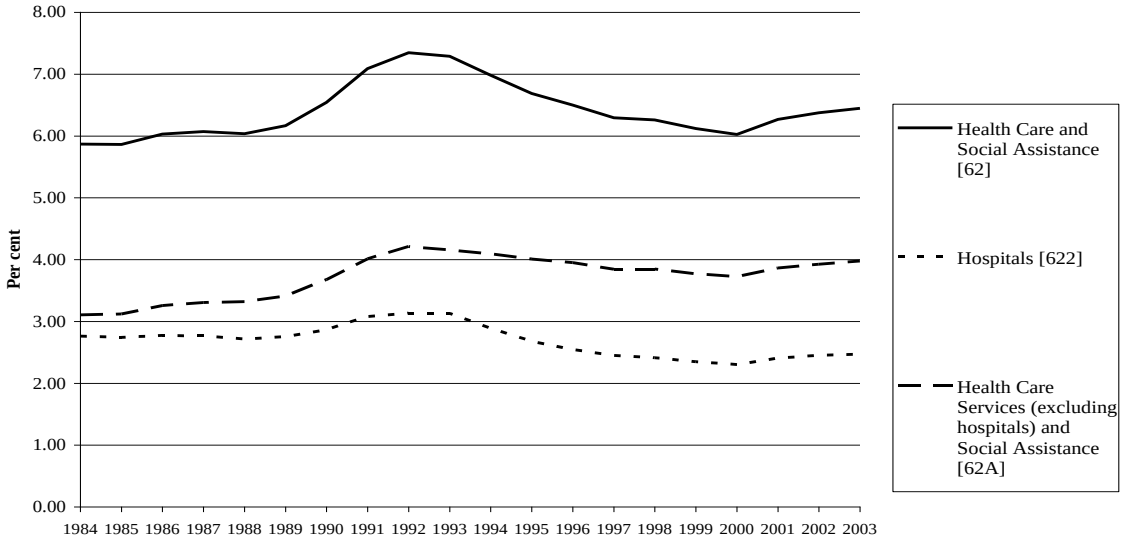


Source: Table 2

The relatively higher levels of growth in nominal output imply that the health care and social assistance industry has become relatively more important in terms of shares of total Canadian economy nominal output. Health care and social assistance industry nominal output has increased as a proportion of total economy nominal output from 5.87 per cent in 1984 to 6.45 per cent in 2003 (Table 2, Chart 4). The nominal GDP of hospitals as a share of total economy nominal GDP fell over this period by 0.29 percentage points while health care services (excluding hospitals) and social assistance showed an increase of 0.87 percentage points in their share of total economy nominal GDP.

From 1992-2000, the nominal GDP data shows the same downward trend as the real GDP data, although less pronounced. There has been a steady decline in the relative importance of the industry in nominal terms in Canada since the early 1990s. However, in the 2000-2003 period, nominal GDP shows an upward trend which is not seen in the real GDP data. The difference between the real GDP data and the nominal GDP data is explained by increasing prices in the health care industry, the effect of which has been removed from the real GDP data.

Chart 4: Health Care and Social Assistance Nominal Output as Shares of Total Economy Nominal Output in Canada, 1984-2003

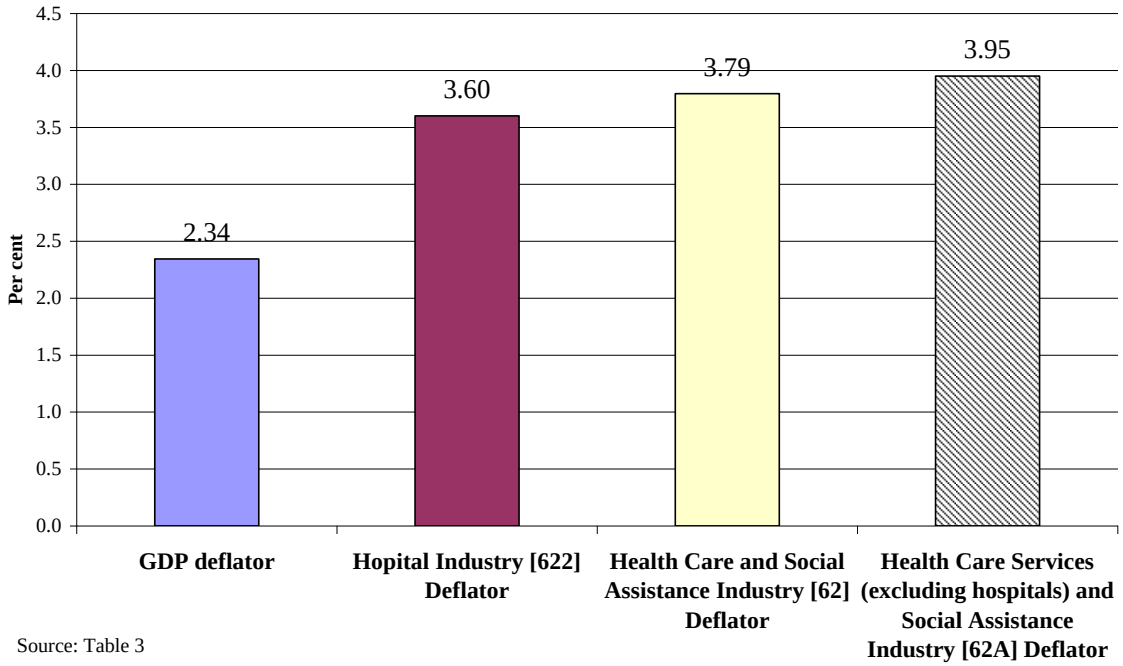


Source: Table 2

Prices for the health care and social assistance industry have been increasing faster, on average, than prices in the Canadian economy. Prices in the health care and social assistance industry increased at an average rate of 3.79 per cent per annum compared to 2.34 per cent per annum for the total economy between 1984 and 2003 (Table 3, Chart 5). Prices of health care services (excluding hospitals) and social assistance output increased at an average rate of 3.95 per cent per annum. Prices of hospital output increased somewhat slower, on average, at 3.60 per cent per annum. Whether or not these relatively higher levels of inflation in the health care sector are due to higher prices or higher quality of care is an important issue. Recent studies indicate

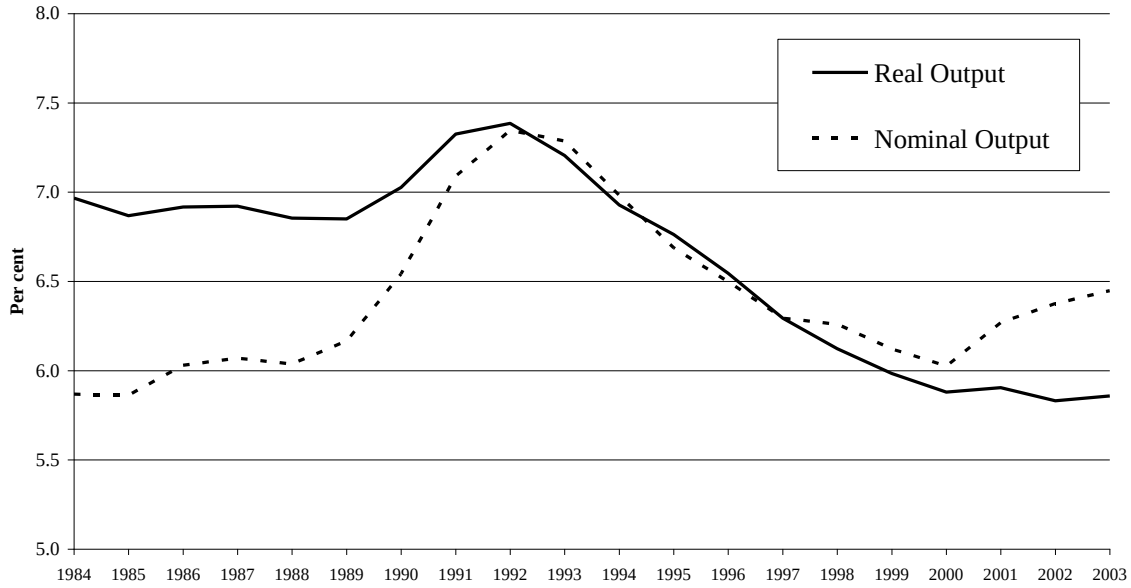
that price indices for the health care sector in both Canada and the United States often do not differentiate between true price increases and improvements in efficacy and quality, resulting in overestimates of the true price of health care (Triplett, 2001).

Chart 5: Implicit Deflators for the Health Care and Social Assistance Industry in Canada, 1984-2003 (average annual growth rates)



Source: Table 3

Chart 6: Real and Nominal GDP of the Health Care and Social Assistance Industry in Canada as a Percentage of Total GDP, 1984-2003



Source: Tables 1 and 2

Chart 6 shows the real output and nominal output for the health care and social assistance industry for the period 1984-2003. This chart reflects trends in the relative implicit price of health care services. Since health care services have become relatively more expensive over this period, nominal value added is increasing faster than real value added. It is important to note that the relative prices implied by Chart 6 are implicit price indices. They are measured by deflating nominal GDP for the health care sector by the constant price or real value of GDP. Prices can also be measured directly, but as mentioned previously, there are often no market transactions in the health care sector to observe prices.

2. Employment

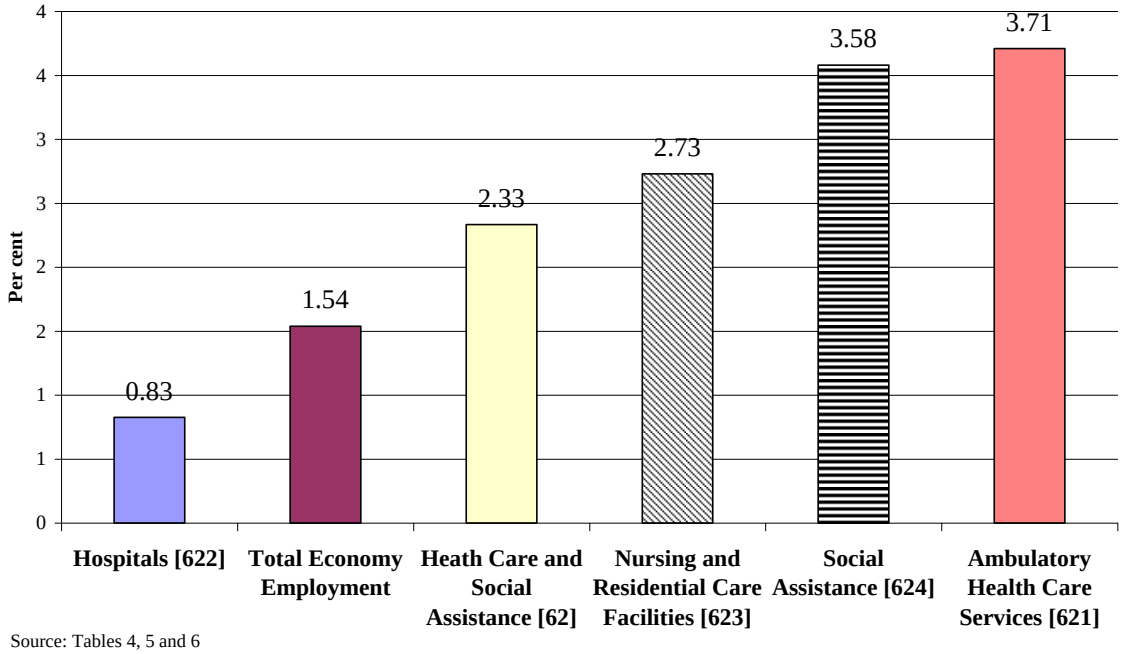
In order to obtain a measure of labour productivity, accurate measures of labour input are required. Labour input can be measured either as hours worked or number of workers. Since average hours worked per worker has remained relatively stable over the 1987-2006 period, labour productivity estimates will be similar when either hours worked or employment is used as the labour input.[12] This report will use data on the number of workers as a measure of labour input. There is no reason to doubt the accuracy of official estimates of employment in the health care sector as this information is accurately recorded. According to the Labour Force Survey, employment in the health care and social assistance industry is increasing, on average, faster than total economy employment. From 1987 to 2006 the health care and social assistance industry recorded a 2.33 per cent average growth rate per annum in employment while total economy employment grew at 1.54 per cent per annum (Table 4, Chart 7). The growth in employment is largely due to ambulatory health care services which saw employment growth of 3.71 per cent per year, and social assistance which saw employment growth of 3.58 per cent annually. In comparison, hospitals grew much slower, on average, at 0.83 per cent per annually.

As a share of total economy employment, the health care and social assistance industry has increased from 9.34 per cent to 10.83 per cent between 1987 and 2006. This increase is driven by health care services (excluding hospitals) and other social assistance whose share of total employment increased by 2.04 percentage points between 1987 and 2006.

Of the four main industries in the health care and social assistance industry, the employment shares of ambulatory health care services, and social assistance increased the most by 0.82 percentage points and 0.84 percentage points, respectively, between 1987 and 2006 (Tables 5 and 6, Chart 8). Nursing and residential care facilities increased by 0.37 percentage points over the same period, while hospital employment as a share of total employment over this same period decreased by 0.55 percentage points.

[12] In 1987, the average hours worked per week per worker in the health care and social assistance industry was 30.4 hours, the same as in 2003. By 2006 this estimate had increased by only 0.03 percentage points.

Chart 7: Employment in the Health Care and Social Assistance Industry in Canada, 1987-2006 (average annual growth rates)



Source: Tables 4, 5 and 6

Within the ambulatory health care services sub-industry, medical and diagnostic laboratories showed the lowest average annual employment growth rate, 0.06 per cent, while other ambulatory health care services, such as ambulance services, blood and organ banks, and blood pressure screening services showed the highest average annual employment growth rate at 6.58 per cent (Table 5). In the social assistance sub-industry, vocational rehabilitation services showed the lowest average annual employment growth rate, 1.04 per cent, while emergency services showed the highest average annual employment growth rate at 7.28 per cent.

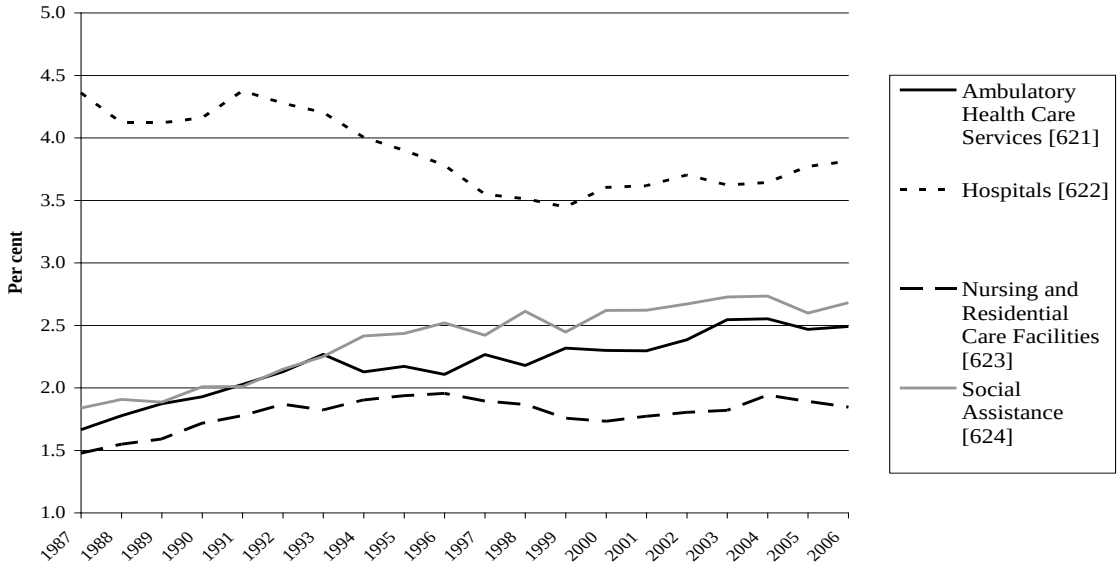
Data on employment are also divided between the business sector and the non-business sector.[13] Employment in the business sector component of the health care and social assistance industry represented 37 per cent of the industry's total employment in 2005 (Table 9). Employment in the business sector of the health care and social assistance industry grew at an average rate of 1.46 per cent annually, while employment in the non-business sector grew by 1.57 per cent annually over the 1997-2005 period.[14] Consequently, there has been no significant change in the relative importance of the business and non-business sectors in terms of employment.[15]

[13] The non-business sector consists of economic agents who are involved in the production of goods and services that are not intended to be sold at a price calculated to cover the production costs. This sector includes non-profit enterprises, public and para-public institutions, religious and welfare organizations. The business sector represents all other economic activities.

[14] Employment data divided by business and non-business sector is only available from 1997 up to 2005.

[15] Nominal compensation per job in the business sector of the health care and social assistance industry was 77 per cent of the nominal health care and social assistance industry average in 2005 (Table 10). This is

Chart 8: Health Care and Social Assistance Employment as Shares of Total Economy Employment in Canada, 1987-2006



Source: Tables 4, 5, and 6

3. Productivity

Productivity measures are a useful summary statistic for policy-makers in the health care sector. Estimates of productivity can identify ways in which resources can be allocated more efficiently as well as enable monitoring of activities in the health care sector. The following section will first describe trends in productivity estimates that are based on official employment and output figures published by Statistics Canada. Then this section will provide the limited official productivity estimates published by Statistics Canada.

i. CSLS Productivity Estimates[16]

Productivity, measured as real GDP per worker, in the health care and social assistance industry over the 1987-2006 period fell, on average, by 0.69 per cent per year (Table 7, Chart 9).[17] Total real GDP per worker in Canada increased by 1.14 per cent per

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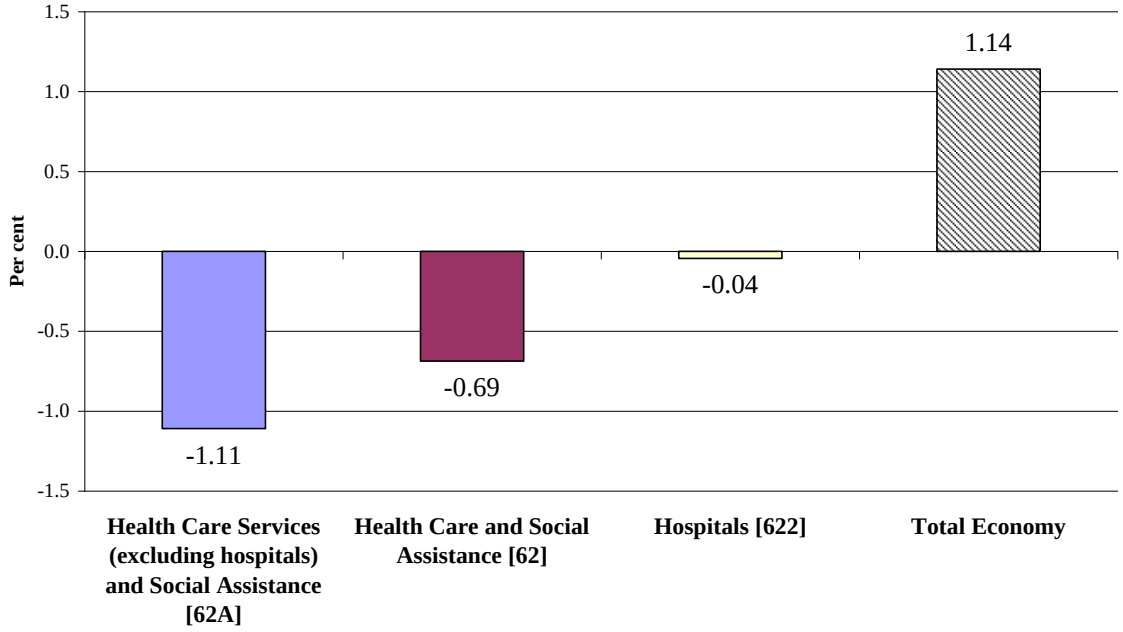
likely due to the high number of day-care workers in the business sector included in the social assistance industry who receive below average wages. Nominal compensation per job for the non-business sector of the health care and social assistance industry was much higher, 114 per cent of the health care and social assistance industry average for that same year. This is likely due to the high wages received by highly specialized health care workers such as physicians and specialists. Total compensation for all jobs in the health care and social assistance industry grew at an average annual rate of 5.86 per cent between 1997 and 2005, nearly 0.5 percentage points faster per year than the compensation for all industries (Table 11). In 2005, 71 per cent of total compensation for all jobs in the health care and social assistance industry was allocated to the non-business sector.

[16] Based on official Statistics Canada employment estimates from the Labour Force Survey and real GDP estimates from the National Accounts.

[17] Real GDP per hour is a better measure of productivity. However, the productivity trends do not change when hours worked is used as the labour input in the productivity calculation. Real GDP per hour for all

year over that same period. Within the health care and social assistance industry, hospital productivity decreased by 0.04 per cent per year while the productivity of health care services (excluding hospitals) and social assistance fell, on average, by 1.11 per cent per year. Over the entire period, from 1987-2006, the health care and social assistance industry recorded a decrease in productivity of 12.3 per cent while the Canadian economy recorded an increase in productivity of 24.1 per cent.

Chart 9: Real GDP per Worker in the Health Care and Social Assistance Industry in Canada, 1987-2006 (average annual growth rates)



Source: Table 7

Based on the official Statistics Canada data on employment and value added in the health care sector in Canada, productivity (measured as real GDP per worker) in the health care and social assistance industry as a share of the all industry average has fallen from 74 per cent in 1987 to 52 per cent in 2006 (Table 7, Chart 10). There is a similar fall in productivity for both hospitals, and health care services (excluding hospitals) and social assistance.

Nominal GDP per worker[18] in the health care and social assistance industry has increased slower, on average, per year than the national average in the period 1987-2003. The health care and social assistance industry grew at 2.9 per cent per annum while the

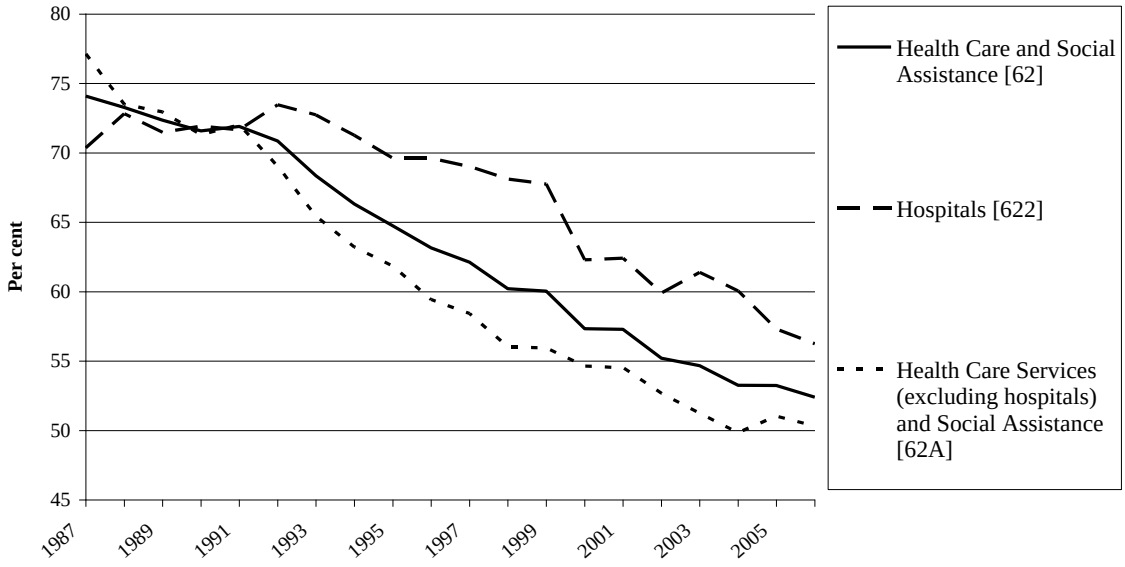
---

Canadian industries from 1987-2006 grew by 1.25 per cent per year. In that same period real GDP per hour in the health care and social assistance industry dropped by 0.73 per cent per year, hospital productivity dropped by 0.09 per cent per year and health services (excluding hospitals) and social assistance productivity dropped by 1.14 per cent per year.

[18] Nominal GDP per worker cannot be used to calculate productivity growth rates as productivity growth must be based on real or constant price output estimates. However, nominal GDP per worker can be used as a measure of the productivity level that reflects current relative prices.

national average grew at 3.4 per cent per annum (Table 8). Compared to real GDP per worker, nominal GDP per worker in the health care and social assistance sector is growing at a rate that is closer to the national average. However, nominal GDP per worker as a share of the national average has remained below 70 per cent for the period 1987-2003. This lower value added per worker, in both real and nominal terms, could be due to the low capital intensive nature of the health care and social assistance industry compared to the average Canadian industry.

Chart 10: Real GDP per Worker in the Health Care and Social Assistance Industry as a Percentage of the All Industry Average in Canada, 1987-2006



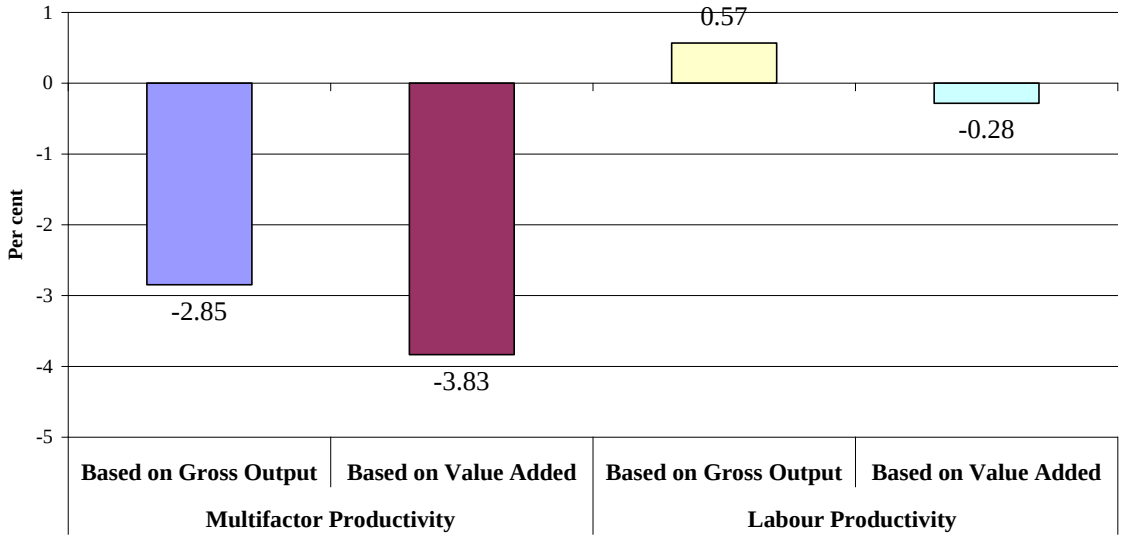
Source: Table 7

ii. Official Productivity Estimates Produced by Statistics Canada

The Statistics Canada website provides official estimates by industry for output (gross, value added), inputs (hours worked, capital, intermediate inputs) and productivity (labour productivity based on both gross output and value added; multifactor productivity based on both gross output and value added) for the 1994-2003 period. Unfortunately, these official estimates are only provided for the business sector of the health care services (excluding hospitals) and social assistance industries. Labour productivity based on gross output increased at an average annual rate of 0.57 per cent from 1994 to 2003 (Table 12, Chart 11). In this same period, multifactor productivity based on gross output fell, on average, 2.85 per cent per year. Both measures of productivity based on value added show negative growth rates between 1994 and 2003 - labour productivity fell 0.23 per cent annually while multifactor productivity fell 3.83 per cent annually.[19]

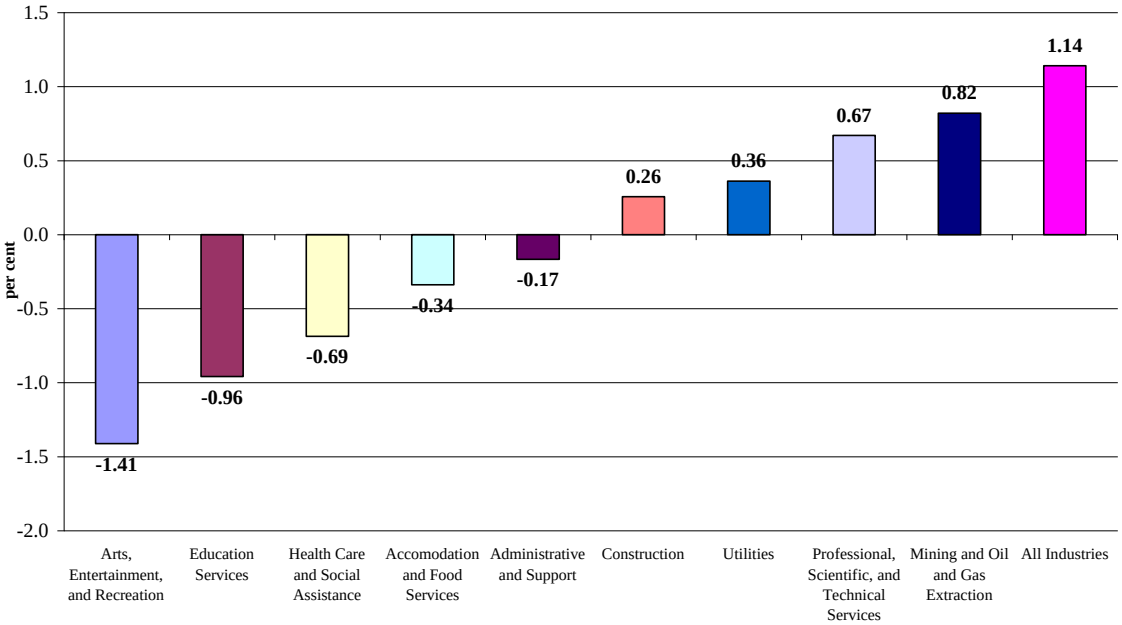
[19] CSLS estimates of labour productivity, measures as real GDP per worker, based on official measures of output and employment show an average annual growth rate of -1.17 for the 1994-2003 period for the

Chart 11: Official Statistics Canada Estimates of Multifactor and Labour Productivity for the Business Sector of the Health Care (excluding hospitals) and Social Assistance Industry in Canada, 1994-2003 (average annual growth rates)



Source: Table 12

Chart 12: Real GDP per Worker of Industries with Lowest Growth Rates in Canada, 1987-2006 (average annual growth rates)



Source: CSLS Productivity database, http://www.csls.ca/data/ptabln.asp.
Note: Among the 18 industries at the 2-digit NAICS level, includes all industries with below average growth rates over the 1987-2006 period.

health care services (excluding hospitals) and social assistance industry, much larger in absolute terms than the official estimate.

There are various reasons why the productivity measures produced by Statistics Canada, and those based on official estimates of output and employment may not be meaningful. First, there is a lack of consensus on what constitutes the output of the health care sector. Second, the Canadian health care sector is, for the most part, non-marketed, so prices and nominal outputs independent of inputs can not be observed. Third, medical advances have improved the quality of health care yet the current price indices fail to capture these improvements.

Based on current official employment and output estimates, the health care and social assistance industry has the third lowest productivity growth rate among all NAICS industries at the 2-digit NAICS level in Canada (Chart 12). Given that the methodology used to gather the data is unclear, it can not be determined whether the falling productivity in the Canadian health care sector is a statistical artefact of the data or a real phenomenon.

III. Health Outcomes

Health outcomes are indicators of the overall health and well-being of the population. This section will first overview the data available on health outcomes for Canada and briefly discuss the relationship between health care sector output and health outcomes of the population. Then this section will discuss Canadian health outcomes that are relevant indicators of the health care sector performance, and compare these indicators to those of other OECD countries.

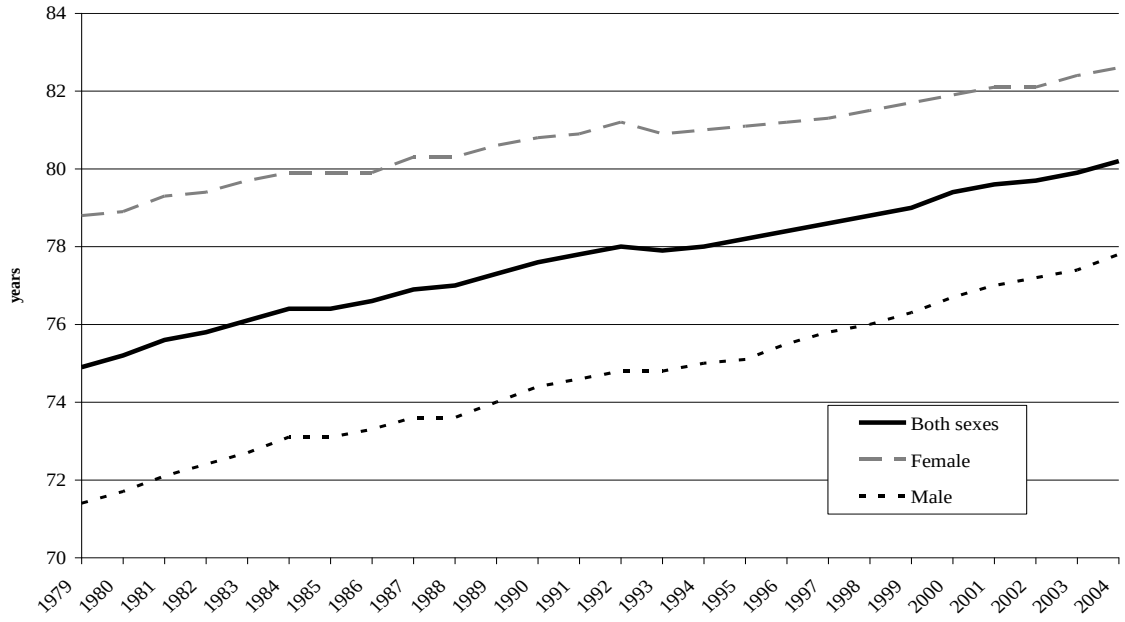
A. Canadian Health Indicators

There are numerous indicators that can be used as a measure of the overall health of the population.[20] Life expectancy is the most commonly used positive health indicator. Other examples of positive health indicators are self-rated health (% excellent or very good), and the physical activity index (% active). Examples of negative health indicators are diabetes prevalence (% yes), asthma prevalence (% yes), depression (% with probable depression), and obesity (% Body Mass Index 30.0 or greater).

Life expectancy is recorded at birth and at age 65 by Statistics Canada. Since 1979, the life expectancy at birth of the average Canadian has increased by more than five years from 74.9 years to 80.2 years in 2004 (Table 21, Chart 13). Females have seen an increase in life expectancy at birth of 3.8 years over the 1979-2004 period while males haves seen an increase of 6.8 years over that same period.

[20] The 2002 Report of the Auditor General of Canada concluded that Statistics Canada provides quality health indicators that measure the health status and health outcomes of the population at the national level due to sound application of a quality assurance system. The Canadian Health Measures Survey (CHMS) was developed to address gaps in the data on health status of Canadians. The CHMS collects direct measures of health and wellness from a sample of 5,000 Canadians aged six to 79 years old. CHMS data should be available in 2010 and will enable the establishment of more detailed national data on a variety of health indicators (Statistics Canada, 2007).

Chart 13: Life Expectancy at Birth in Canada, 1979-2004



Source: Table 21

More comprehensive measures of life expectancy are the Disability-Free Life Expectancy (DFLE), the Disability-Adjusted Life Expectancy (DALE), and the Health-Adjusted Life Expectancy (HALE).[21] These indicators introduce concepts of quality of life into measures of life expectancy as they integrate data on mortality, long-term institutionalization and activity limitations.[22] In 1996, the DALE was 74.5 years at birth while life expectancy was 78.4 years at birth for both sexes. In contrast, the DFLE was 68.6 years in 1996 for both sexes. In 2001, the HALE for males was 68.3 years compared to a life expectancy of 76.9 years. The HALE for females was 70.8 years compared to a life expectancy of 82 years. All of these quality-adjustment indicators result in a downward adjustment of life expectancy.

Summary Table 2 provides a list of indicators of health status divided into three categories: health conditions, human function, and well-being. Activity limitation measures the population who report being limited in selected activities (home, school, work and other) because of a physical condition, mental condition, or health problem which has lasted or is expected to last six months or longer. In 2005, 29.6 per cent of Canadians over the age of 12 recorded being limited in one of the selected activities (Table 20). Functional health (otherwise known as the Health Utility Index (HUI)) measures health on a scale between zero and one based on eight dimensions of functioning (vision, hearing, speech, mobility, dexterity, feelings, cognition and pain). A

[21] The DALE and the Disability-free life expectancy are only available for 1996 and the HALE is only available for 2001 from Statistics Canada, Vital Statistics, Death Database, Demography Division.
[22] The DALE and the HALE are conceptually the same in that they place weights on years based on quality of life. The DFLE is different in that it does not count years of life lived with a disability when the quality of life is below a certain threshold.

score between 0.8 and 1.0 is considered to be very good or perfect health. In 2005, 78.1 per cent of the Canadian population over 12 years of age was listed as being in very good or perfect health (Table 18). Two-week disability days records the number of persons who stayed in bed or cut down on normal activities because of illness or injury, on one or more days in the past two weeks. In 2005, 16.7 per cent of Canadians over twelve years of age recorded one or more two-week disability days (Table 19). In the period from 1994 to 2005 there was an increase in recorded activity limitations and two-week disability days. Additionally, the percentage of Canadians reporting moderate or severe functional health problems increased over that period.

Summary Table 2: Health Indicators

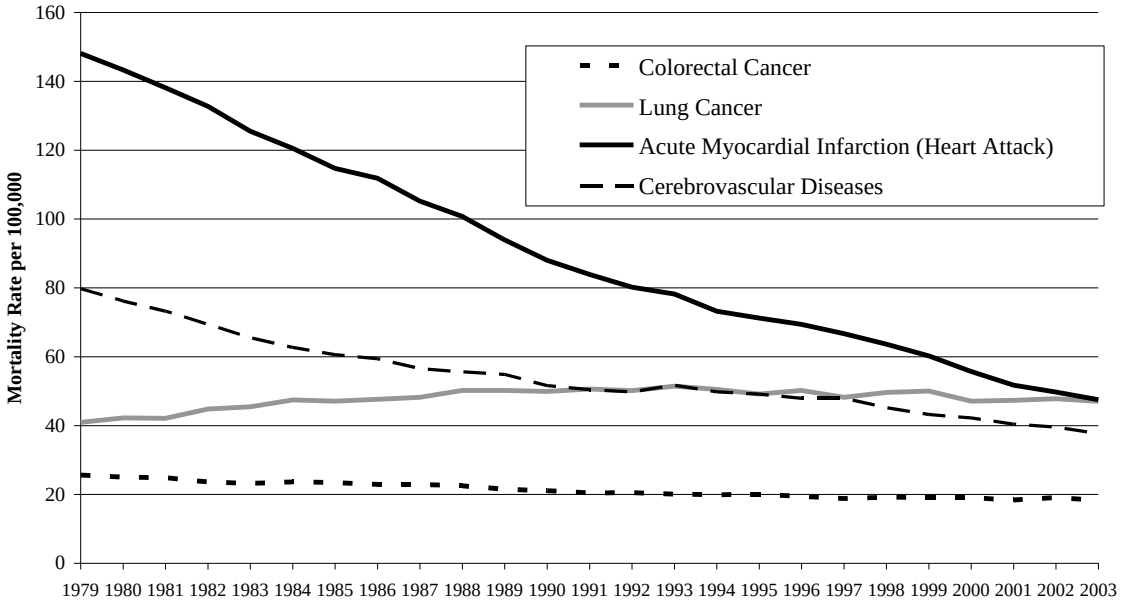
Health Status		
Health Conditions	**Human Function**	**Well-Being**
Body Mass Index (BMI)	Activity limitation	Self-rated health
Chronic conditions:	Functional health	
arthritis/rheumatism	Two-week disability days	
diabetes	Disability-Free Life Expectancy	
asthma		
high blood pressure		
chronic pain (affect on activities)		
depression		
Low birth weight		
Cancer incidence		
Injury hospitalization		
Injuries		
Food and waterborne diseases		

Source: CIHI, "The Health Indicators Project: The Next 5 Years. Report from the Second Consensus Conference on Population Health Indicators," (2005).

Health outcome data are also available at the level of specific conditions or diseases. Chart 14 shows the mortality rate by selected causes for Canada between 1979 and 2003. The mortality rate for Acute Myocardial Infractions (heart attacks) and Cerebrovascular diseases[23] dropped dramatically over this period, 68 per cent and 53 per cent respectively. The mortality rate for colorectal cancer decreased slightly over this period, while the mortality rate for lung cancer actually increased by 15 per cent over this period.

[23] Cerebrovascular disease is a cardiovascular disease that is sometimes used interchangeably with 'stroke', however it is technically somewhat broader.

Chart 14: Mortality Rate per 100,000 by Selected Causes in Canada, 1979-2003

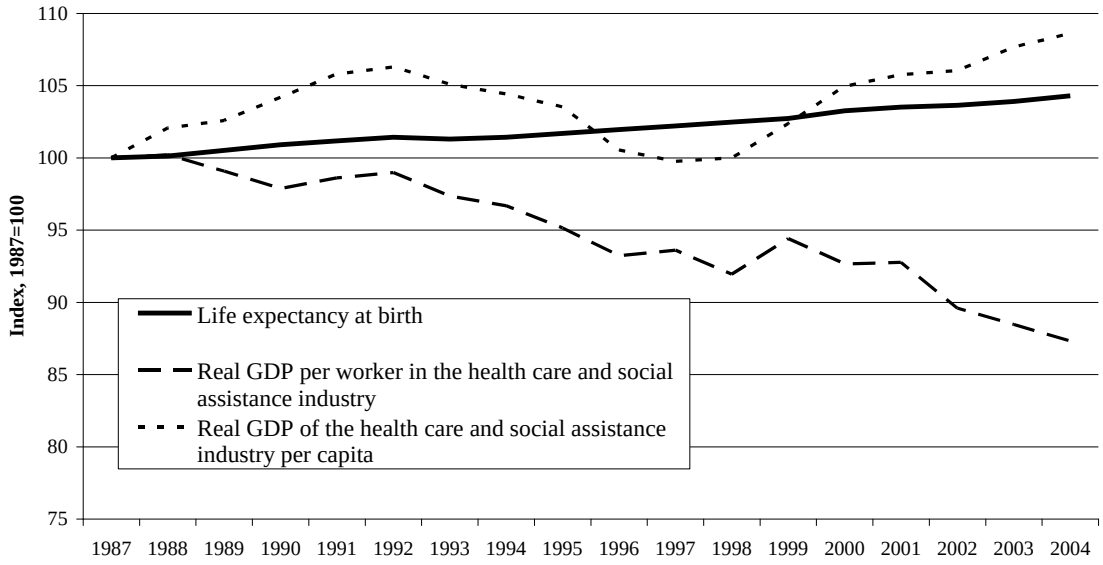


Source: Table 27

While health outcomes, such as life expectancy, have been rising, Chart 15 shows that estimates of productivity in the health care and social assistance industry based on official output and employment figures have been steadily declining. While the variables in Chart 15 are not directly comparable, it is interesting to see that current productivity estimates and health outcome trends are moving in opposite directions. Unfortunately, time series data on quality adjusted life expectancy are not available for Canada. Not all health outcomes are showing a positive upward trend similar to life expectancy at birth. Chart 16 shows examples of self-reported negative indicators of overall health for the period 1994-2005. The upward trend shown for all of these measures of health outcomes implies an overall decline in the health of Canadians since 1994. These indicators may not be robust estimates of the overall health of the population as they are based on self-report surveys.

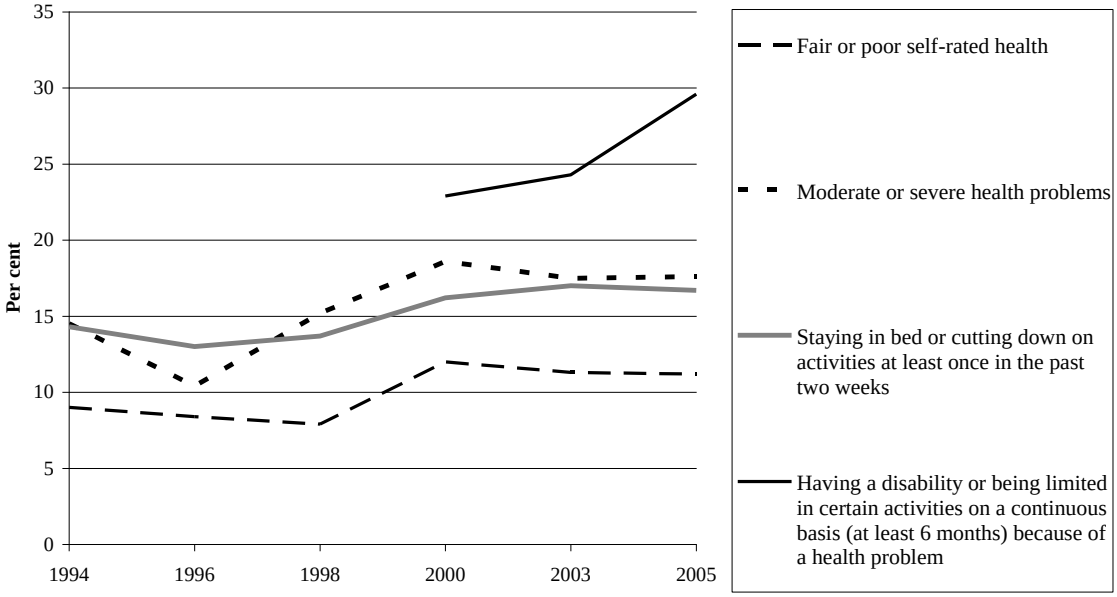
Measures of health outcomes on their own can not be used as a measure of health care output as there are numerous factors, in addition to health care or medical services, that contribute to the overall health of a population. These other factors include lifestyle, genetics, education and environment, among others. As Triplett (2001) points out, these other factors are likely to differ across countries and over time which further complicates aggregation and comparison of health outcomes. However, we should not disregard the importance of health outcome changes as a portion of them can surely be attributed to health care services. For example, it has been estimated that roughly 50 per cent of the life expectancy gains since 1950 can be attributed to advances in health care services (Cutler et al., 2006).

Chart 15: Health Outcomes, Health Productivity and Health Output per Capita in Canada, 1987-2004



Source: Tables 7 and 21

Chart 16: Health Outcomes in Canada, 1994-2005 (percentage of population who cited)



Source: Tables 17, 18, 19, and 20

Research by Lichtenberg (2007) estimated the impact of new drugs on life expectancy while controlling for other factors that affect life expectancy such as income, nutrition, the environment, and education. He found that there is a strong positive relationship between the launch of new drugs and the probability of survival between 1982 and 2001 using data from 52 countries (including Canada). Although the definition of the health care sector used by Statistic Canada, based on NAICS, does not include the pharmaceutical industry, Lichtenberg's results show that there is a tangible relationship between expenditures on health care and health outcomes.

B. Canadian Health Outcomes Compared to Other OECD Countries

While not all health outcomes can be attributed to health care services, health outcomes are often used to make international comparisons regarding the quality of health care services across countries. The OECD is currently creating a set of health care quality indicators (HCQI) for that purpose (Kelley and Hurst, 2006 and Garcia Armesto et al., 2007). Without using monetary values to weight health outcomes, these indicators of effectiveness of care can be used as gauges of health care quality. Each indicator has been chosen based on its importance in three areas: health impact (the indicator addresses an area where there is a gap between observed and potential health), policy importance (high cost is used as a proxy of policy importance), and the susceptibility to being influenced by the health care system (changes in the indicator will reflect changes in health care system policy). Additionally, each indicator is being adjusted to ensure that it is fit for international comparisons, this includes age standardization, harmonizing data periods and ensuring consistency of operational definitions across countries.

There are currently 19 indicators that have been deemed fit for international comparisons. Unfortunately, not all OECD countries record data for all 19 indicators for the same time periods. In 2007, the OECD published the indicators for the most recent year available for each member country.[24] The HCQI project is on-going and hopes to have comparable data for harmonized data periods by 2008. Summary Table 3 lists the data available for Canada and ranks Canada according to the most recent indicators available for other OECD countries, where a higher rank reflects better health care quality.

Canada ranks in the top half of all countries with data available for the majority of these indicators. Overall, Canada ranks 9th out of 22 countries for the 18 indicators where data are available for Canada. Canada fares particularly poorly in the in-hospital mortality rate within 30 days of hospital admission for stroke (ranked 17th out of 21) and the incidence of Hepatitis B (ranked 19th out of 22). Canada has a high cervical cancer screening rate (ranked 3rd out of 23) and one of the lowest smoking rates (ranked 4th out of 29). Unfortunately the OECD has not officially created rankings for the countries, nor created an aggregate index of health care quality. As the data becomes available for consistent time periods, more reliable international rankings can be made according to these indicators of health care quality.

[24] The earliest data included are indicators from 1995. The majority of indicators used by the HCQI project were recorded between 2000 and 2005.

Summary Table 3: Health Care Quality Indicators in Canada with International Comparisons

HCQI Indicator (most recent year data is available for Canada)	Value (Canada's rank/Number of OECD countries with data)
Breast cancer mortality per 100 000 women (2002)	23.7 (7/21)
Mammography screening rate (2005)	70.4 per cent (7/24)
Cervical cancer five-year survival rate (proxy used: Mortality per 100 000 women) (2002)	1.8 (5/21)
Cervical cancer screening rate (2005)	72.8 per cent (3/23)
Colorectal cancer five-year survival rate (proxy used: Mortality per 100 000 women) (2002)	18.4 (13/21)
Incidence of vaccine preventable diseases per 100 000 population (2004)	
Hepatitis B	2.7 (19/22)
Measles	0.03 (9/23)
Pertussis	8.79 (13/21)
Coverage of basic vaccination programme as a percentage of children up to their first birthday (Pertussis) and their second birthday (Measles) (2004)	
Hepatitis B	n/a
Measles	94.0 per cent (12/24)
Pertussis	74.0 per cent (12/24)
Asthma mortality rate, ages 5-39, per 100 000 population (2003)	0.20 (18/25)
In-hospital mortality rate within 30 days of hospital admission for acute myocardial infarction (AMI) (2004-2005)	9.3 per cent (12/23)
In-hospital hemorrhagic mortality rate within 30 days of hospital admission for stroke (2004-2005)	29.9 per cent (17/21)
Waiting times for surgery after hip fracture, over age 65 (measured as the percentage of femur fractures operated on within 48 hours of diagnosis) (2004-2005)	77.8 per cent (6/15)
Influenza vaccination, per cent of adults over age 65 who were offered the vaccine (2005)	66.5 per cent (8/23)
Smoking rate (2005)	17.3 per cent (4/29)
Retinal exams in diabetics (2005)	48.6 per cent (8/12)
Asthma admission rate per 10 000 discharges (2004-2005)	3.73 (5/17)*

*Note: As a consequence of insufficient primary treatment, asthma patients need to be hospitalized. A larger rate indicates a lower overall quality of health care.
Note: A higher ranking indicates higher health care quality.
Source: Garcia Armesto, Sandra., Maria Lapetra, Lihan Wei, Edward Kelley (2007) "Health Care Quality Indicators Project 2006 Data Collection Update Report," OECD Health Working Paper No. 29, October (Paris: OECD).

IV. Improved Measures of Health Care Output

There is a consensus that a more reliable measure of health output than one based on inputs is a measure that accounts for health outcomes. That is, the output of the health care sector should take into account the overall health of the population that can be attributed to health care services. More specifically, "if increased medical spending leads to health improvements worth more than their cost, then medical care productivity is increasing" (Cutler and Berndt, 2001:1). Productivity measures should be based on data that tell us whether a patient got better from a treatment rather than data which simply tell us that a patient received a treatment (Eggleston and Grossman, 2004). However, the data needed to measure productivity in terms of health improvements are not readily available in Canada due to a reliance on an input-based method of measuring health output. Additionally, productivity estimates will be dependent on how the output is valued; methods are: the cost of a treatment to the patient, the patient's willingness to pay for the treatment, or the actual production cost of the treatment.

This section will first briefly outline a utility based approach for obtaining a measure of the output of the health care sector. This is an unconventional method which indicates that increased utility from improved health status should be incorporated into valuations of health care sector output. Then this section will describe a production-based approach to quality adjust measures of health output for health outcomes. The *Atkinson Report* (2005) suggests three ways in which a production-based quality-adjustment can be made for the health care output: (i) differentiate services so that quality changes can be represented through structural changes within the aggregate; (ii) define the volume measure in terms of the degree of success; or (iii) introduce the contribution of health care activities to changes in health outcomes. The production-based approach attempts to construct better estimates of output and prices to reflect the true change in the cost of medical output, once adjusted for quality improvements. Most of the work in this area focuses on data at the disease/condition level. All of the approaches described in this section attempt to monetize the output of the health care sector so that output figures can be reported in the national accounts.

A. A Utility-Based Approach to Measuring Health Care Output

William Nordhaus of Yale University argues that current measures of health care output are "incomplete and misleading" (Nordhaus, 2003:5). He suggests valuing improvements in human health so that they can be incorporated into the national accounting framework. By weighting measures of health status with prices, the utility-based approach adjusts the value of real income for improvements in health status. This approach is based on the idea that people are better off when they live longer and, thus, puts a dollar value on additional life years. After appropriately valuing gains in health status, what he calls 'health income', improvements in health status are compared to health care expenditure.

The motivation for this type of approach is that current measures of output in the health care sector rely on measures such as days in hospitals or number of physician

visits, rather than measures of services delivered or changes in health status. In contrast to the production-based approach (discussed below) which relies on data indicating the impact of specific health treatments on health status, this approach relies solely on data regarding changes in longevity of the population and appropriate valuations for those changes. An obvious shortcoming of this approach is that there are numerous other factors that affect the life expectancy of the population. However, the estimates constructed by Nordhaus do indicate that health output estimates that do not account for health status improvements will significantly underestimate the value of health care sector output.

Nordhaus found that that the economic value of increases in longevity in the last 100 years is about as large as the value of measured growth in non-health goods and services. Over the 1900-1995 period, the value of improved health or health income grew at between 2.2 and 3.0 per cent per year in the United States, compared to only 2.1 per cent for consumption. Over the 1980-1990 period, the increase in expenditure on health care was one half the increase in the value of health income. Indeed, Nordhaus (2003:35) states that

> "The medical revolution over the last century appears to qualify, at least from an economic point of view, for Samuel Johnson's accolade as "the greatest benefit to mankind.""

Other research, by Cutler and Richardson (1998) advocates this type of approach, where a value is placed on the utility of health status. In their study, they estimated that the value of health of the American population increased by between $100,000 and $200,000 per person between 1970 and 1990. This increase was greater than the increase in health care expenditures over that period, although they do acknowledge that other factors can affect health status in addition to health care. This type of measurement, they argue, should be incorporated into estimates of the value of the health care system. A critique of this approach is that similar adjustments are not made for other types of goods in the national accounts where the willingness to pay exceeds the price of the good.

B. Quality Adjusting Health Output using a Production Approach

1. Differentiating Services

Outputs can be quality-adjusted without the use of health outcomes by differentiating services to arrive at classifications of services that are homogeneous in nature. Quality changes in output can then be identified through changes in the proportions of services as some groups require more intensive treatments than others. In Canadian hospitals there is already a system in place that differentiates services into homogeneous groups called Case Mix Groups (CMGs), that could be used to quality-adjust measures of output in hospitals. It is unclear whether the official Statistic Canada figures on health care output make use of CMGs. Ariste and Yu (2007) developed a methodology to measure hospital output based on the number of episodes by CMGs.

CMGs are a patient classification system similar to the Diagnostic Related Groups (DRGs) used in the United States and the Australian National Diagnostic Related Groups (AN-DRGs). The Canadian Institute for Health Information (CIHI) manages the CMGs. The purpose of CMGs are to classify patients according to diagnosis into groups that require similar resource utilizations and that are clinically homogeneous. Patients are first grouped into one of 25 Major Clinical Categories (MCCs). MCCs are partitioned according to surgical categories, i.e. those patients who require procedures, and medical categories, i.e. those patients who do not require procedures.

By disaggregating diagnosed patients into groups that require homogeneous resource utilization and weighting them according to their costs, changes in the proportion of services capture a portion of the total quality change. This approach can quality-adjust for compositional changes within the aggregate but will not capture quality changes for individual treatments. For example, existence of better performing practitioners or medical devices will not show up in this type of measurement. Furthermore, there is a growing body of literature identifying significant variations in care across practitioners that do not correspond to differences in patient needs or outcomes (Fisher et al., 2003a,b). This evidence suggests that it may not be possible to differentiate health care services into homogeneous groups according to resource utilization based on diagnosis groups.

A second problem with this type of approach is that weighting groups by cost assumes that treatments with higher costs are of a higher quality. A quality improvement that arises when a lower cost treatment can provide equal or better results compared to a more expensive treatment will not be captured if a cost-weighted index is used. The *Atkinson Report* (2005) suggests that groups should be weighted by an indicator of the quality of the health outcome achieved due to medical intervention rather than cost. A third challenge with creating these groups based on diagnosis is that there are often co-morbidities, patients with more than one condition or disease being treated.

2. Quality Adjusting Health Care Output for Health Outcomes

There are two ways to adjust health care output for health outcomes suggested by the *Atkinson Report*: define quantity in terms of quality, or make incremental adjustments for health outcomes. The first approach would measure the output of the health care sector in terms of the number of diseases or conditions cured. This approach is problematic in practice when applied to the health care sector. First, the end result of a treatment can not be entirely attributed to health care services as there are numerous other factors that can enter into the success or failure of a treatment, such as pre-treatment health or co-morbidities. Second, the health care sector provides a diverse set of services, only some of which entail treatments for specific illnesses, diseases and conditions, and the definition of "success" would have to be extended to these diverse services.

Rather than attributing entire health outcomes to health care it is possible to make marginal adjustments to health output to reflect changes in health outcomes. The first step in this type of approach is micro-oriented, focusing on costs of treatment for specific

conditions or diseases. The next step aggregates total costs so that a measure of productivity for the health care sector can be estimated, and a figure of health output can be included in the national accounts (Eggleston and Grossman, 2004). The value of this approach is that the true cost or "price" of health outcomes attributed to health care services can be quantified.

Current literature suggest the use of a health indicator such as the quality adjusted life year (QALY), in order to estimate the value of a year of health. This is similar to the measure of Functional Health published by Statistics Canada. A QALY values the quality of one life year, given different symptoms or impairments, on a scale from 0 to 1, where 0 is death and 1 is perfect health. This measure is used to link health outcomes to health costs in three stages, namely, measure the population's health, attribute health to specific conditions, and measure health care costs by condition (Cutler, 2006). These three stages enable the creation of a model that links the benefits of treatment to the costs of treatment by condition. Any change in the QALY due to health care services and treatments can be used to calculate service and treatment costs per QALY. Additionally, the common metric allows for aggregation across conditions.

By decomposing health outcomes by condition it is possible to provide answers to questions concerning changing population health over time, productivity of the health care sector, cost-effectiveness of treatments and what factors contribute to improved health outcomes (Cutler et al., 2005). Additionally, this link between health care costs and outcomes enables evaluation of the efficiency of resource allocation in the health care sector. The effects of adjusting life years for quality has substantial effects on health care productivity measures. Cutler (2006) found that when life expectancy is quality adjusted, gains in productivity in the United States' health care sector between 1987 and 2000 are twice as large as the estimated gains in productivity when life expectancy is not quality adjusted.

One weakness of this approach is that there are various ways to measure quality of life, and the robustness of results will depend on which measure is used. It has been suggested that results obtained using different measures of quality of life should be compared and standard errors should be reported when using QALY data (Cutler et al., 2005). Another weakness of this approach is that most medical conditions can produce a range of symptoms and impairments that are more specific than either their presence or absence. Further, self-reported health data, which is often used in this approach, is problematic due to factors such as culture, individual health history, and future health expectations which are not homogeneous across populations (Cutler et al., 2005). Another consideration when implementing this approach to measuring health costs is the existence of unpredictable cost synergies of treatments due to co-morbidities (Cutler et al., 2005). This further complicates the disaggregation of diseases and conditions by symptoms and impairments.

This approach requires data on costs at the disease or condition level, and this type of data is not often recorded. In 2002, Health Canada published a report that estimated the economic burden of illnesses based on 1998 data. This report is highly

detailed, estimating both direct and indirect costs of 18 principal diagnostic categories. Direct costs are defined as the value of goods and services for which payment was made and resources used in providing health care. Indirect costs are defined as the value of economic output lost due to illness or injury. In 1998, cardiovascular diseases, mental disorders, and digestive diseases had the largest total direct costs of all the diagnostic categories. Cardiovascular diseases, musculoskeletal diseases, and cancer had the largest total costs of all the diagnostic categories. Unfortunately, Health Canada has not updated these estimates or provided a more recent report since 2002. This type of time series data that disaggregates costs at the disease level would be invaluable for constructing more reliable quality-adjusted measures of health output.

The discussion so far in this section has identified the challenges associated with measuring the value of the product of the health care sector, population health, attributed to health care services. This is only one of the difficulties encountered when trying to develop a price index for the health care sector. For example, Cutler et al. (2001) cite both the rapidly changing quality and nature of health goods and services over time, and the fact that consumers pay very little at the margin due to insurance as factors that cause health care price indices to be inaccurate. The Canadian health care CPI increased 4.6 per cent annually between 1949 and 2003, while the Canadian CPI increased 4.0 per cent annually (Ariste et al., 2006). Whether rising health care costs are due to rising prices or rising quality and hence quantity will have very different policy implications.

Cutler et al. (1996) found that the true price index of the treatment of heart attacks rose about 5.5 per cent per year more slowly than the official price index for heart attack treatment contained in the US CPI between 1983 and 1994. Shapiro and Wilcox (1996) found that a price index for cataract surgery that adjusts for realized reduced levels of hospital services rose 4.6 per cent per year more slowly than a CPI-like cataract surgery index between 1969 and 1993. Triplett (1999, 2001) also shows how the construction of disease-specific measures of health care inflation results in much smaller increases in measured health care inflation, and hence larger increases in the real quantity of health care services.

Ariste et al. (2006) estimate two types of price indices for heart attack treatment in Ontario for the period 1995 to 2002 following Cutler et al. (2001). The service price index (SPI) prices specific medical treatments without adjusting for health outcomes. The cost-of-living index (COLI) measures the outcome utility-adjusted cost of a specific medical treatment. They found that the SPI of the treatment of heart attacks increased annually while the COLI fell one per cent per year.

V. Aggregate Measures of the Health Care Sector

There is debate on whether or not the national accounts framework is an appropriate framework for aggregate health care output measurement since it involves monetizing health output and outcomes. One view is that the national accounts framework should be abandoned when measuring the health care sector because the nature of health care services are not adequately defined. Indeed, as the previous section

has identified, there are numerous ways to define and quality adjust the output of the health care sector. Furthermore, there are often no market transactions where prices can be observed. Current measures of output are valued at the cost of providing them. Moreover, there is no reason to believe that health care is provided up to the point where the marginal benefit or willingness to pay for a service is equal to the marginal cost of that service (Atkinson, 2005). This section will first examine aggregate measures of the health care sector that do not include prices. It will then provide a brief discussion of health satellite accounts, a type of health account that could supplement current measures of health output in the national accounts.

A. Non-Monetized Measures of the Health Care Sector

Without using prices, it is possible to construct an index of the performance of the health care sector. For example, an outcome measure of health, such as life expectancy, can be measured, weighted and aggregated but not monetized. The OECD's HCQI project, discussed previously, is an example of this approach. Without using monetary values to weight health outcomes, these indicators of health status can be used as gauges of health care quality. Alternatively, in the *World Health Report 2000*, the World Health Organization (WHO) ranked the health systems of their 191 member states based on five indicators of health system[25] goal attainment (based on 1997 data):

- overall level of population health measured as the Disability Adjusted Life Expectancy (DALE). Canada ranked 12th.

- health inequalities within the population measured using an index of the equality of child survival, children 5 years and under. Canada ranked 18th.

- overall level of health system responsiveness based on survey data. Key informants were asked to rank the health care system of countries on dignity, autonomy, confidentiality, prompt attention, quality of basic amenities, access to social support networks during care, and choice of care provider. Canada ranked 7th.

- distribution of responsiveness within the population based on survey data. An index was estimated to indicate the prevalence of disadvantaged groups (for example, women, the elderly or indigenous groups) with regards to responsiveness. Canada ranked 3rd, tied with 36 other countries.

- distribution of the health system's financial burden within the population measured as the share of income beyond subsistence that is spent on health (this includes taxes, out of pocket expenditures, and insurance). A country's rank will fall as the proportion of beyond subsistence income that is spent on health rises. Canada ranked 17th, tied with 2 other countries (Nauru and the Solomon Islands).

[25] The WHO defines the 'health system' as all activities whose primary objective is to promote, restore or maintain health. However, most of the data used in their analysis fit a narrower definition which includes preventative, curative, and palliative interventions.

These indicators were given weights (in order: 25%, 25%, 12.5%, 12.5% and 25%) to create an index of overall goal attainment. Canada ranked 7th out of the 191 countries in terms of overall goal attainment.[26] This indicator tells us that, relative to other countries, the overall health of Canadians is high, we have been meeting the expectations of patients and there is fairness in terms of personal contributions to health care.[27] However, this index does not reveal much about the effectiveness of the health care sector.

These five indicators of goal attainment were then used to create an index of overall health system performance, which relates the health system's attainment of goals to the level of health expenditure per capita in each country.[28] The methodology used by the WHO not only compares the indicators across countries, it also compares each country's health system to an estimate of the upper limit of performance that can be attained with the level of resources available in that country (Evans et al., 2001). However, this is a very broad ranking of health as it not only compares the ability of a health system to improve health, but also the fairness of financial contributions and how the system responds to patient's expectations. Canada had the 10th highest level of health care expenditure per capita (international dollars) and ranked 30th in terms of overall health system performance. The United Kingdom ranked 18th, Australia ranked 32nd and the United States ranked 37th. France was the top ranked country.

The WHO also provided a ranking of health system performance in regards to how efficiently health systems translate expenditure into health outcomes, measured as the DALE. The WHO acknowledges that there are numerous other factors, in addition to the health care system, that can account for changes in health outcomes. They assume that education is representative of these other factors, and therefore control only for education levels. Additionally, they control for the level of health that would be obtained in the absence of the health care system. This was estimated by looking at a cross-section of countries and the estimated level of health in the early 1900s (average year, 1908). This is based on the assumption that the health system was not fully functioning at that time, so levels of health could not be attributed to the health system. This methodology has been criticized for neglecting other potentially important variables, most notably, geographical factors that can affect health outcomes. In this performance indicator Canada ranked 35th. The United Kingdom ranked 18th, Australia ranked 37th and the United States ranked 72nd. Oman was the top ranked country.

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[26] The top six ranked countries for overall goal attainment were (in order starting with the first ranked country): Japan, Switzerland, Norway, Sweden, Luxembourg, and France.

[27] In 2006, the Conference Board of Canada (Hamilton, 2006) released a similar report that ranked the provinces in Canada according to health status, health outcomes, and health care utilization and performance using 70 health indicators. British Columbia and Alberta were the top performers, while Manitoba ranked 10th overall. They also compared Canada to 23 OECD countries and found that Canada ranked 11th.

[28] The 2000 WHO rankings of health systems has been criticized for the methodologies used to create the indices, failure to investigate links between inputs and outcomes, and use of extrapolation. In 2003, the WHO postponed the release of the Health System Performance (HSP) ranking as the methodologies used in 2000 were under review, and they have yet to release up to date rankings. The WHO maintains a website (http://www.who.int/health-systems-performance/) with the latest news on the progress of the HSP ranking.

The advantage of using an index, like the one constructed by the WHO, is that international comparisons can easily be made since the indicators are constructed in a consistent way across countries. A criticism of the national accounting framework is that international comparisons of health care output levels and output and productivity growth rates are not robust since the methodologies used by different countries for measuring output in the health care sector can be highly variable. However, obtaining accurate measures of productivity in the health care sector could have effects on measures of overall Canadian productivity due to the size of the public health sector in Canada. For example, after switching to direct output measures from input-based methods for all government output, the Netherlands found that GDP growth rates were lower, Italy found no change in GDP growth rates, while Australia and New Zealand found that GDP growth rates increased (Atkinson, 2005). Therefore, although it is difficult to monetize health care sector output, failing to provide accurate estimates of health care output will likely affect national estimates of output and productivity making international comparisons of those figures less reliable.

B. Satellite Health Account

In recognition of the difficulties encountered when incorporating the health care sector into the official national accounts, there has been a movement towards the construction of satellite health accounts. The purpose of this type of account is to encourage the development of health care data that could eventually be used in conventional national accounts. A satellite account for health would not replace the estimates of health care sector output in the national accounts, but exist alongside it. Satellite accounts make the use of complementary and alternative concepts so that there is extended coverage of costs and benefits that are of particular social concern.[29]

The Bureau of Economic Analysis (BEA) (2005) suggests the creation of a health (not health care) satellite account as a first step towards determining the causal relationship between health care and health. The structure of the health satellite account would include measures of all health inputs: medical care, time invested in own health, consumption of non-medical goods and services, research and development and environmental factors. Health outputs would be measured independently of health inputs and include the value of better health, and the additional income that a healthier person would generate. This type of satellite account would eventually facilitate the measure of productivity in the health care sector. A satellite account constructed exclusively for health care would need to clearly identify the boundaries of the health care sector.

VI. Conclusion

The Canadian health care sector is an increasingly important part of the Canadian economy, particularly in the context of an aging population. In 2006, Canadian expenditures in the health care sector accounted for 10.2 per cent of nominal GDP. According to official labour input and output estimates, labour productivity in the health

[29] In Europe, France and Spain have already implemented satellite health accounts. Numerous Latin American countries are also planning to adopt satellite health accounts (WHO, 2004).

care sector has been falling over the 1987-2006 period. This paper has provided an overview of trends for both output and productivity in the Canadian health care sector. In addition, alternative methodologies for measuring health care sector output and productivity were discussed. Research in Europe and the United States provides the motivation as well as a detailed framework for improving measures of health care output and productivity in Canada.

Key Highlights:

- Statistics Canada relies largely on an input-based approach to the measurement of health care output. Not surprisingly, estimated labour productivity based on official estimates of labour input and real GDP is close to zero.

- Life expectancy in Canada has risen by 5.3 years over the 1979-2004 period. Females have seen an increase in life expectancy at birth of 3.8 years over the 1979-2004 period while males have seen an increase of 6.8 years over that same period.

- The true contribution of the health care sector to the well-being of the Canadian population, estimated using health outcome indicators, is not being captured in current estimates of health care output and productivity.

- According to CSLS estimates of productivity based on official Statistics Canada estimates of employment and real GDP, labour productivity fell by 0.76 per cent per year between 1987 and 2003. The estimates are of questionable reliability and may seriously underestimate the true contribution of the health care sector to output and to the economic well-being of Canadians.

- Alternative approaches show that price indices for health care output may be overestimated and that quality improvements are therefore not captured by estimates of real health care output. More resources are needed to further investigate the alternative approaches discussed in this report and develop better output measures that adjust for outcomes directly related to health care spending.

- Better documentation of current procedures and methodologies used by Statistics Canada is needed to fully understand and accurately interpret the trends in the productivity data. This includes publishing data that are disaggregated by the business and non-business sector, data that excludes the social assistance industry, as well as data at the 4-digit NAICS level.

- The construction of a satellite health account, to exist alongside current national account estimates of the health care sector, would allow for extended exploration of output and productivity measurement concepts that could ultimately improve official productivity estimates for the health care sector.

Whether increased spending on health is due to higher prices or increasing quality and hence quantity will have very different policy implications for the evaluation of the effectiveness of health spending. Further, with current estimates of output in the health care and social assistance industry, it can not be determined whether the falling productivity in the health care sector is a real phenomenon or simply a statistical artefact of the data.

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Appendix I: Sources and Methodologies Used to Estimate Output in the Health Sector in the Canadian System of National Accounts[30]

This appendix provides a technical discussion of the sources and methodologies used by Statistics Canada to estimate output and prices in the health care sector in Canada. It also provides a discussion of how GDP projections are estimated.

A. Sources and Methods for Collecting Benchmark Estimates of Output and Prices in the Health Care Sector According to NAICS

The nominal output and value added (GDP) measures for the health sector in the SNA draw primarily on survey data from Health Statistics Division (STC), the Canadian Institute for Health Information (CIHI), administrative data files from Canada Revenue Agency (CRA)and Capital Stock estimates from STC. The price adjusted measures "real" output and GDP draw upon price measures from the consumer price and product price indices (STC). In some cases direct volume measures such as employment and number of patients treated are used to measure real output. Summary Table 1 provides an overview of the major data sources used in the estimation process.

The output of the health care sector in the Canadian economy is best articulated in the Input-Output Accounts. The Canadian Input-Output Accounts contain two matrices of approximately 300 industries and 700 commodities: (1) the "Make matrix" contains the value of output by industry for each of the goods and services they produce and (2) the "Use Matrix" contains values for the primary and intermediate inputs for each industry. The primary inputs measure the returns to labour and capital services which represent the value added or GDP of the industry. Within the Input-Output Accounting framework GDP by industry is equivalent to the Gross Output of the industry less the value of its purchases of intermediate inputs, which broadly fall into commodity categories of materials, energy use and services. There is also a "Final Demand Matrix" which links the production of goods and services of Canadian industries to consumer spending, investment (construction, machinery and equipment or inventories) and exports. The Input-Output Accounts (national and provincial) are produced annually within three years of the reference period and provide benchmark measures for the Canadian System of National Accounts, specifically the monthly GDP by Industry and the quarterly Income and Expenditure Accounts.

1. Offices of Physicians

This industry comprises establishments of licensed physicians primarily engaged in private or group practice of general medicine, specialized medicine or surgery. The industry includes clinics and medical centres that accommodate patients without appointments and often have extended hours of operation. This industry, however, excludes out-patient centres sometime referred to as clinics, as described in NAICS Code

[30] This section was written by Hans Messinger, former Director of the Industry Measures Division at Statistics Canada.

6211, which are included in "Miscellaneous Ambulatory Health Care Services", included in section 2.2.3. The main source of output data is collected and compiled by the Canadian Institute for Health Information (CIHI) "National Health Expenditure Trends" An estimate for physicians' laboratory services are transferred from this industry to Miscellaneous Ambulatory Health Care Services. In the absence of survey data the structure of intermediate input expenditures is based on historical patterns.

The value added (GDP) is based on administrative data from Canada Revenue Agency with wages and salaries derived from T-4 files plus Supplementary Labour Income estimated by Income by Statistics Canada, T-2 files for incorporated medical practices and T-1 files for unincorporated practices to estimate GDP where income ("Mixed Income") includes both a wage and a return to capital.

The constant price ("real") output this industry is derived from a payments-schedule-changes index for the revenue of physicians produced by the Canadian Institute of Health Information. The price indices (deflators) for the intermediate inputs come from Consumer and Producer Price index detail produced by Prices Division at Statistics Canada.

2. Office of Dentists

This industry includes establishments of licensed dentists practicing generalized, specialized or dental surgery, as well as licensed dentists who work in clinics and dental centres (NAICS code 6212). The main source of output data comes from the Canadian Institute for Health Information (CIHI) "National Health Expenditure Trends". In the absence of survey data the structure of intermediate input expenditures is based on historical patterns.

The value added or GDP is based on administrative data from Canada Revenue Agency with wages and salaries derived from T-4 files plus Supplementary Labour Income estimated by Income by Statistics Canada, T-2 files for incorporated dental practices and T-1 files for unincorporated practices to estimate GDP where income ("Mixed Income") includes both a wage and a return to capital. The constant price output for this industry uses the Consumer Price Index for dental care as a deflator. The price indices (deflators) for the intermediate inputs come from Consumer and Producer Price Index detail from Prices Division, Statistics Canada.

3. Miscellaneous Ambulatory Health Care Services

This industry grouping in the Input-Output Accounts captures the balance of ambulatory health care services other than those provided by licensed physicians and dentists as described in the previous 2 industry groups. The services include the following covering NAICS Codes 6213 to 6219:

i. Health practitioners: chiropractors, optometrists, psychologists, physiotherapists,

ii. Out-patient care centres: Mental and Substance abuse, Family Planning and Community Health,

iii. Medical and Diagnostic Laboratories

iv. Home Health Care Services

v. Ambulance Services

The output for the largest component of this industry (items 1 and 2) is based on special tabulations from the CIHI publication "National Health Expenditure Trends. The next largest components laboratory and ambulance services are estimated from taxation data. In the absence of survey data the structure of intermediate input expenditures is based on historical patterns. The value added or GDP is based in administrative data from Canada Revenue Agency with wages and salaries derived from T-4 files plus Supplementary Labour Income estimated by Income by Statistics Canada, T-2 files for incorporated practices and T-1 files for unincorporated practices to estimate GDP where income ("Mixed Income") includes both a wage and a return to capital. The main price deflator source for estimating constant price output is the Consumer Price Index for paramedical practitioners, laboratories and private duty nurses. Ambulance services are deflated using an index of average weekly earnings for non-institutional health care services. A price deflator for special care facilities is based on employment, on the assumption that operating expenses are proportional to employment. The price indices (deflators) for the intermediate come from Consumer and Producer Price index detail from Prices Division at Statistics Canada.

4. Hospitals

Canadian hospitals are predominantly in the public sector. Private hospitals account for slightly less than 10 per cent of the industry. In the Input-Output classification and NAICS Industry 222, hospitals are establishments primarily engaged in providing medical, diagnostic and treatment services and provide specialized accommodation services to in-patients. Many Canadian hospitals also provide ambulatory services (emergency clinics) and out-patient services. Hospitals employ a staff of physicians, nurses, other health professionals, technicians, managers, administrative and maintenance support. The nominal gross output of hospitals is determined by the value of the intermediate and primary inputs less direct hospital revenues.

Intermediate expenses include expenditures on hospital supplies, utilities (heat, water electricity, etc.), repairs and maintenance, and a variety of services such as laundry and food preparation. Primary inputs are composed of the wages, salaries and supplementary income of hospital staff and depreciation of buildings, medical and office machinery and equipment. In nominal terms, the value added/GDP estimate for hospitals is the value of primary inputs (labour and capital costs), which equal the gross output less the value of the intermediate inputs.

The Annual Hospital Survey, produced by the Canadian Institute for Health Information (CIHI) is the primary data source for measuring the nominal output and GDP for hospitals. These data are compiled in conjunction with other sources, such as T-4 taxation data, and capital stock surveys within Statistics Canada (Public Institutions, Income and Expenditure, and Investment and Capital Stock Divisions) to produce estimates of gross output and GDP for hospitals.

The measurement of constant price output of hospitals is based on the number of patients treated by type of treatment. Separate estimates are compiled for acute patients, chronic care patients, day surgery, and out-patient clinical visits. Each category has a different cost structure. The data is taken from the Annual Return of Health Care Facilities-Hospitals Survey which contains expense information by department that can be split for in-patients and out-patients. The measure of price change for hospitals is a weighted index of acute and chronic care treatments. The acute care price index is adjusted for resource intensity data provided by CIHI. This survey examines variations in costs for treating different medical conditions.

5. Nursing and Residential Care Facilities

This industry comprises business sector establishments primarily engaged in providing residential care that requires nursing, supervisory or other types of special care. These facilities produce both health and social services. The health component consists mainly of nursing services. The basic source data for measuring gross output is based on a survey on residential care facilities conducted by Health Statistics Division at Statistics Canada. Output for the industry is essentially revenues from households and government. The estimation of intermediate inputs also draws upon information from this survey, along with a variety of other data sources. Estimates of GDP for this industry again make use of the survey on residential care facilities plus administrative taxation data.

Constant price ("real") output for institutional care is a weighted price index that measures year-to-year price change by type of care at the provincial level. The type of care in each province can have up to 7 categories ranging from room and board only, to room and board with counselling and guidance to room and board with custodial care. The personal expenditure portion of residential care is deflated (price adjusted) with the Consumer Price Index for special care facilities.

B. Monthly Projections GDP by Industry for the Health Sector

The monthly GDP by industry projects constant price value added ("real" GDP) forward from the most recent benchmark from the Input-Output Accounts. Monthly estimates are available within 2 months of the reference period (e.g. GDP for January is published by the end of March). The monthly release dates for each year are announced in advance. In many of the service producing industries, including the health care sector, monthly projections are based on employment estimates. The health care sector in the

monthly GDP is described in 3 industry groupings: Ambulatory Health Care Services, Hospitals, and Nursing and Residential Care Facilities. Gross Domestic Product for the health care sector is concentrated in the non-business sector (62 per cent), mainly government. The business sector share (38 per cent) is mainly accounted for by the offices of physicians and dentists.

1. Ambulatory Health Care Services

This industry grouping encompasses physicians, dentists, and other health practitioner services of the Input-Output tables as described in the previous section. This industry in the initial NAICS year, 1997, represented nearly 2.3 per cent of total GDP and 36 per cent of the total health care and social assistance sector. Over 80 per cent of this industry is classified to the business sector. Month-to-month changes in GDP are determined by the number of employees in this industry taken from Monthly Earning, Hours and Employment Survey, Statistics Canada (Catalogue no. 72-002).

2. Hospitals

This industry in the initial conversion to NAICS accounted for 2.5 per cent of total GDP and 39 per cent of the health care and social assistance sector of the economy. Over 95 per cent of this industry is funded through the public sector. The output of hospitals in the monthly GDP is all attributed to the government sector. The monthly projector for GDP growth is measured by month-to-month changes in the number of hours worked by hospital employees as estimated in the System of National Accounts to estimate Productivity Growth in Canada, Annual, Statistics Canada, (Catalogue no.15-204).

3. Nursing and Residential Care Facilities

Nursing and Residential Care Facilities account for 0.9 per cent of GDP and 14 per cent of the health and social assistance sector. Over 70 per cent of the value added for this industry comes from establishments in the non-business sector, mainly government. Monthly GDP is projected by number of employees from Employment, Earnings and Hours Monthly, Statistics Canada (Catalogue no.72-002).

Appendix II: List of Tables