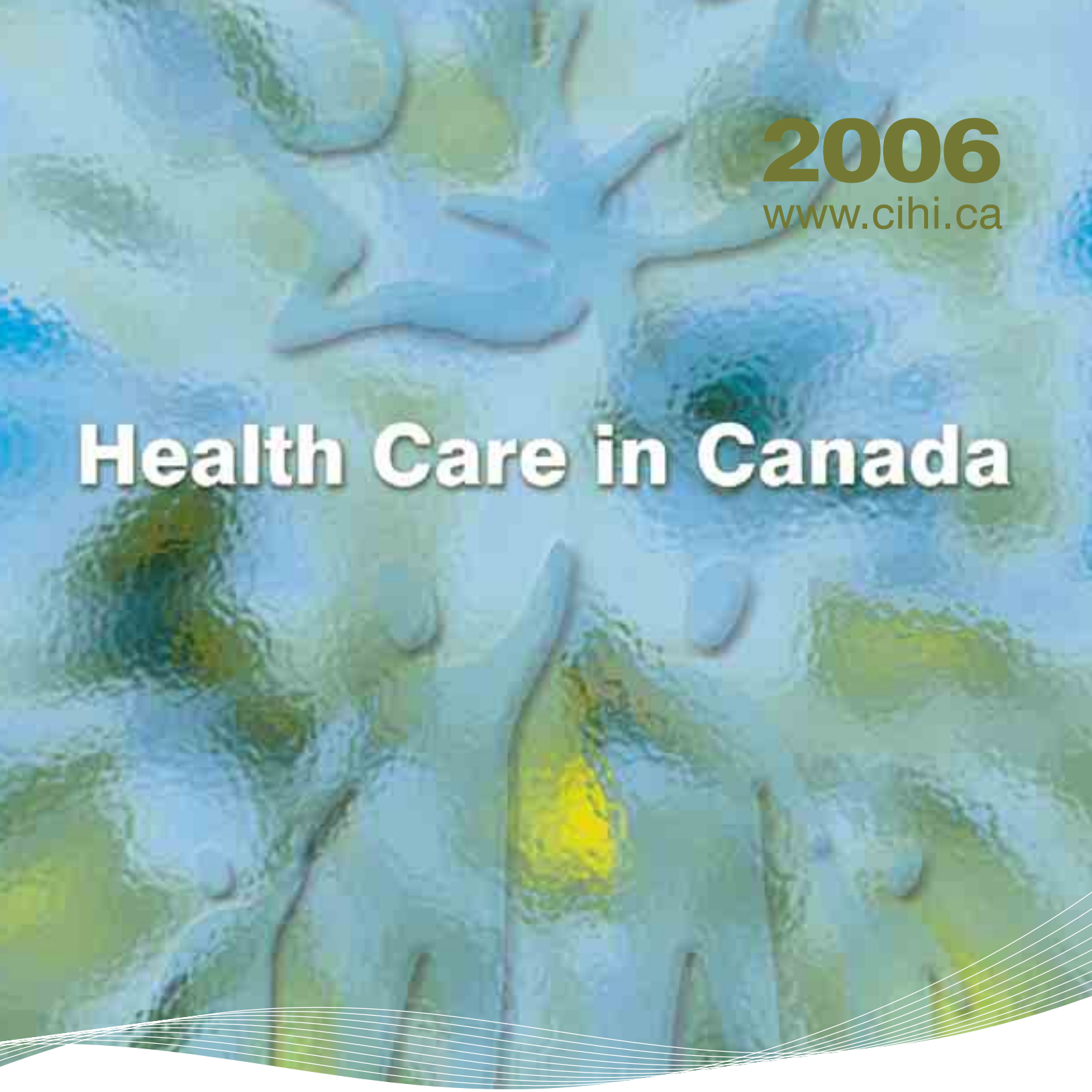


2006

www.cihi.ca

Health Care in Canada

Statistics Canada / Statistique Canada

Canadian Institute for Health Information

Institut canadien d'information sur la santé

Canadian Institute for Health Information
495 Richmond Road
Suite 600
Ottawa, Ontario K2A 4H6

Phone: (613) 241-7860
Fax: (613) 241-8120
www.cihi.ca

ISBN 1-55392-856-3 (PDF)

Cette publication est aussi disponible en français sous le titre *Les soins de santé au Canada 2006*
ISBN 1-55392-858-X (PDF)

2006

www.cihi.ca

Health Care in Canada

Dedication

This report is dedicated to Ian Button (1975–2006), Senior Analyst, Health Expenditures, Canadian Institute for Health Information and husband, son, brother, father-to-be, friend, colleague, athlete.

Contents

About the Canadian Institute for Health Information

The Canadian Institute for Health Information (CIHI) collects and analyzes information on health and health care in Canada and makes it publicly available. Canada's federal, provincial and territorial governments created CIHI as a not-for-profit, independent organization dedicated to forging a common approach to Canadian health information. CIHI's goal: to provide timely, accurate and comparable information. CIHI's data and reports inform health policies, support the effective delivery of health services and raise awareness among Canadians of the factors that contribute to good health.

For more information, visit our Web site, at www.cihi.ca.

As of April 1, 2006, the following individuals are members of CIHI's Board of Directors:

- Mr. Graham W. S. Scott, C.M., Q.C., (Chair), Managing Partner, McMillan Binch Mendelsohn LLP
- Ms. Glenda Yeates (ex officio), President and CEO, CIHI
- Dr. Penny Ballem, Deputy Minister, British Columbia Ministry of Health Services
- Dr. Peter Barrett, Physician and Faculty, University of Saskatchewan Medical School
- Ms. Jocelyne Dagenais, Assistant Deputy Minister of Strategic Planning, Evaluation and Information Management, ministère de la Santé et des Services sociaux, Quebec
- Ms. Roberta Ellis, Vice President, Prevention Division, Workers' Compensation Board of British Columbia
- Mr. Kevin Empey, Executive Vice President, Clinical Support and Corporate Services, University Health Network
- Dr. Ivan Fellegi, Chief Statistician of Canada, Statistics Canada
- Ms. Nora Kelly, Deputy Minister, New Brunswick Ministry of Health and Wellness
- Ms. Alice Kennedy, COO, Long Term Care, Eastern Health, Newfoundland and Labrador
- Dr. Richard Lessard, Director of Prevention and Public Health, Agence de développement de réseaux locaux de services de santé et de services sociaux de Montréal
- Mr. David Levine, President and Director General, Agence de la santé et des services sociaux de Montréal
- Mr. Malcolm Maxwell, CEO, Northern Health Authority
- Dr. Brian Postl, CEO, Winnipeg Regional Health Authority
- Mr. Morris Rosenberg, Deputy Minister, Health Canada
- Mr. Ron Sapsford, Deputy Minister, Ministry of Health and Long-Term Care, Ontario
- Ms. Sheila Weatherill, President and CEO, Capital Health Authority, Edmonton

About Statistics Canada

Statistics Canada is authorized under the *Statistics Act* to collect, compile, analyze, abstract and publish statistics related to the health and well-being of Canadians. The Health Statistics Division's primary objective is to provide statistical information and analyses about the health of the population, determinants of health and the scope and utilization of Canada's health care sector.

Acknowledgements

The Canadian Institute for Health Information (CIHI) would like to acknowledge and thank the many individuals and organizations that have contributed to the development of this report.

Particularly, we would like to thank the members of the Expert Advisory Group, who provided invaluable advice throughout the development process, including reviewing a draft of the report. Members include:

- Dr. David Alter, Scientist, Cardiovascular Research, Institute for Clinical Evaluative Sciences
- Dr. Jafna Cox, Director of Health Services and Outcomes Research, Queen Elizabeth II Health Sciences Centre
- Dr. Victor Dirnfeld, Past President, Canadian Medical Association and Past Chair, Medical Advisory Council, Vancouver Coastal Health Authority
- Dr. Gordon Gubitz, Neurologist, Queen Elizabeth II Health Sciences Centre
- Dr. Michael D. Hill, Associate Professor, Department of Clinical Neurosciences, University of Calgary
- Mr. John Malcom, Chief Executive Officer, Cape Breton District Health Authority
- Ms. Wendy Nicklin, President and CEO, Canadian Council on Health Services Accreditation
- Dr. Louise Pilote, Associate Professor of Medicine, McGill University
- Dr. Andreas Wielgosz, Professor of Medicine, Community Medicine and Epidemiology, University of Ottawa

It should be noted that the analyses and conclusions in this report do not necessarily reflect the opinions of individual members of the Expert Advisory Group or their affiliated organizations.

The core project team for *Health Care in Canada 2006* included:

- Jennifer Zelmer, Vice President and Editor
- Jack Bingham, Director and Editor
- Jacinth Tracey, Manager and Editor
- Jenny Lineker, Program Lead
- Maraki Merid, Analytic Lead
- Genevieve Martin, Chapter Lead
- Thi Ho, Chapter Lead
- Tina LeMay, Writer
- Chad Gyorfi-Dyke, Data Analyst
- Audrey Boruvka, Data Analyst
- Julia Gao, Data Analyst
- Sharon Gushue, Data Analyst
- Patricia Finlay, Writer and Editor
- Josh Fagbemi, Data Quality
- Alina Rivilis, Data Quality
- Michael Yabko, Project Assistant
- Sarita Patel, Project Assistant
- Mary Neill, Administrative Support
- Lynne Duncan, Administrative Support

Health Care in Canada 2006 could not have been completed without the generous support and assistance of many other CIHI staff. We would like to thank CIHI staff from the various data holdings, who compiled and validated the data, as well as individuals from Publications, Translation, Communications, Distribution Services and Web Content. A special thanks goes out to the members of the Health Indicators team at CIHI for their work in developing the indicators on which this report is based.

The project team responsible for the development of *Health Indicators 2006* included:

- Indra Pulcins, Manager
- Eugene Wen, Senior Methodologist
- Yana Gurevich, Project Lead
- Joan Porter, Project Lead
- Zeerak Chaudhary, Senior Analyst
- Kathy Nguyen, Senior Analyst
- Carolyn Sandoval, Senior Analyst
- Dragos Daniel Capon, Analyst
- Jeremy Herring, Analyst
- Sharon Relova, Analyst
- Natalia Lobach, Coordinator

Executive Summary

When Tim first felt his chest tightening, he decided to wait and see if the pain would go away. He continued working, as he needed to make his deadline. He didn't realize he was having a heart attack. Across town, John was experiencing similar symptoms. He remembered that these were signs of a heart attack and called 911 immediately. Tim's delay in accessing care resulted in greater damage to his heart muscle. John, on the other hand, made a full recovery.

A heart attack may seem sudden and unexpected. But often, the seeds of the problem were sown years, or even decades, earlier. Genetics, demographics, the physical and social environment, health behaviours and history, and other long-standing factors, may influence a person's chances of having and of surviving a heart attack. So, too, may the health care received before, during and after the event. The same is true for strokes.

Health Care in Canada 2006 focuses on what we know and don't know about how often Canadians die shortly after being admitted to hospital with a new heart attack or stroke. It also explores why some people are more at risk of dying than others. In some cases, links between different risk factors or types of care and patient outcomes are well understood; in others, our knowledge is still developing. The level of information available about the types of care that patients receive also differs. We tend to know more, for example, about care of a patient in the hospital than we do about what happens before admission or after discharge.

In addition to focusing on heart attack and stroke survival, this report aims to provide a glimpse into how our $142 billion health care system is organized, as well as the results it achieves for patients and communities. The companion *Health Indicators 2006* provides information on 23 key measures of health care outcomes for 71 larger health regions across Canada, representing 95% of Canada's population. This year's report includes, for the first time, information on regional trends in 30-day in-hospital mortality for patients admitted with a new heart attack or stroke. These and other indicators allow different areas of the country to compare their results and identify potential opportunities for learning and improvement.

New Findings for Canada—Mortality Rates

The good news is that heart attack survival is improving. Patients admitted with a new heart attack are less likely to die in hospital within 30 days than in the past. The death rate dropped from 13.4% in 1999–2000 to 11.1% in 2004–2005.† However, results continue to vary across the country. After differences in age, sex and other illnesses were accounted for, death rates in some larger regions (population of over 75,000) were more than double those in others. In the most recent three-year period (2002–2003 to 2004–2005), regional 30-day in-hospital mortality rates ranged from 7.6% to 16.3%. Of the 54 regions for which data are available, 11 had rates statistically significantly higher than the overall average. Five had lower rates.

Patients admitted to hospital with a new stroke are more likely to die than those with a new heart attack—18.8% died in hospital within 30 days in 2004–2005, a rate that was relatively stable over the preceding five years. Within this group, a patient's chances of dying depend on the type of stroke. Mortality rates for the subset of patients with a hemorrhagic stroke (a rupture of a blood vessel in the brain) have dropped—from 37.7% in 1999–2000 to 32.8% in 2004–2005. Most patients, however, have ischemic strokes (disruptions of blood flow to the brain). The 30-day in-hospital mortality rate for these patients has remained relatively stable in recent years, at 13%.

As for heart attacks, there are also regional variations in mortality following admission with a new stroke. For the latest three-year period (2002–2003 to 2004–2005), regional mortality rates ranged from 14.7% to 29.2%. Of the 57 regions for which data are available, 15 had rates statistically significantly higher than the overall average and 7 had lower rates.

Different Outcomes for Different Patients

To shed light on what might account for differences in the rates, we looked to see why some people were more likely to die shortly after admission with a new heart attack or stroke than others. The impact of many of the factors known to be associated with short-term mortality rates for heart attack and stroke—such as the underlying health of a population or the use of preventative measures—is difficult to measure. But we were able to explore a number of patient and provider characteristics.

We found that characteristics of individual patients—such as their age, sex and whether or not they have other serious illnesses (for example, kidney disease) along with their heart attack or stroke—can influence their chances of survival. For example, the chance of having a heart attack or stroke rises with age, as does the risk of dying after having had one. New analyses conducted for this report show that, after adjustment is made for sex and comorbid conditions, the chance that a person aged 50 to 64 admitted to hospital with a new heart attack will die in hospital within the next 30 days is more than two times higher than for younger patients. Risks are even higher for seniors. Age-related differences are not quite as large for patients who have strokes, but they are still important. The risk of dying is two times higher for those aged 65 to 74 and four times higher for

† Due to historical differences in data collection, trend data exclude Newfoundland and Labrador (heart attack rates only), Quebec and British Columbia. Results for B.C. are available for the most recent years and are included in the regional comparisons.

those aged 75 and older than for those under 50. Likewise, women admitted with a new heart attack or stroke were more likely to die in hospital within 30 days than men; this was true even after age and co-existing illnesses were taken into account.

Timely intervention, as well as appropriate care and support, are just some of the other factors that can have an impact on a patient's chances of survival following a heart attack or stroke. For example, previous studies have shown better cardiac outcomes for patients treated by specialists and in centres that treat more patients, are located in urban areas and have on-site facilities to perform revascularization (procedures used to restore blood flow to the heart). Often, these factors are linked. Urban hospitals tend to treat more patients, have on-site revascularization and have more specialists on staff.

CIHI analysis found that 36% of patients admitted with a new heart attack were mainly cared for by a cardiac specialist in 2004–2005. These patients were less likely to die in hospital within 30 days than those primarily cared for by other types of physicians. Likewise, the 26% of stroke patients who had a neurologist or neurosurgeon as their main attending physician also tended to have better outcomes. This remained true even after other patient and hospital characteristics (for example, the number of patients a facility cared for) were taken into account.

Monitoring Key Trends

In addition to detailed analyses of mortality for patients with heart attacks and strokes, *Health Care in Canada 2006* highlights broad trends in health expenditures. Findings include:

- Canada spent an estimated $142 billion on health care in 2005, or $4,411 per person. After inflation was taken into account, this was almost three times what was spent in 1975.
- Between 1975 and 2005, private-sector spending (inflation-adjusted) rose more quickly than public-sector spending: 4.4% versus 3.5% on average per year.
- Spending patterns have changed. For example, hospitals still account for the largest share of Canadian health expenditures, representing a record $42.4 billion in 2005. However, the relative of total health expenditures going to hospitals has declined—from 44.7% in 1975 to 29.9% in 2005—as spending in other parts of the health sector has risen more rapidly.

The report also provides an update on the health workforce, touching on issues from training through retirement. Findings include:

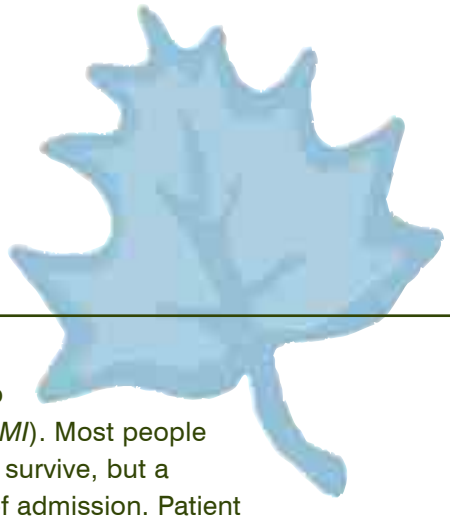
- Across the country, over 1.5 million people work in health and social services. That's about 1 in 10 employed Canadians. Nursing and medicine are the two largest health professions.

- The numbers and mix of students graduating from health professional training programs have changed over time. For example, there were more graduates from chiropractic, dental hygiene, occupational therapy, physiotherapy and medicine programs in 2004 than in 1993. In contrast, there were fewer graduates in dentistry, optometry and pharmacy.

- A larger proportion of physicians than nurses trained in other countries. In 2004, about 22% of Canada's physicians were educated abroad, compared to 7% of registered nurses and 2% of licensed practical nurses (2003 data).

- As in other areas that have long training requirements, workers in the health sector tend to be older than the workforce overall. The proportion aged 45 to 64 is also increasing more rapidly in health care than the general trend. Across all health occupations, the average age in 2003 was 41.6 years, a 6% increase from 1994.

Introduction



Each year, thousands of Canadians experience a stroke or a heart attack (also called an *acute myocardial infarction*, or *AMI*). Most people admitted to hospital with these conditions survive, but a significant number die within a few days of admission. Patient characteristics such as age and sex, and even whether or not patients have other illnesses, can contribute to outcomes. Recognizing the symptoms of a heart attack or stroke soon after it occurs can be crucial to survival. Research suggests that other factors linked to processes of care—such as whether or not patients are admitted to a high-volume hospital, whether they are transferred from one hospital to another or even the type of health service provider they see once they are admitted—can also have an impact on whether or not they survive their heart attack or stroke.

The good news is that, in recent years, a smaller proportion of people who experienced a new heart attack died shortly afterwards than in the past. For example, in 2004–2005, 11.1% of patients with an AMI died within 30 days of being admitted to hospital—down from 13.4% in 1999–2000. The short-term in-hospital mortality rate has also fallen for some, but not all, types of stroke. While the 30-day in-hospital mortality rate for patients with *ischemic* stroke (disruption in the blood flow inside the skull) remained relatively stable between 1999–2000 and 2004–2005 (at roughly 13.0%), the rate for those with *hemorrhagic* strokes, ruptures of a blood vessel inside the skull, dropped significantly from 37.7% to 32.8% over that same period. Rates for 30-day in-hospital AMI and stroke mortality vary, sometimes widely, across areas of the country and within individual provinces and territories.

Collecting information on 30-day in-hospital mortality rates not only provides information about outcomes of patient care and health system performance, but can also suggest opportunities for improvements in care. Since 2001, CIHI has been tracking 30-day in-hospital mortality rates for AMI; in 2002 we began to track rates for stroke as well. *Health Care in Canada 2006* highlights and builds on these two health indicators in order to shed light on how patient characteristics and processes of care relate to mortality rates. Understanding this relationship is more than an academic question. As we learn more about who is most likely to survive a heart attack or stroke and why, this information may help policy-makers and health professionals facing practical questions about the use and design of health care and health delivery systems. It may also inform individual Canadians who want to know more about the health care system and their chances of surviving a heart attack or stroke.

About This Report

CIHI's annual series of *Health Care in Canada* reports was launched in 2000. The aim of each report—produced in partnership with Statistics Canada—has been to increase our understanding of specific health issues and provide updated data and analyses about topics of ongoing relevance and importance. Every year, CIHI researchers consolidate the most current information available from across Canada and, where appropriate, compare these findings to those from other countries. This international perspective adds an important dimension to our knowledge of different health systems and the type of care they deliver.

Each report builds on previous information to ensure continuity and also highlights recent local, provincial/territorial, pan-Canadian and international data. The reports also reflect the feedback received from health professionals, health researchers, policy-makers and individual Canadians. This input helps CIHI in identifying new issues for review.

This year's *Health Care in Canada* report is divided into two sections:

Part A: *A Look Inside Canada's Health System* summarizes recent data on health spending and health human resources in Canada. In Chapter 1 we look at spending in general and by health category; Chapter 2 focuses on health care providers.

Part B: *Surviving a Heart Attack or a Stroke* is divided into four chapters that provide an in-depth look at 30-day in-hospital mortality rates for patients with heart attacks and strokes, as well as the factors that influence those rates. It also includes data on rehabilitation services.

The report also includes a companion document entitled *Health Indicators 2006*. This reference offers comparative data on a range of health and health system indicators for health regions with populations of 75,000 or more—which comprise more than 95% of Canada's total population—and for provinces and territories. More detailed data are available at www.cihi.ca/indicators or www.statcan.ca.

There's More on the Web!

The electronic version of this report can be found on our Web site, at www.cihi.ca. With the release of *Health Care in Canada 2006* and in the following weeks, CIHI will add more information to the site. For example, it will be possible to:

- **download free copies of the report and the accompanying Technical Report, as well as *Health Indicators 2006* (in English or French)**
- **view a glossary explaining some of the more technical or unusual terms used in the report**
- **sign up to receive regular email updates on CIHI's upcoming reports**
- **view a presentation of the report's key findings**
- **look at:**
  - **related report series, such as *Giving Birth in Canada* and *Medical Imaging in Canada*, as well as CIHI's regular series of reports on aspects of health spending, health human resources, health services and population health**
  - **previous *Health Care in Canada* annual reports**
  - **reports from Statistics Canada**
- **learn about upcoming reports**

For More Information

Highlights and the full text of *Health Care in Canada 2006* are available free of charge in English and French on the CIHI Web site, at www.cihi.ca. To order additional printed copies of the report (a nominal charge will apply to cover printing, shipping and handling costs), please contact:

Order Desk, Canadian Institute for Health Information
495 Richmond Road, Suite 600
Ottawa, Ontario K2A 4H6
Phone: (613) 241-7860
Fax: (613) 241-8120

The *Improving the Health of Canadians 2005–2006 Report Series* and the *How Healthy Are Canadians?, 2006* report series are or will be available through the Web after their release.

CIHI welcomes comments and suggestions about this report and about how to make future reports more useful and informative. We encourage you to use the feedback sheet, "It's Your Turn," provided at the end of this report—or to email your comments to healthreports@cihi.ca.

Part A: A Look Inside Canada's Health System

1

What We Spend

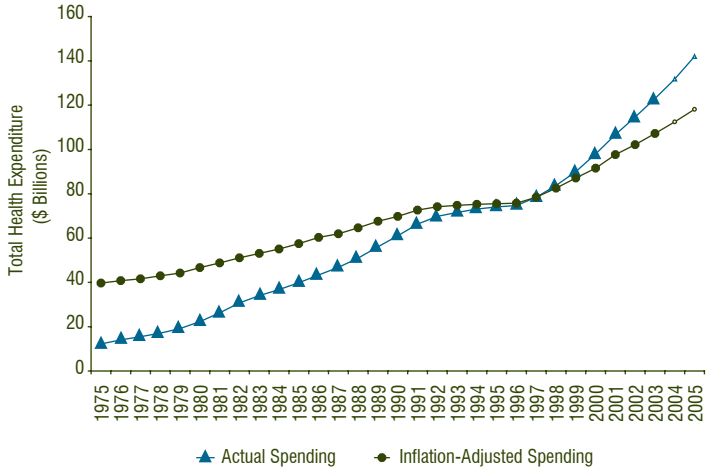
What We Spend

Most Canadians use some type of health care each year, from routine physician and dentist visits to highly specialized diagnostic tests and surgical procedures. In 2005, Canada spent an estimated $142 billion on these and other health services. That's about $4,411 per person. After the effect of inflation is taken into account, this is almost three times more than what was spent in 1975.† Other factors that contribute to increased spending on health include population growth, greater use of existing and new services and changes in how services are organized and delivered.

Total Health Spending in Canada

1

Total health spending by the public and private sectors continues to climb, even after adjustment is made for inflation.



Notes: Data for 2004 and 2005 are forecasts. Inflation adjustments are based on 1997 constant dollars

View Data

Source: National Health Expenditure Database, CIHI.

Canada's health spending represents about one-tenth (10.4% in 2005) of its economic output, or gross domestic product (GDP). Health spending as a proportion of GDP varies among countries belonging to the Organisation for Economic Co-operation and Development (OECD).‡ For example, in 2003, South Korea spent less than 6% of its GDP on health, compared to 15% spent by the United States. Canada ranks in the middle of this range, with the U.S., Switzerland, Germany and France devoting a larger share of their GDP to health care.[1]

Does higher spending mean better health? Although no single indicator can fully describe the overall health of a population, researchers commonly focus on life expectancy because it is a relatively reliable measure, particularly when making international comparisons.[2] The OECD has found a small and positive association between health spending as a proportion of GDP and life expectancy at birth across OECD countries.[1] However, this relationship does not always hold true. For example, the U.S. spends considerably more than Canada on health care, but Canadians tend to live longer. In 2003, Canadians' life expectancy at birth was 79.7 years, compared to 77.2 years in the U.S. At the same time, some countries that spend less, such as Japan, achieved a higher life expectancy (81.8 years) than Canada.*

† Inflation adjustments in this chapter are based on 1997 constant dollars.

‡ The OECD asks member countries to report health expenditures according to its system of health accounts. The 12 countries that most closely follow the proposed system of health accounts are Australia, Canada, Denmark, France, Germany, Hungary, Japan, South Korea, the Netherlands, Switzerland, the UK and the U.S.

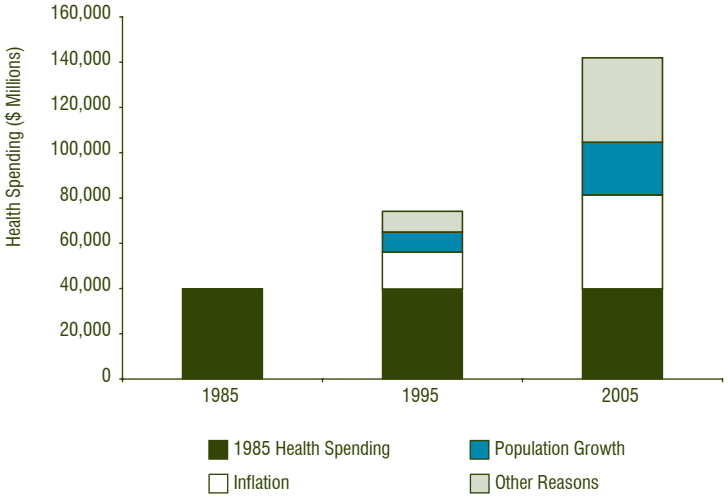
* Life expectancy data for Canada and the U.S. are for 2002, as updates were not available for 2003.

Public vs. Private Spending

In Canada, as in many other OECD countries, both the public and private sectors finance health care services. Public-sector financing—which consists primarily of expenditures by municipal, provincial/territorial and federal governments, as well as worker's compensation boards or other social security programs—accounts for the largest share of total spending on health care. Public-sector spending reached an estimated $98.8 billion in 2005 (69.6% of total health spending). The same year, private-sector expenditures were about $43.2 billion (30.4% of total health spending). These included out-of-pocket spending by individuals, spending by commercial and not-for-profit health insurance plans and non-consumption expenditures (for example, non-patient revenue to hospitals, such as ancillary operations, donations and investment income).

Components of Growth in Canadian Health Spending [2]

Between 1985 and 2005, total health spending in Canada grew by over $100 billion. Population growth and inflation together accounted for nearly two-thirds (63%) of this total growth. Other factors included higher spending on health services per person, which is partly related to changes in practice patterns and the changing use of technologies and services.



Note: Data for 2005 are forecasts.

View Data

Source: National Health Expenditure Database, CIHI.

Over the last three decades, both the public and private sectors have spent more on health care. Private-sector spending (inflation-adjusted) rose more quickly than public-sector spending over this period—4.4% versus 3.5% respectively, on average, per year. Over the last five years, growth rates have been faster, averaging 6.0% in the private sector and 4.9% in the public sector.

The proportion of spending on health services by the public and private sectors varies internationally. Private-sector financing—primarily through private health insurance and out-of-pocket payments—accounts for between one-fifth and one-half of health expenditures in most OECD countries.[1] Canada's proportion of private-sector spending was 30% in 2005, within the range of other OECD countries. Canada's private share is similar to those of Spain and Australia, but larger than those of the United Kingdom, France, Germany and Sweden. Canada's private sector pays mainly for services beyond "core" hospital and physician care, such as drugs, dental and vision care.

Want to Know More?

CIHI's report, *Exploring the 70/30 Split: How Canada's Health Care System Is Financed*, provides an in-depth look at trends in health spending in Canada, as well as variations in the public and private financing of health services across provinces and territories. This report can be downloaded free of charge from CIHI's Web site, at www.cihi.ca.

The type of services financed by public dollars also differs among OECD countries. In Canada, the public sector pays for most hospital care, physician services, public health programs and services for Status Indians and Inuit. It also pays part of the cost of other services, such as prescription drugs and ambulances. In some other OECD countries—such as Germany, the Netherlands and France—the level of per capita health spending is similar to that of Canada. However, compared to Canada, these three countries spend proportionately more public funds on pharmaceuticals and dental services, but less on physician services.

Who Pays for What

3

Countries that spend about the same amount on health care per capita may finance health care costs very differently. The table below shows the public sector's share of spending for different types of services in Canada and in the three OECD countries with the most similar levels of total per capita spending on health in 2003.

	Canada*	Germany	The Netherlands	France*
Total Expenditure on Health	70%	78%	62%	76%
Physician Services	98%	85%	N/A	74%
Curative and Rehabilitative Inpatient Care	93%	84%	74%	92%
Pharmaceuticals and Other Medical Non-Durable Goods	38%	75%	57%	67%
Inpatient Long-Term Nursing Care	78%	75%	98%	100%
Dental Services	5%	68%	N/A	36%

Notes: *Public expenditure figures as a proportion of total health expenditure for Canada and France in 2003 are estimates. N/A = not available.

Source: OECD Health Data 2005 (CD-ROM), OECD.

Spending Across Canada

Spending on health care has increased in all provinces and territories. Although the rate of growth has varied, between 1985 and 2005 total per capita health spending rose by at least 50% in all jurisdictions after adjustment was made for inflation.

Among the provinces, health spending per person ranged from about $3,900 in Quebec and $4,100 in Prince Edward Island to about $4,800 in Alberta and Manitoba in 2005. In the territories, spending per person was significantly higher, partly as a result of costs associated with relatively small populations spread over large geographic areas. For example, in 2003, the Northwest Territories spent approximately $539 per person on ambulance and other medical transportation, while Alberta spent about $24 per person. Provincial/territorial variation may also be attributed to other factors, such as differences in the delivery and coverage of services, demographics, the health status of a population and the price of providing care (for example, differences in fee schedules, wages, benefits and supplies).

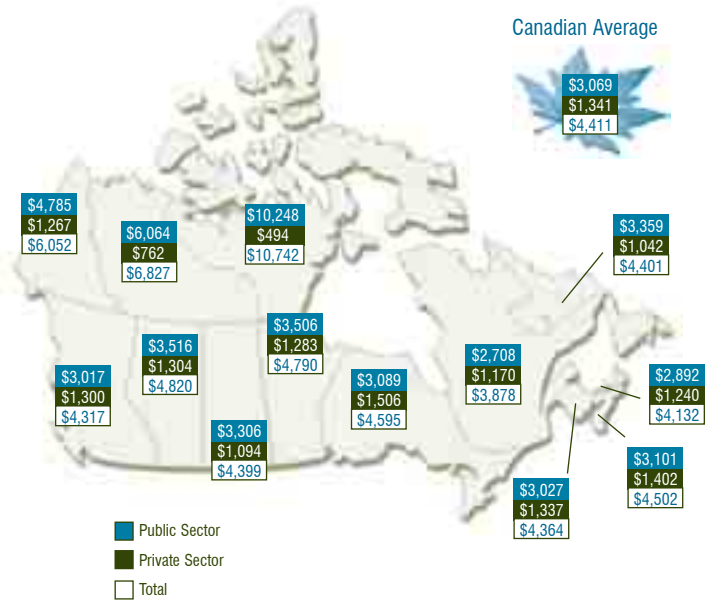
Following the Money

Hospitals, retail drug sales and physician services continue to absorb the largest shares of total health spending in Canada. In 2005, these three spending categories represented well over half (60%) of total health expenditure. However, the growth in spending on hospitals and physician services has been outpaced by growth in some other areas over the last decade. Between 1995 and 2005, spending on hospitals and physician services grew by an average 5.2% and 5.5% per year respectively (unadjusted for inflation), while the annual growth in spending on public health, retail drug sales, capital and administration was 9% or more.

Health Spending per Person

4

The public sector funds approximately 70% of health spending in Canada. However, the proportion of public-sector spending varies across the country. For example, the public sector financed an estimated 76% of per capita health spending in Newfoundland and Labrador, versus 67% in Ontario. In the territories, the public sector pays for a significantly larger proportion of total health costs than in the provinces. The map below shows forecast per capita spending on health services by the public and private sectors in 2005, as well as total expenditures.



Notes: Data are forecasts. Some provincial/territorial totals may not add up due to rounding.

Source: National Health Expenditure Database, CIHI.

Increased Spending on Capital

Although not the largest category of health expenditure, spending on capital has increased substantially over time. In 2005, capital spending reached an estimated $6 billion, or 4% of total health care spending. The public sector financed an estimated $4.7 billion (or 78%) of total capital spending in 2005. The remaining $1.3 billion (or 22%) came from the private sector.

Over the past decade, the annual growth rate in capital spending averaged 10.2% (unadjusted for inflation), the highest growth rate of all major health-spending categories. The category with the second-highest growth rate was retail drug sales, which increased by an average of 9.4% per year (unadjusted for inflation) over this time period.

Capital expenditures include purchases of machinery, equipment, construction services and some software for hospitals, clinics, first-aid stations and residential care facilities. For example, over the past 15 years, the supply of major medical imaging machines in Canada has increased significantly. According to CIHI data, between 1990 and 2005, the numbers of magnetic resonance imaging (MRI) and computed tomography (CT) machines grew by 157 (826%) and 163 (82%) respectively.[3] For more information on the supply, cost and utilization of medical imaging in Canada, please refer to *Medical Imaging Technology in Canada 2005*, which can be downloaded free of charge from CIHI's Web site, at www.cihi.ca.

Hospitals

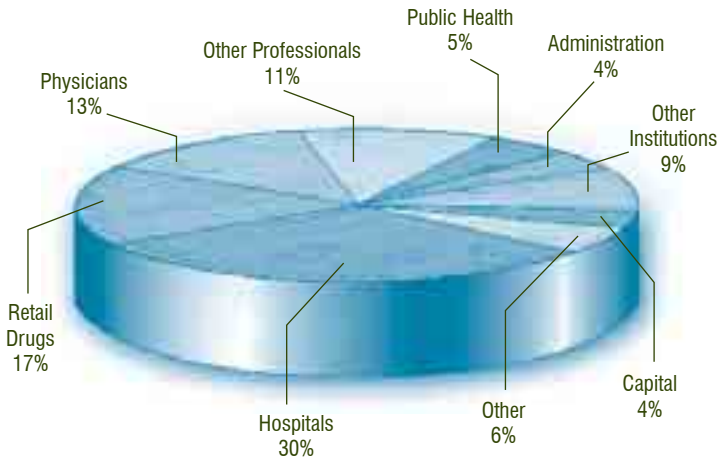
Hospitals continue to account for the single largest share of Canadian health expenditures. In 2005, spending on hospitals reached $42.4 billion, or 29.9% of total health spending. Most (91% or $38.7 billion) of this spending came from the public sector.

While spending on hospitals continues to rise, it has increased at a lower rate than overall health expenditures. As a result, between 1975 and 2005, hospitals' relative share of total health spending fell from 44.7% to 29.9%.

5

Distribution of Health Spending

Of the $142 billion spent on health care in 2005, hospitals (30%), retail drug sales (17%) and physician services (13%) accounted for more than half of the total.



Notes: Data are forecasts. Percentages do not add to 100% due to rounding. The "other professionals" category includes expenditures for the services of privately practising dentists, denturists, optometrists and dispensing opticians, chiropractors, massage therapists, orthoptists, osteopaths, physiotherapists, podiatrists, psychologists, private duty nurses and naturopaths.

Source: National Health Expenditure Database, CIHI.

What's Happening in Public Health?

Recent events such as the SARS outbreak, cases of waterborne disease and the spread of avian flu have reminded Canadians of the challenges—and the importance—of sustaining a strong public health system. One of the responsibilities of that system is the prevention and control of infectious diseases. Public health also includes emergency preparedness, food and water safety, early childhood development and other population health strategies, programs to encourage healthy living, the prevention and control of chronic diseases and injuries and other activities.[4]

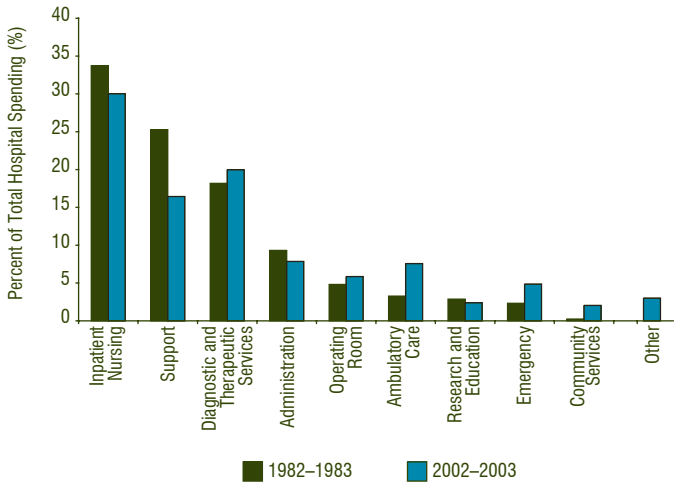
In 2004, CIHI began reporting public health spending as a separate category of health expenditure. The results show that public health services are financed almost entirely by governments and government agencies. In 2005, an estimated $7.8 billion was spent on public health, accounting for 5.5% of total health care spending and 7.9% of public-sector health spending. More money is being spent on public health than in the past. In 1975, public health accounted for 3.3% of total spending and 4.4% of public-sector health spending.

Over the years, patterns in resource allocation and care within hospitals have also shifted. Inpatient-nursing services continue to account for the largest single share of hospital spending (30% in 2002–2003). However, between 1982–1983 and 2002–2003, their relative share of hospital spending declined, as did the share of spending on hospital support and administration. Spending in other areas, such as ambulatory care, diagnostic and therapeutic services, emergency departments, operating rooms and community services, has increased more quickly.[5] For example, according to CIHI's hospital discharge data, the number of same-day surgeries grew by more than 50% between 1995–1996 and 2002–2003.†

Shifts in Hospital Spending

6

Hospitals are spending their budgets differently than in the past. Between 1982–1983 and 2002–2003, for example, the share of expenditures going to inpatient nursing and support services fell. In contrast, ambulatory care and emergency services account for a larger proportion of total spending than in the past.



Note: "Other" functional centre costs were not reported for 1982–1983. For 2002–2003, this category included undistributed expenses such as non-patient food services, ancillary operations, transportation and capital fund and unallocated administrative expenses (for example, taxes, depreciation and amortization).

Source: Canadian Institute for Health Information, *Hospital Trends in Canada: Results of a Project to Create a Historical Series of Statistical and Financial Data for Canadian Hospitals Over Twenty-Seven Years* (Ottawa: CIHI, 2005).

View Data

Retail Drugs

In 2005, retail sales of prescribed and non-prescribed drugs totalled $24.8 billion. At 17.4%, retail drugs were the second-largest category of total health spending. Most spending is on prescribed drugs. Between 1975 and 2005, spending on prescribed drugs grew from an estimated $772 million to $20.6 billion (unadjusted for inflation). Prescribed drugs now account for 83% of total retail drug sales, up from 72% three decades ago. According to data from IMS Health Canada, in 2005 the most frequently filled classes of prescribed drugs were cardiovascular medication (15%), psychotherapeutics (12%), hormones (6%) and antibiotics (6%).[6]

In 2003, the private sector financed just over half (53%, or $8.8 billion) of total prescribed drug expenditures in Canada. Private insurance companies financed nearly two-thirds (64%) of this amount, while household out-of-pocket payments accounted for the remaining 36%. In contrast, over-the-counter drugs and personal health supplies (for example, oral hygiene products) are financed entirely by the private sector ($3.6 billion in 2003), typically through out-of-pocket household payments.

† Same-day surgery data are based on seven provinces/territories that submitted same-day surgery hospitalization data to CIHI: B.C., Ontario, Nova Scotia, New Brunswick, Newfoundland and Labrador, Yukon Territory and the Northwest Territories.

7

Cost-Related Access Problems

In a 2005 Commonwealth Fund survey, adults with health problems in six countries were asked if cost was a determining factor in whether or not they received health services in the two years prior to the survey. The percentage of adults saying "yes" ranged from 13% in the UK to 51% in the U.S. In Canada, about a quarter (26%) of adults surveyed reported not filling prescriptions or skipping doses; having a medical problem but not visiting a doctor; and/or skipping a test, treatment or follow-up because of cost.

	Australia	Canada	New Zealand	Germany	UK	U.S.
Did not fill prescriptions or skipped doses	22%	20%	14%	19%	8%	40%
Had a medical problem but did not visit a medical doctor	18%	7%	15%	29%	4%	34%
Skipped test, treatment or follow-up	20%	12%	14%	21%	5%	33%
Said yes to at least one of the above	34%	26%	28%	38%	13%	51%

Source: 2005 International Health Policy Survey, The Commonwealth Fund.

Physicians

In 2005, spending on physician services reached an estimated $18.1 billion. This makes it the third-largest category of health spending. Over the past decade, spending on physician services grew by 5.5% on average per year (unadjusted for inflation). However, the relative share of physician spending as a proportion of total health spending has fallen over time—from 15.1% in 1975 to 12.8% in 2005.

Over 98% of expenditures on physician services in Canada came from the public sector in 2005. Private payments come primarily from households (not insurance companies) and may include charges for uninsured services and administrative fees.

Public-sector spending on physician services flows primarily through government fee-for-service health insurance plans (80.5% of total clinical service payments in 2003–2004). The remaining 19.5% is financed by alternative payment plans, such as salaries, contracts and sessional payments.[7] According to data from CIHI's National Physician Database, specialists received over half (54%) of all fee-for-service payments to physicians in 2003–2004. The rest (46%) went to family physicians. Although fee-for-service payments to specialists were split equally between consultations and procedures, family physicians received the bulk of their payments (87%) for consultations.[8]

Information Gaps: Some Examples

What We Know

- How health spending varies across Canada and has changed over time.
- Factors that contributed to the increase in health spending over time.
- How Canada's health spending compares internationally.
- How health care dollars are financed overall and for different types of health services.
- The international variation in the proportion of adults who have health problems that report cost-related access difficulties.
- How payments to physicians vary by physician specialty, type of reimbursement and type of service.

What We Don't Know

- How do increases in health spending affect outcomes such as life expectancy, health-related quality of life and patient satisfaction? How do financing differences and the amount of expenditure on health care influence health outcomes and cost efficiencies?
- How do different combinations of public and private funding and service delivery affect costs, access, quality, outcomes and satisfaction?
- To what extent do different factors explain variations in spending across the country?
- How do the costs and benefits of various programs that aim to achieve similar objectives, such as fewer low–birth weight babies or better survival following a heart attack, compare?

What's Happening

- In December 2005, CIHI released the latest version of the *National Health Expenditure Trends* series (1975 to 2005). This publication includes updated expenditure data, by source of funds and health sector, at the provincial/territorial and pan-Canadian levels.
- In March 2006, CIHI released the latest *National Grouping System Categories Report* (2003–2004), which provides the most recent fee-for-service information on payments to physicians for services reimbursed by provincial and territorial health insurance plans.
- CIHI is currently redeveloping the Case Mix Group (CMG) methodology for acute care inpatients, with updates to be implemented on April 1, 2007. CIHI has also enhanced the Comprehensive Ambulatory Classification System (CACS) and Day Procedure Group (DPG) methodologies for ambulatory care patients. These changes were implemented on April 1, 2006.

For More Information

1 Organisation for Economic Co-operation and Development, *Health at a Glance—OECD Indicators 2005* (Paris, France: OECD Publishing, 2005).

2 P. Crémieux, P. Ouellette and C. Pilon, "Health Care Spending as Determinants of Health Outcomes," *Health Economics* 8 (December, 2003): pp. 627–39.

3 Canadian Institute for Health Information, *Medical Imaging in Canada 2005* (Ottawa: CIHI, 2005).

4 Health Canada, *A Public Health System for the 21st Century*, [online], last modified May 29, 2005, cited March 31, 2006, from <http://www.hc-sc.gc.ca/hcs-sss/delivery-prestation/fptcollab/2004-fmm-rpm/fs-if_13_e.html>.

5 Canadian Institute for Health Information, *Hospital Trends in Canada: Results of a Project to Create a Historical Series of Statistical and Financial Data for Canadian Hospitals Over Twenty-Seven Years* (Ottawa: CIHI, 2005).

6 IMS Health Canada, *Prescription Drug Purchases by Canadian Hospitals and Pharmacies Reach $16.57 Billion in 2005*, [online], last modified March 15, 2006, cited April 20, 2006, from <http://www.imshealthcanada.com/htmen/1_0_26.htm>.

7 Canadian Institute for Health Information, *Average Payment per Physician Report, Canada, 2002–2003 and 2003–2004* (Ottawa: CIHI, 2006).

8 Canadian Institute for Health Information, *National Grouping System Categories Report, Canada, 2003–2004* (Ottawa: CIHI, 2006).

Health Human Resources in Canada

2 Health Human Resources in Canada

Thousands of professionals, drawn from dozens of different occupations, form the backbone of Canada's health system. These individuals work in a variety of settings to promote good health, to care for and comfort the sick, to deliver high-quality health care and to strengthen the health system.

More than 30 health professions are now regulated under legislation in at least one province or territory, and some are currently unregulated. Each profession tends to specialize in certain areas, although skills and roles vary across the country and often overlap.

Questions about how to ensure that the right number of health care providers with the right mix of skills is available to provide appropriate and timely health services to all Canadians remain at the top of the health-policy agenda. While counts, population ratios and basic data on demographics and education are of value in responding to these questions, they provide only part of the picture. Effective health human resources planning and management require consideration of many different factors, such as the activity levels of health professionals, their scopes of practice and additional information on demographics and practice patterns. Portions of this information are available, but important gaps remain—some of which are now on the way to being filled.

As a starting point, to support and stimulate policy discussions, this chapter presents summary information on the supply and distribution of Canada's health care providers. The primary focus of this chapter is medicine and nursing, the two largest health professions. More information—on these occupations and others—is available in CIHI's other reports on health human resources.

Want to Know More?

Other CIHI reports offer additional information on health human resources, including:

- ***Canada's Health Care Providers: 2005 Chartbook***
- ***Geographic Distribution of Physicians in Canada: Beyond How Many and Where***
- ***The Regulation and Supply of Nurse Practitioners in Canada***
- ***Health Personnel Trends in Canada, 1995 to 2004***

All can be downloaded free of charge from CIHI's Web site, at www.cihi.ca.

The Health Workforce

Over 1.5 million people across the country work in health and social services. That's about 1 in 10 employed Canadians. Nursing and medicine are the two largest health professions. Canada's health care team also includes a wide range of regulated, unregulated and informal or volunteer caregivers.

The distribution of health professionals varies across the country, depending on the health needs of the population, population size, the availability of employment in a given region, where health care providers choose to practise and many other factors. For example, CIHI data show that among the provinces, Newfoundland and Labrador had the highest rate of registered nurses (RNs) per capita in 2004, and British Columbia the lowest (1,055 and 670 RNs per 100,000 respectively). There are similar variations for other occupations, leading to differences in the mix of health professionals from province to province.

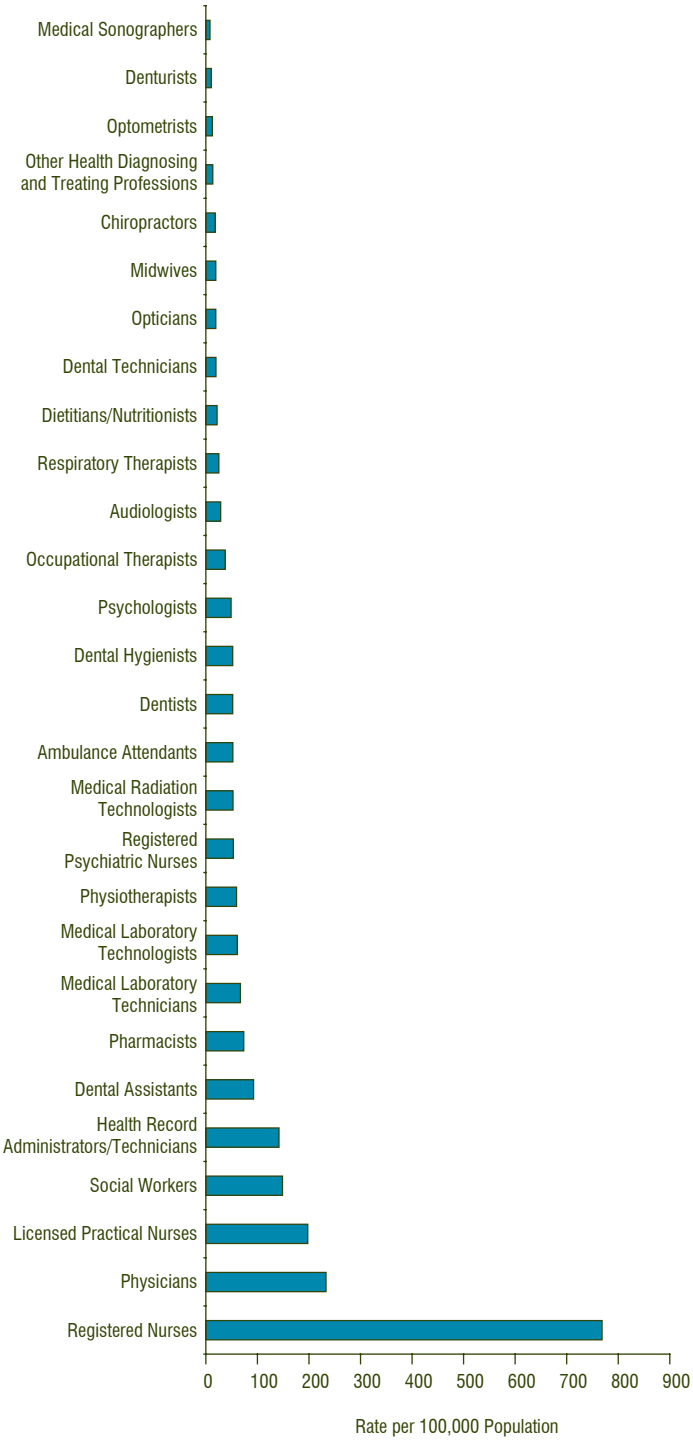
More Nurse Practitioners

A nurse practitioner (NP) is a registered nurse with additional education in health assessment, diagnosis and management of illnesses and injuries, typically including prescribing drugs. In 2003, seven jurisdictions in Canada licensed 725 NPs. A year later, in 2004, 878 NPs were licensed in eight jurisdictions, a 21% increase. Almost half (45.1%) of licensed NPs employed in 2004 worked in the community health sector. Others reported working in hospitals (22.8%) and nursing homes or long-term care sectors (3.8%). The remaining NPs worked in other types of facilities or did not state their place of employment.[1]

8

Sharing Health Care Professionals

Together, registered nurses (RNs), licensed practical nurses (LPNs) and registered psychiatric nurses (RPNs) account for just under half of all health care workers. The rest come from a wide variety of occupations. The chart below shows the number of health professionals per 100,000 Canadians in 2004 for selected professions.



Note: Registered psychiatric nurses are registered only in B.C., Alberta, Saskatchewan, and Manitoba; therefore the ratio for this group is calculated using the population of these four provinces only.

Sources: Nursing data: Regulated Nursing Databases, CIHI; other health professionals: Labour Force Survey, Statistics Canada.

9

Interprovincial Survey of Health Professions Regulated by Legislation

The table below summarizes results of a Health Canada survey of health professions regulated by legislation, as of May 2005. Regulatory approaches differ across Canada. All provinces and territories require that some groups, such as pharmacists and registered nurses, have licences to practise. There is less consistency for other groups.

Health Profession	B.C.	Alta.	Sask.	Man.	Ont.	Que.	N.B.	N.S.	P.E.I.	N.L	Y.T.	N.W.T.	Nun.
Chiropractors	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		
Dentists	Y	Y	Y	Y	Y	Y	Y^DA	Y	Y	Y	Y	Y	Y
Dental Hygienists	Y	Y	Y	Y^DA	Y	Y	Y	Y^DA	Y^DA	Y^DA	Y	Y	Y
Dietitians and Nutritionists	Y	Y	Y^D	Y^D	Y^D	Y	Y	Y^D	Y^D	Y^D			
Licensed Practical Nurses/Registered Practical Nurses	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Medical Laboratory Technologists		Y	Y	Y^2	Y	Y	Y	Y					
Medical Practitioners/ Physicians	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Medical Radiation Technologists		Y^NPF	Y		Y	Y	Y	Y	Y	Y^NSR/ NH			
Midwives	Y	Y^NSR	Y^2	Y	Y	Y						Y	
Occupational Therapists	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y			
Optometrists	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y^2	Y	Y	Y
Pharmacists	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Physical Therapists/ Physiotherapists	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y^2		
Psychiatric Nurses	Y	Y	Y	Y									
Psychologists	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		Y	Y
Registered Nurses	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Respiratory Therapists		Y		Y	Y	Y							
Social Workers	Y^NSR	Y	Y^NH		Y^NH	Y	Y	Y^NH	Y	Y			
Speech Language Pathologists and Audiologists		Y	Y	Y	Y	Y	Y						

Notes:
Y: Profession regulated.
Y^2: Act passed but not proclaimed.
Y^DA: Regulated under a dental act.
Y^NSR: Regulated directly by government.
Y^NH: Regulated under legislation not administered by a health ministry.
Y^D: Refers to dietitians and not nutritionists.
Y^NPF: Inclusion of electroneurophysiologists under development.

Source: Health Care Strategies and Policy Directorate, Health Canada.

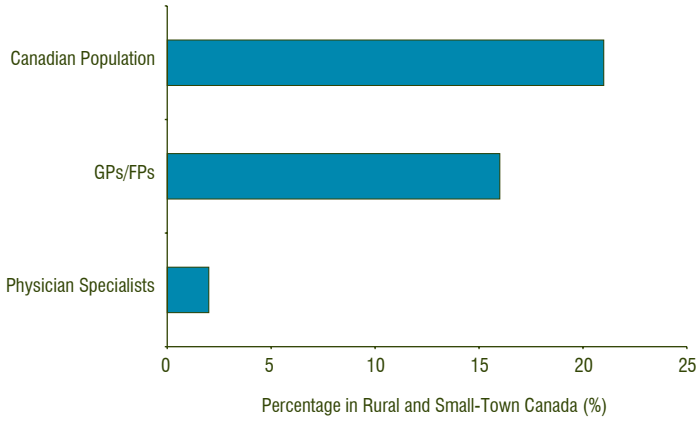
Urban and Rural Differences

Results of the 2004 National Physician Survey, carried out by the College of Family Physicians of Canada, the Canadian Medical Association and the Royal College of Physicians and Surgeons of Canada, shed new light on physicians' practice patterns.[9, 10] Interestingly, family doctors in urban and rural areas tend to have different practice characteristics. Survey results show that physicians in rural and remote communities tend to have a broader scope of practice and perform a greater range of clinical procedures than their urban colleagues.[2] However, practice patterns among all family physicians are changing. Studies show that, overall, their scope of practice is narrowing rather than expanding. For example, fewer are delivering babies or providing assistance in operating rooms than in the past.[8]

Although there are fewer family doctors per capita in rural areas, these physicians are more likely to say that they are accepting new patients.† Across Canada, 20% of family physicians reported accepting new patients (without restrictions) in 2004.[3] The rate for rural physicians was higher, at 34% (about the same as in 2001). The gap between rural physicians and their urban counterparts has widened in recent years: only 18% of urban family physicians accepted new patients in 2004, down from 21%.

Who's in Rural and Small-Town Canada? 10

In 2004, about one-fifth of Canada's population (21%) lived in communities with a population of less than 10,000. About 16% of family doctors and 2% of physician specialists worked in these areas.



Sources: Scott's Medical Database, CIHI; 2004 Population Estimates, Statistics Canada.

† In asking family physicians if they were accepting new patients, both surveys offered two identical response options: "no restrictions; practice is open to all new patients" and "completely closed." The two surveys differed with respect to the response options for partially closed practices. The 2004 survey provided a single response option for "partially closed" practices, whereas the 2001 survey offered a variety of response options (for example, "closed, but will accept new referrals from other physicians" and "closed, but will accept friends of current patients").

The Three Rs: Recruitment, Retention and Retirement of Nurses

Canada's nurses are getting older. The average age of registered nurses (RNs) in 2004 was 44.6 years, up from 41.4 in 1994. Over the last decade, the number of RNs aged 50 to 54 employed in nursing rose 6.5%. This group accounted for 17% of the entire regulated nursing workforce in 2004.[5]

What's happening? One factor that partly explains the trend is that RNs graduating from training today are older than before. According to CIHI data, the average age of RNs graduating in the 1950s was 22 years. That compares to 24 years for those graduating after 2000. Longer training programs may partly explain this increase. Many other factors are also at play.

Yet some parts of the country are bucking the overall trend.[6] For example, Capital Health in Edmonton reports that the average age of its nursing workforce fell from 45 years in 2000 to 40 years in 2005 after the organization created more professional development opportunities, implemented new graduate initiatives and took other steps. Vacancy rates and job satisfaction also improved. Likewise, St. Boniface Hospital in Winnipeg reports decreased vacancy rates as well as a decline in worker's compensation claims following the implementation of mentorship programs, enhanced professional development opportunities and other programs and initiatives to encourage greater employee input in decision-making.

Planning Ahead

As in other areas that have long training requirements, workers in the health sector tend to be older than the workforce overall. The proportion aged 45 to 64 is also increasing more rapidly in health care than the general trend.[3] Across all health occupations, the average age in 2003 was 41.6 years—a 6% increase from 1994.[4]

These changes—and other trends—have focused attention on the future availability of health professionals. As a result, national and provincial/territorial health human resources strategies and plans are underway or being rolled out. Through education, recruitment, retention and other initiatives, their aim is to ensure that the right mix of health care providers is available to meet the health needs of Canadians. The approaches being taken vary and are evolving over time. Examples include:

- providing funding for increased enrolment at medical and nursing schools
- improving processes for the licensing of foreign-trained medical graduates
- developing a framework to identify workplace issues to improve retention of various health professionals

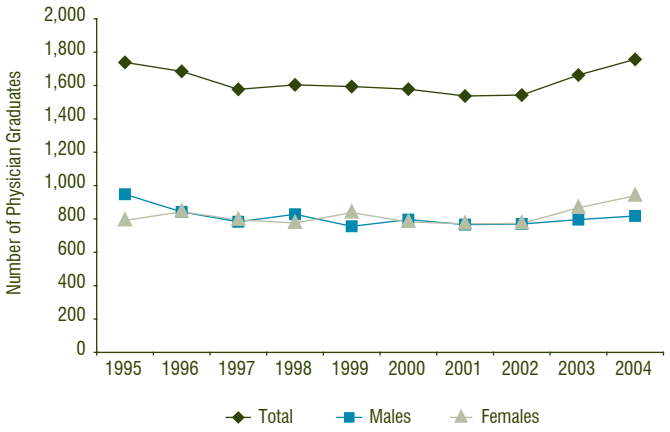
Tomorrow's Health Care Providers

Graduates from today's training programs are tomorrow's health care providers. The number and types of graduates will have substantial effects on the future of our health care system. So will where and how they choose to practise.

The numbers and mix of students graduating from training programs have changed over time. For example, there were more graduates from chiropractic, dental hygiene, occupational therapy, physiotherapy and medical programs in 2004 than in 1993. Over the same period, there was a decrease in the number of graduates from dentistry, optometry and pharmacy.

11 More Physician Graduates

After a dip in the mid-to-late 1990s, the number of physician graduates from Canada's medical schools is again on the rise. Given recent increases in enrolment, this trend is expected to continue in the future.



Source: Association of Canadian Medical Colleges.

12 The Next Generation

The chart below shows the number of graduates in 1993 and 2004 of selected health care professions that were regulated in all 10 provinces in May 2003. It also shows which provinces and territories provided basic training programs as of the 2003–2004 school year.

	1993 Grads	2004 Grads	B.C.	Alta.	Sask.	Man.	Ont.	Que.	N.B.	N.S.	P.E.I.	N.L.	Y.T.	N.W.T.	Nun.
Chiropractors+	138	195					✓	✓							
Dental Hygienists~	542	677	✓	✓	✓	✓	✓	✓		✓					
Dentists	501	439	✓	✓	✓	✓	✓	✓		✓					
Occupational Therapists	495	593	✓	✓		✓	✓	✓		✓					
Optometrists	113	108					✓	✓							
Pharmacists	771	672	✓	✓	✓	✓	✓	✓		✓		✓			
Physiotherapists	567	631	✓	✓	✓	✓	✓	✓		✓					
Physicians	1,702	1,757	✓	✓	✓	✓	✓	✓		✓		✓			

Notes:
+ The first graduating class from the Université du Québec à Trois-Rivières program was in 1998.
~ True values may be higher, as not all schools are currently reporting.
No updates available for registered nurses or licensed practical nurses.

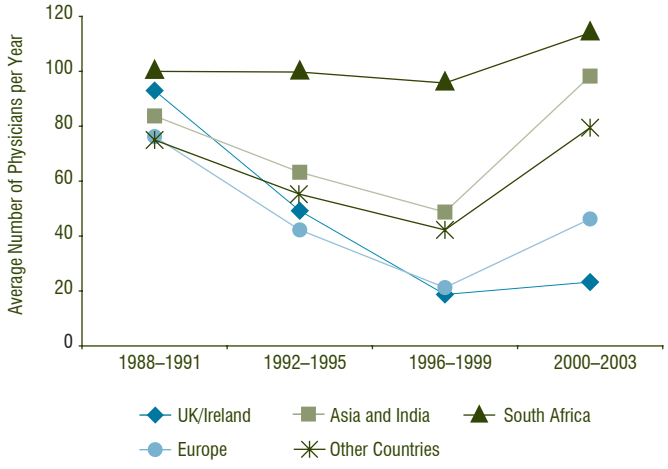
Source: Health Personnel Database, CIHI.

Some health care educational programs are available across the country; others are offered in only a few locations. A province may host a training program on behalf of a number of other jurisdictions. This allows for professional training of students from areas of the country where there may not be sufficient numbers to justify their own programs. In some cases, new programs have recently opened or are planned. For example, the New Brunswick Medical Training Centre, which offers a French-language program, will open its doors in September 2006. The University of Sherbrooke will coordinate the curriculum, but teaching will be done at the University of Moncton. The Centre hopes to graduate 22 students a year beginning in 2010.

13

New Physicians From Abroad

Over the years, Canada has attracted physicians from many different countries. The figure below shows the average number of physicians who immigrated to Canada by country/region of MD graduation, between 1988 and 2003.



Source: Scott's Medical Database, CIHI.

Coming From Abroad

Many health professionals migrate to Canada each year. Even if they are licensed to practise in their home country, they must often undergo an extensive process before being allowed to work in a regulated occupation in Canada. A number of recent efforts have focused on streamlining this process to make it easier for international medical graduates to practise in Canada.[7]

Historically, foreign-trained health professionals make up a significant portion of Canada's health workforce. Throughout the 1970s, for example, about 30% of our physicians were educated outside of Canada. By 2004, 22% of physicians working in Canada had trained elsewhere. This result reflects long-term trends, as well as a recent decline in the percentage of foreign-trained specialist physicians (a drop of 2.7 percentage points since 2000). On the other hand, there was an increase in foreign-trained family physicians working in Canada (up 1.1 percentage points). The net effect of these two trends has been a slight decrease in the percentage of foreign-trained doctors working in Canada over time—from 23.1% in 2000 to 22.3% in 2004.[2]

Some physicians enter the country each year, while others leave. In recent years, Canada has lost about 1% (net) of its physician supply each year to other countries.[3] However, in 2004, more physicians returned to Canada than left to practise elsewhere. CIHI data show that 317 physicians returned to Canada and 262 moved abroad.[7]

A smaller proportion of Canada's nurses are foreign-trained. In 2003, about 7% of registered nurses and close to 2% of licensed practical nurses (LPNs) in Canada were trained abroad. However, the situation varies across the country. For example, B.C. had the highest proportion of foreign-trained registered nurses (15%), while New Brunswick had the lowest (1%). On the other hand, Nova Scotia had very few foreign-trained LPNs (0.3%), while about 3% of Ontario's LPNs were educated outside of Canada.[4]

On the Move

Not only do health professionals move in and out of Canada, they also move within the country. For example, B.C., Alberta and Ontario have experienced net gains in physician numbers due to migration between jurisdictions. On the flip side, Saskatchewan, Manitoba, Quebec and Newfoundland and Labrador have experienced net losses. However, net losses of physicians due to migration do not necessarily imply that total physician numbers are falling. For example, even though Newfoundland and Labrador showed net losses due to jurisdictional migration, the total number of physicians working in that province has grown from 927 physicians in 2000 to 992 in 2004—a 7% increase.[8]

Nurses and other health professionals are also on the move in Canada, but their migration patterns are more difficult to track. In order to get a general idea of where nurses are coming from and going to work, CIHI compares where nurses graduated to the province or territory in which they are currently registered to practise.

Based on this indicator, the extent of migration varies across the country. In 2004, about one-third of Saskatchewan registered nursing (RN) graduates were employed elsewhere. In contrast, Quebec RN graduates were more likely to work in the province in which they were trained—about 6% were registered elsewhere to practise.[5]

It is important to note that this information represents only an indicator of migration, not a precise measure. For example, some nurses will leave their province of residence with the intention of coming back to practise. This indicator does not account for these instances and only includes comparisons between two points in time (additional migration during the two points in time is not measured).[5]

Information Gaps: Some Examples

What We Know

- The supply, distribution and demographics of specific health care providers and how they have varied over time.
- The proportion of physicians and nurses in Canada who trained in other countries.
- The percentage of physicians on the move inside and outside of Canada.
- How many students enrol in and graduate from health professional training programs each year.

What We Don't Know

- How many and what mix of health professionals will be required to meet the health care needs of Canadians in the future—locally, provincially and nationally? How will the current health human resources strategies across Canada affect the supply, mix and distribution of health providers?
- How will shifts in regulatory models and scopes of practice of Canada's health professionals affect the delivery and outcomes of care in the country?
- How will changes in the number of available places in health professional training programs (for example, medical schools with an emphasis on practice in rural and remote areas) affect the number and distribution of health professionals in the future?
- How will changing educational requirements affect the future supply of health professionals and how they provide care?

What's Happening

- Statistics Canada will release results from the 2005 Canadian Community Health Survey in June 2006. These data will provide updated estimates of how often Canadians consult with different types of health care providers, how many have a regular doctor and much more.
- Data collection for a new national survey aimed at understanding the working conditions and well-being of nurses started in October 2005. CIHI is sponsoring the survey, in collaboration with Statistics Canada and Health Canada. The first results will be available in the fall of 2006.
- As part of the Pan-Canadian Health Human Resources Strategy, Health Canada has collaborated on and funded many health human resources planning initiatives, which are still underway. One of those initiatives is the Health Human Resources Databases Development Project (HHR-DDP), which will be executed by CIHI. This project has been ongoing since 2004–2005 and is expected to last five years.

For More Information

1 Canadian Institute for Health Information, *The Regulation and Supply of Nurse Practitioners in Canada* (Ottawa: CIHI, 2005).

2 R. W. Pong and J. R. Pitblado, *Geographic Distribution of Physicians in Canada: Beyond How Many and Where* (Ottawa: CIHI, 2005).

3 Canadian Institute for Health Information, *Analysis in Brief: Family Physicians Accepting New Patients: Comaprison of 2001 Janus Survey and 2004 National Physician Survey Results* (Ottawa: CIHI, 2005).

4 Canadian Institute for Health Information, *Canada's Heath Care Providers: 2005 Chartbook* (Ottawa: CIHI, 2005).

5 Canadian Institute for Health Information, *Workforce Trends of Registered Nurses in Canada, 2004* (Ottawa: CIHI, 2004).

6 Canadian Federation of Nurses Unions, *Taking Steps Forward: Retaining and Valuing Experienced Nurses* (2006), [online], cited March 6, 2006, from <www.nursesunions.ca/cms/index.php/Research/Taking_steps_forward>.

7 Health Canada, *Pan-Canadian Health Human Resource Strategy: 2004–2005 Annual Report* (Health Canada, 2005), [online], cited March 16, 2006, from <www.hc-sc.gc.ca/hcs-sss/hhr-rhs/strateg/ar-ra-2005/index_e.html>.

8 Canadian Institute for Health Information, *Supply, Distribution and Migration of Canadian Physicians, 2004* (Ottawa: CIHI, 2005).

Part B: Surviving a Heart Attack or a Stroke

More than a century ago, Florence Nightingale used mortality rates to show that sanitary reforms could reduce deaths in the Crimean War. At the time, such statistics were rare. Today, however, mortality rates have become one of the most widely used measures for understanding outcomes of care.[1] For example, they have been used to stimulate improvements to care, to review existing practice patterns and to strengthen public accountability.[2]

Cardiovascular diseases, including heart attacks and strokes, are among the most common reasons for emergency admission to hospital.† Together, they form the leading cause of death in Canada today.‡ In 2001, CIHI began tracking how often patients die in hospital within 30 days of being admitted with a new heart attack. The following year, we added data on survival following new strokes.

Health Care in Canada 2006 examines these two indicators in detail. Chapter 3 outlines the latest data. It focuses on today's mortality rates, how they have changed over time and how they vary across the country. Chapter 4 starts to answer the question, "Who is more likely to die from a heart attack or a stroke?" It focuses on age, sex and other factors present at the time that the patient was admitted to hospital. Chapter 5 then looks at what we know and don't know about the effects of different types of health care on patients' survival chances. The final chapter examines a selection of topics related to care received after the heart attack or stroke.

All four chapters start from the point at which someone has had a heart attack or stroke. But clearly there are many factors that affect how likely you are to experience these events. Examples include demographics, overall health, smoking and other health behaviours, living and working conditions, personal resources, environmental factors and access to high-quality primary health care.[3] A full discussion is beyond the scope of this report, but you can find regional and provincial/territorial data on many of these risk factors in the *Health Indicators* e-publication, at www.cihi.ca.

† Discharge Abstract Database, 2004–2005, CIHI.
‡ OECD Health Data, 2005.

3

The Rates

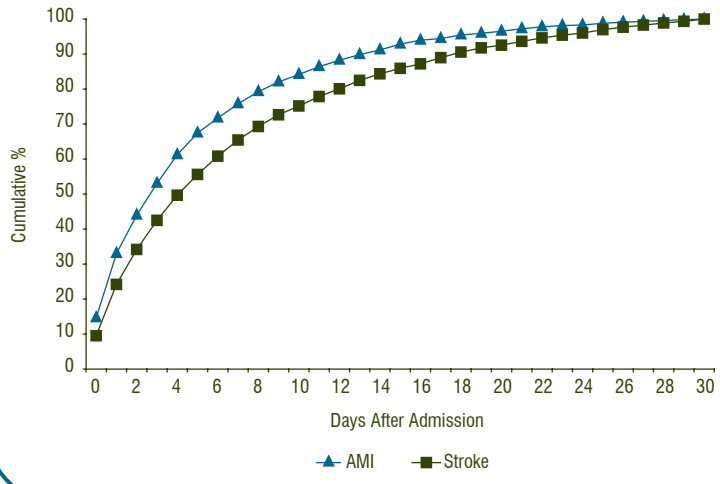
3 The Rates

While most patients survive, both heart attacks and strokes can have fatal consequences. About 11.1% of those admitted to hospital with a new heart attack between 2002–2003 and 2004–2005 died in hospital within 30 days.† Death rates for stroke patients were higher. Overall, 19.1% of people admitted with a new stroke died in hospital within 30 days.‡

14

When Do Deaths Occur?

In 2004–2005, half or more of in-hospital deaths within 30 days following admission with a new acute myocardial infarction (AMI) or stroke occurred within four days of admission to hospital (61% for AMI and 50% for stroke). The graph below shows the cumulative percentage of deaths, by days after admission, for patients who died in hospital within the first 30 days.



View Data

Source: Discharge Abstract Database, CIHI.

Stroke and AMI Defined

Acute myocardial infarction (AMI) is the clinical term for a heart attack. A **heart attack** is the death of heart muscle from the sudden blockage/clot of a vessel supplying blood to the heart. Using the results of an electrocardiogram (a diagnostic test that measures the heart's electric activity), cardiac specialists differentiate between types of heart attacks, two of which are called "ST-elevation" and "non-ST-elevation." Since our data do not indicate the type of AMI, we consider both types together in this report.

Stroke is the death of brain cells due to sudden disruption in the blood flow to the brain by either a blockage (**ischemic stroke**) or a rupture of a blood vessel in the brain (**hemorrhagic stroke**). The term "**brain attack**" is sometimes used to refer to strokes. Like AMI, stroke can be classified into different types (see page 34). These can be differentiated in the data that we use, so we consider the type of stroke in our analyses.

† Excludes B.C., Quebec and Newfoundland and Labrador. Three-year pooled mortality rates (2002–2003 to 2004–2005) for AMI are identical to the 2004–2005 rate.
‡ Excludes B.C. and Quebec.

Understanding 30-Day In-Hospital Mortality Measures

The analyses in this chapter build on methods used in previous CIHI reports, as well as research conducted in Canada by the Institute for Clinical Evaluative Sciences[4] and elsewhere. (For more information, refer to Chapter 4.) To make results as robust and comparable as possible, we used strict definitions to identify AMI and stroke cases. For example, we included only patients with new heart attacks or strokes. Individuals who had been hospitalized with the same condition in the past year were excluded from the analyses. Accordingly, findings may not be generalizable to all AMI and stroke patients. Both *ischemic* (interruption of blood flow to the brain) and *hemorrhagic* (the rupture of a blood vessel in the skull) strokes were included in the analyses, as well as strokes reported as "ill-defined." This decision, along with other aspects of stroke definition, was reviewed by experts from the Canadian Stroke Network. Further details on the methodology are provided in the Technical Notes, found in the *Health Indicators* e-publication on our Web site, at www.cihi.ca.

We look at deaths in hospital within 30 days of admission, not those that occurred over a longer time period or those that occurred out of hospital. Previous research suggests that short-term mortality is related to in-hospital care.[4]

Overall rates† presented in this report are unadjusted. Age-standardized rates adjust for the changes in age distribution of the population over time. This method allows a more accurate comparison of mortality rates from different years. Rates for particular geographic areas are adjusted, as appropriate, to improve comparability. Risk-adjusted mortality rates account for differences in age, sex and comorbidity across regions (see Chapter 4 for further details). Comorbidities are other diagnoses that a patient has, in addition to the heart attack or stroke. Nevertheless, differences across regions may reflect more than the quality of care patients received in hospital. Other influences that we are not able to control for—such as variations in risk factors, in care before admission or in hospital documentation practices—may also play a role in regional variations.

Our provincial and regional analyses are based on where patients live, not where they are hospitalized. As a result, the rates reflect mortality for AMI or stroke patients who reside in a specific region (although they may have received their care outside of that region).

We excluded data from Quebec due to differences in coding of diagnosis types. Additionally, data from B.C. were excluded in trend analyses due to historical differences in coding of admissions from the emergency room. As of 2002–2003, however, this discrepancy no longer existed, and we were able to include B.C. when presenting provincial and regional rates from that year on. We excluded data from Newfoundland and Labrador for AMI due to different coding of this condition. Data for Nunavut are not available due to incomplete submission.

We report 95% confidence intervals for risk-adjusted mortality rates to provide information on the precision of our estimates. These intervals tend to be larger (that is, the rate estimate is less precise) for regions with fewer patients. For example, Toronto's rate for AMI in 2002–2003 to 2004–2005 is estimated to be accurate to within ±0.8 percentage points 19 times out of 20. In contrast, the rate for Prince Albert, Saskatchewan, (with only a fraction of Toronto's cases) is accurate to within ±3.7 percentage points. Regional rates that are reported here are based on data that were pooled over a three-year period.

† Overall rates reflect provinces and territories for which comparable data were available.

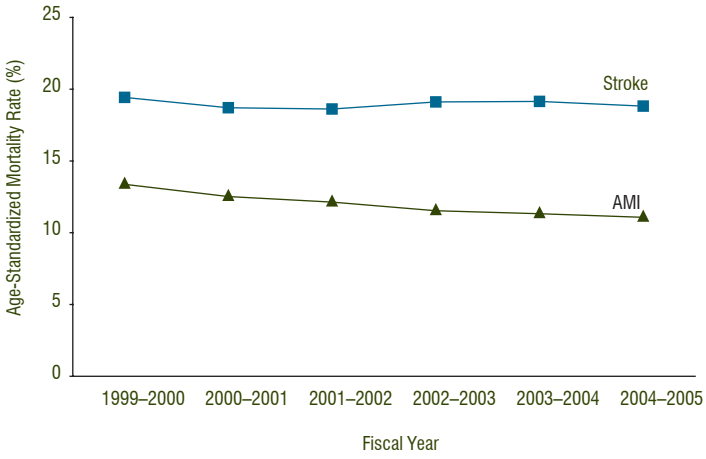
Watching the Trends

Heart attack death rates are falling. The age-standardized 30-day in-hospital mortality rate was 11.1% in 2004–2005, down from 13.4% five years earlier. This result translates into lives saved. About 401 fewer people died outside of B.C., Quebec and Newfoundland and Labrador in 2004–2005 than would have if survival rates had not improved.

15

Short-Term AMI Mortality Rates Are Falling

The proportion of patients who die in hospital within 30 days of admission with a new AMI has decreased over the past five years, while short-term death rates for patients with strokes have remained relatively stable. This graph shows age-standardized mortality rates for both groups. Age standardization adjusts for the changes in the age distribution of the population over time. This method allows a more accurate comparison of mortality rates from different years.



Notes: Rates are directly standardized to the age distribution for 2004–2005. Changes in rates over time may be partly attributed to changes in diagnosis coding standards.

View Data

Sources: Hospital Morbidity Database, CIHI; Discharge Abstract Database, CIHI.

Overall 30-day in-hospital mortality following admission with a new stroke has been relatively stable since 1999–2000, with a death rate of about 19%. However, mortality from hemorrhagic strokes has dropped. Age-standardized death rates fell from 37.7% to 32.8% over the same period. This type of stroke is more deadly but less common than ischemic strokes. About 13% of those admitted with a new ischemic stroke die in hospital within 30 days, a rate that has not changed significantly in recent years.

These improvements in survival occurred during a period when the number of people being admitted with new heart attacks and strokes was falling. According to CIHI data, the age-standardized, per capita number of hospitalizations due to a new heart attack decreased by 18.9% between 1999–2000 and 2004–2005. Hospitalizations from new strokes fell by 23.0% over the same period.† Undoubtedly, a number of factors, not all of which are fully understood, contributed to these trends. These changes do, however, follow the general trend of decreasing inpatient hospital utilization.[5] Population-based mortality rates due to AMI and cerebrovascular disease (including stroke) have also been decreasing.‡

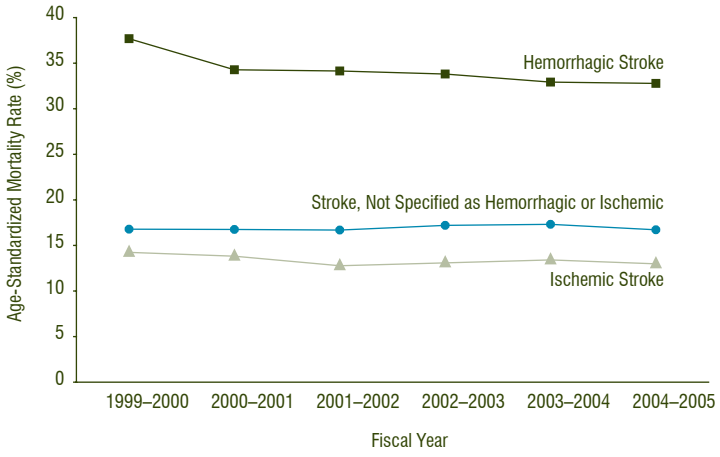
† Per capita hospitalization rates were age-standardized to the 2004–2005 population age distribution. Data from B.C. and Quebec are excluded. Data from Newfoundland and Labrador are also excluded for AMI. The rates were defined so that interhospital transfers did not result in double-counting of patients.

‡ OECD Health Data, 2005.

16

Short-Term Stroke Mortality Rates Are Stable

Survival trends vary by type of stroke. Overall, mortality rates have been stable over time, except for hemorrhagic strokes. Because hemorrhagic strokes are less common than ischemic strokes, the decline in hemorrhagic stroke mortality has not had a large effect on the overall stroke mortality rate.



Notes: Rates are directly standardized to the age distribution for 2004–2005. Changes in rates over time may be partly attributed to changes in diagnosis coding standards.

View Data

Sources: Hospital Morbidity Database, CIHI; Discharge Abstract Database, CIHI.

The Type of Stroke Matters

In 2004–2005, one-third (33.5%) of patients admitted with a new hemorrhagic stroke died in hospital within 30 days, compared to 13.1% of patients with a new ischemic stroke.† In addition, there were differences in outcomes depending on the type of hemorrhagic stroke. Of patients admitted with a new intracerebral hemorrhage (ICH) (a bleed within the brain), 40.8% died in hospital within 30 days of admission. This compares to 27.6% of patients admitted with a new subarachnoid hemorrhage (SAH), a bleed between the brain and the skull. Although patients with a hemorrhagic stroke have a higher mortality rate, these cases occur less frequently than ischemic strokes. Hemorrhagic strokes accounted for 22.5% of new stroke cases in 2004–2005.

What Is the Picture Across Canada?

Your chances of having and surviving a heart attack (AMI) or a stroke may depend on where you live. To some extent, this is because of differences in how and why different people have health problems. Major risk factors for AMI include smoking, diabetes, high blood pressure, obesity and physical inactivity.[6] Many of these same risk factors also apply to stroke.[7] Certain social and economic conditions also place people at higher risk for having cardiovascular disease. For example, research suggests that unskilled workers are more likely to have a heart attack than managers.[8] Likewise, Ontario studies have found that people living in poorer neighbourhoods have less access to specialized care following a stroke and are more likely to die than those living in wealthier neighbourhoods.[9]

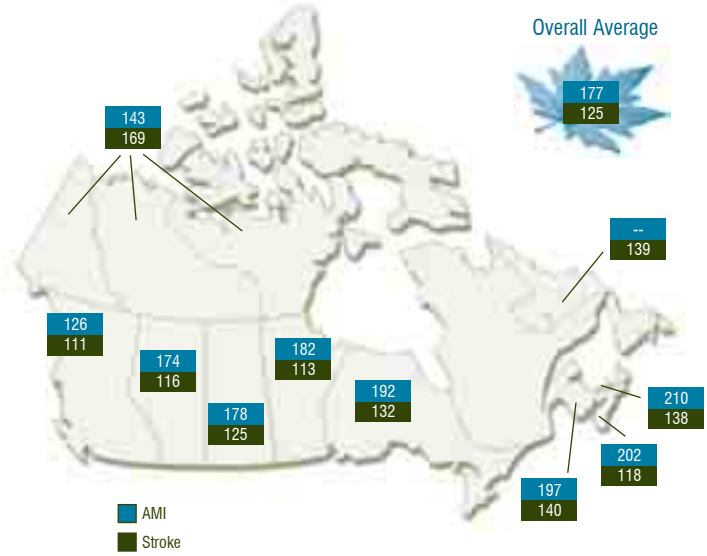
At approximately 210 per 100,000 population in 2004–2005, P.E.I. had the highest age-standardized per capita rate of hospitalizations with a new AMI. This compares to the lowest rate of about 126 per 100,000 in B.C., which also had the lowest age-standardized hospitalization rate with a new stroke (111 per 100,000). The territories (combined) had the highest stroke hospitalization rate (169 per 100,000).

† Excludes Quebec.

Hospital Admissions for AMI and Stroke

17

Although imperfect, the number of hospitalizations with a new AMI or a new stroke can provide an estimate of the number of new cases. The graph below shows the age-standardized number of people admitted to hospital with a new heart attack or a new stroke in 2004–2005 per 100,000 population, by province or territory of residence.



Note: Rates for each province and the territories are standardized to the overall age distribution.

Source: Discharge Abstract Database, CIHI; Statistics Canada, Demography Division.

So there are differences in how likely people are to have heart attacks or strokes—but what about once you have one? How do patients across the country fare?

Between 2002–2003 and 2004–2005, Saskatchewan, Manitoba and Ontario had 30-day in-hospital risk-adjusted AMI mortality rates that were about the same as the overall rate. The remaining provinces had rates that were statistically significantly different from the overall rate. For example, Alberta's risk-adjusted mortality rate was statistically significantly lower than the overall rate, while the rates for B.C., New Brunswick, Nova Scotia and P.E.I. were higher. Relative to the overall rate,† a change in the risk-adjusted mortality rate between 1999–2000 to 2001–2002 and 2002–2003 to 2004–2005 occurred in some provinces. Manitoba, Saskatchewan and Ontario saw a relative decrease in their mortality rates over this time period, while P.E.I. saw an increase.

Provincial results for stroke mortality are also mixed. For example, between 2002–2003 and 2004–2005 the risk-adjusted mortality rate for persons admitted with a new stroke was statistically significantly lower than the overall rate in Alberta and Ontario, and higher in B.C., Manitoba, Nova Scotia and Newfoundland and Labrador. In recent years, stroke risk-adjusted mortality rates have remained fairly stable in most provinces. None of the provinces saw a statistically significant change in risk-adjusted mortality rates relative to the overall rate between 1999–2000 to 2001–2002 and 2002–2003 to 2004–2005.†

Health Indicators: Want to Know More?

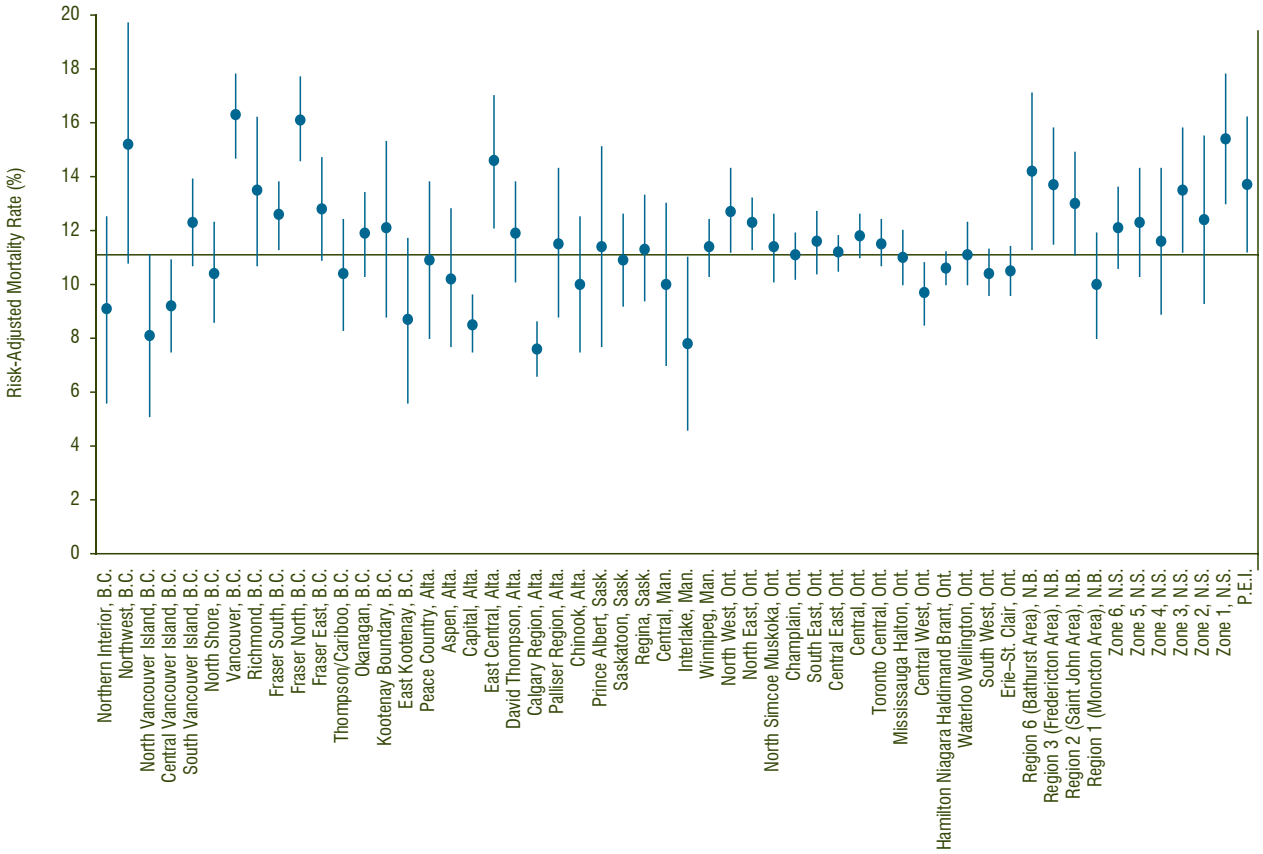
Since 1999, CIHI and Statistics Canada have collaborated on the Health Indicators project to produce a broad range of key health status and system performance indicators for health regions across the country. *Health Indicators 2006* reports on 23 key indicators for health regions with a population of 75,000 or more (covering approximately 95% of Canada's population). Additional information and comparative data on other indicators can be found in the *Health Indicators 2006* booklet that accompanies this report, as well as on our Web site, at www.cihi.ca.

† The risk adjustment for 2002–2003 to 2004–2005 is applied to the data from 1999–2000 to 2001–2002 to obtain comparable rates.

18

Regional Variations in Mortality Following an AMI

The risk-adjusted proportion of in-hospital deaths within 30 days of admission with a new AMI varies from region to region across Canada. Risk-adjusted mortality rates for larger health regions for 2002–2003 to 2004–2005 are shown (in circles) below. The rates are estimated to be accurate to within the range indicated by the vertical bars 19 times out of 20. This range corresponds to the 95% confidence interval for the risk-adjusted rate. The solid line indicates the overall rate (11.1%).



Note: Regions not shown in the graph are excluded due to small numbers or non-comparable data.

Sources: Hospital Morbidity Database, CIHI; Discharge Abstract Database, CIHI.

Link to E-publication

Taking Action: A Province's Story

Improving Cardiovascular Outcomes in Nova Scotia (ICONS) is a province-wide and population-based disease management program to assess and improve cardiovascular care. Launched in 1997 as a five-year project, it is now designated as a provincial program. The ICONS registry not only collects data on patients hospitalized with cardiovascular diseases, it also encourages people in the community with a prior cardiovascular hospitalization and those over 55 years of age with diabetes and at least one other major modifiable risk factor to enrol in the registry.[22, 23]

The registry reports that results from the first five years for patients hospitalized with AMI show improvements in:

- **timely administration of clot-busting drugs**
- **in-hospital mortality rates**
- **number of patients prescribed recommended medications at discharge[22]**

Nova Scotia's AMI 30-day in-hospital risk-adjusted mortality rate remains above the overall rate, but it has decreased—from 14.3%† in 1999–2000 to 2001–2002 to 12.8% in 2002–2003 to 2004–2005.

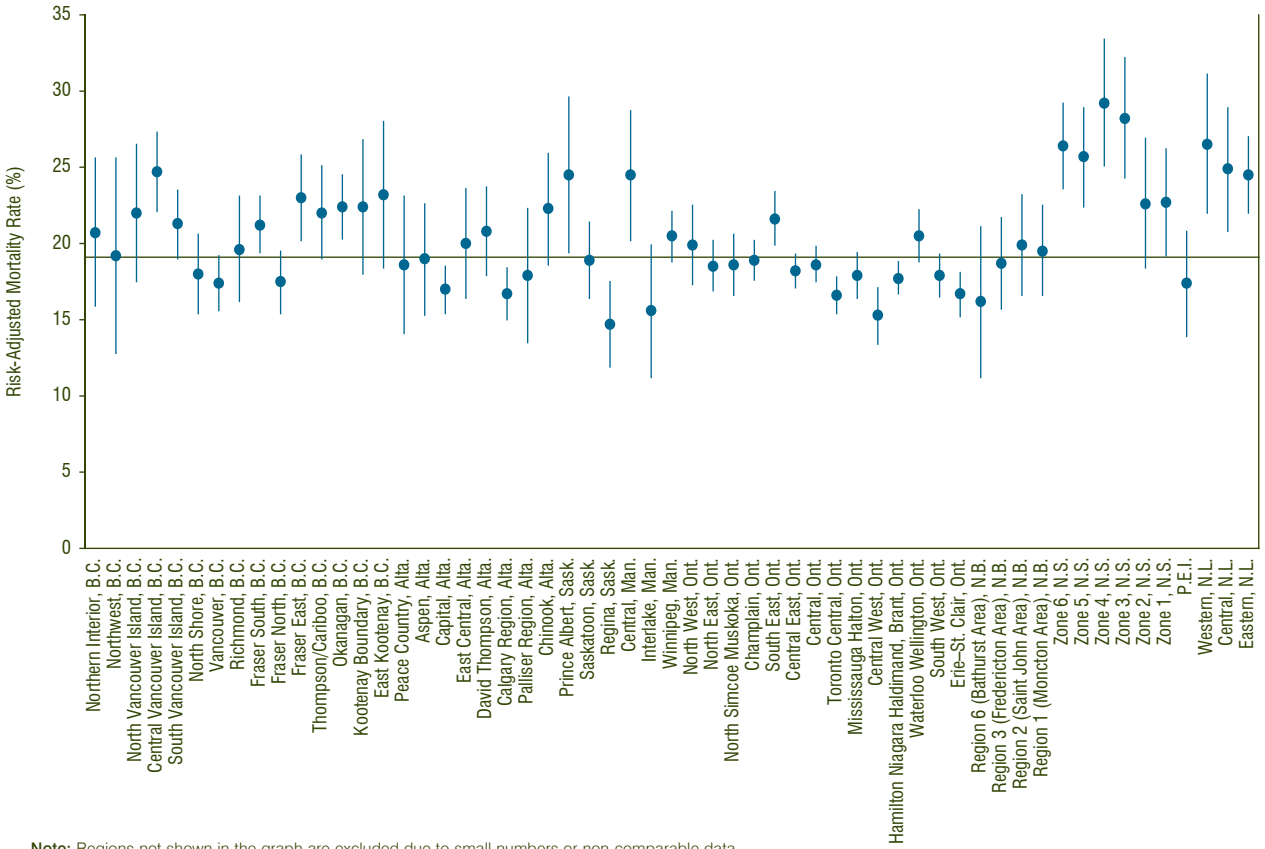
† Based on the same risk adjustment for 2002–2003 to 2004–2005.

Survival rates also vary within provinces. After risk adjustment, we found that most large regions had rates that were about the same as the overall average. But some were substantially above or below the average. For example, between 2002–2003 and 2004–2005, 30-day in-hospital AMI risk-adjusted mortality rates in some parts of Alberta were almost double those in other regions of the province. Likewise, while Saskatchewan's stroke risk-adjusted mortality rate (19.7%) for this period was about the same as the overall rate (19.1%), regions within the province had rates ranging from 14.7% to 24.5%.

19

Regional Variations in Mortality Following a Stroke

The risk-adjusted proportion of in-hospital deaths within 30 days of admission with a new stroke varies from region to region across Canada. Risk-adjusted mortality rates for larger health regions for 2002–2003 to 2004–2005 are shown (in circles) below. The rates are estimated to be accurate to within the range indicated by the vertical bars 19 times out of 20. This range corresponds to the 95% confidence interval for the risk-adjusted rate. The solid line indicates the overall rate (19.1%).



Note: Regions not shown in the graph are excluded due to small numbers or non-comparable data.

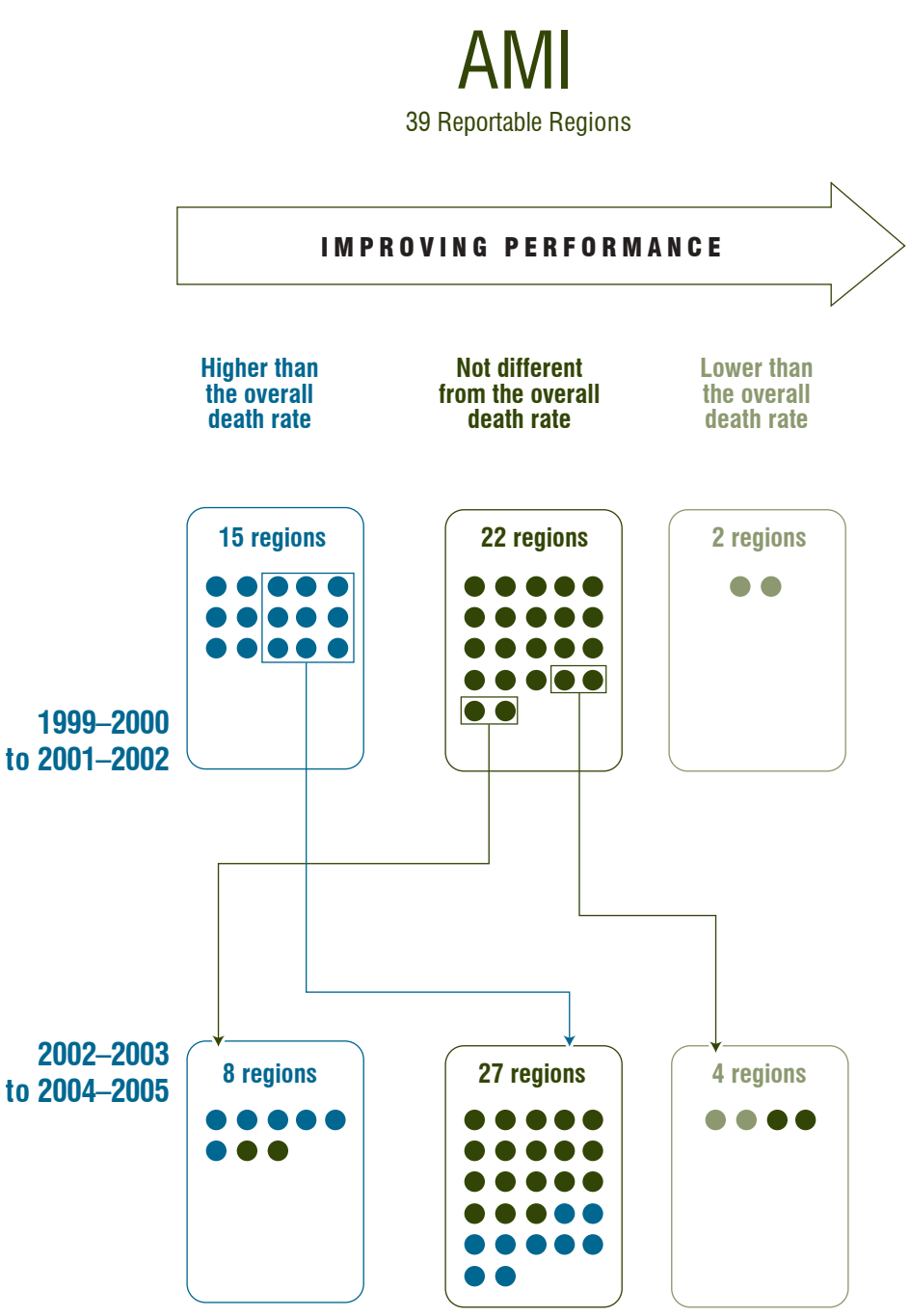
Sources: Hospital Morbidity Database, CIHI; Discharge Abstract Database, CIHI.

Link to E-publication

20

Regional Trends

Overall, 30-day in-hospital death rates for patients admitted with a new acute AMI have fallen since 1999–2000. Most regions with risk-adjusted mortality rates that were not statistically significantly different from the overall rate in 1999–2000 to 2001–2002 were still in this category by 2002–2003 to 2004–2005. The same was true for regions with higher or lower rates. A few regions did see a change in their relative positions, as depicted in the diagrams below. Trends and rates for both AMI and stroke are available in *Health Indicators 2006*.



Notes: Includes only regions where data were available for both time periods. Not all regions from other provinces and territories are included due to small numbers. The 2002–2003 to 2004–2005 region definitions and risk adjustment are applied to the 1999–2001 to 2001–2002 data to obtain comparable rates.

Sources: Hospital Morbidity Database, CIHI; Discharge Abstract Database, CIHI.

Why this variation? Some of the differences may be due to risk factors or conditions that we were not able to adjust for. For example, research in Ontario has shown that, all else being equal, lower-income patients are more likely to die within one year of a heart attack than higher-income patients.[12] Other differences may relate to access to, or to the quality care of, health services or other reasons. What we do know is that many lives could be saved each year if all regions were able to achieve mortality rates similar to the best performers or even the overall rate.

For example, if all regions with higher rates across Canada had been able to achieve the overall rate, there would have been approximately 821 fewer deaths between 2002–2003 and 2004–2005 (345 among patients with a new AMI† and 476 among those with a new stroke‡).

Just as death rates vary from region to region, so do trends. Most regions maintained their relative position over time. For example, 18 regions with AMI risk-adjusted mortality rates that were about the same as the overall rate between 1999–2000 and 2001–2002 maintained this position between 2002–2003 and 2004–2005. Among the remaining regions, 11 regions saw a relative improvement in their risk-adjusted mortality rate and 2 regions saw a statistically significant relative increase in risk-adjusted mortality rate. A wide range of factors may explain these trends. Some relate to the health care that patients received, while others do not.

Taking Action: A Health Region's Success Story

Reporting mortality rates can suggest opportunities to improve the quality of care.[13] When *Health Indicators 2002* showed that the Champlain region's (Ottawa area) 30-day in-hospital AMI mortality rates were higher than the overall rate (14.1% vs. 12.6%),[14] the Ottawa Heart Institute and its partners took action. The institute brought together CEOs from area hospitals, paramedics and representatives from the Ontario Ministry of Health and Long-Term Care to devise a new treatment protocol to change the way emergency services dealt with AMI patients.

A number of changes were made as a result. For example, qualifying patients can now be brought directly to a catheterization laboratory rather than to the emergency department (ED). This occurred because paramedics have now been trained to recognize a myocardial infarction waveform on an electrocardiogram, a recording of the electrical activity of the heart, allowing them to bypass the ED in certain circumstances. In addition, depending on their proximity to a hospital with a catheterization laboratory and the patient's condition, they may also bypass the nearest hospital to go to one with this type of facility.[15] The Ottawa Heart Institute reports that the result of these and other steps has been a substantial reduction in time to treatment, because the need for transferring patients after admission to another hospital with more specialized facilities is reduced.[16]

How Does Canada Compare?

International comparisons of AMI and stroke mortality rates are difficult. Countries collect hospital data in different ways, organize care differently and have other differences that may affect survival rates. A recent Organisation for Economic Co-operation and Development (OECD) project attempted to compare 30-day in-hospital mortality for a number of countries. Using different methods than those used in this report, 20 countries reported crude 30-day in-hospital AMI mortality rates and 17 reported crude in-hospital stroke mortality rates for the first time earlier this year. Although imperfect, this project was a first step toward making comparable international data available. Canada's rates were higher than many, but not all, countries for AMI mortality. Our mortality rates for ischemic and hemorrhagic stroke were about the same as those in Australia and the Netherlands respectively, but higher than those in many other countries.[17] In the future, the OECD hopes to build on this initial work to move towards more comparable estimates of mortality.

† Excludes regions from Quebec and Newfoundland and Labrador, as well as regions whose rates are not reportable due to small numbers. Data for Nunavut are not available due to incomplete submission.

‡ Excludes regions from Quebec and regions whose rates are not reportable due to small numbers. Data for Nunavut are not available due to incomplete submission.

21

Outcomes in Canada and the U.S.

Many researchers have compared practice patterns and outcomes following heart attacks for different countries. The table below illustrates how challenging such comparisons, and interpreting their results, can be. It highlights key features and findings of four recent studies comparing the experience of heart attack patients in Canada and the U.S. More recently, the OECD has attempted to compare outcomes across a broader range of countries.[17] This project highlighted the challenges and potential of international comparisons of health outcomes.

Study	Population	Data Year(s)	Intervention Rates	30-Day Mortality	Long-Term Mortality
Pilote et al. (2003)[18]	Quebec age 65+; U.S. age 65+	1988–1994	Growth in the use of procedures (catheterization, CABG, PCI, angioplasty), especially in the first days after AMI, was much more rapid in the U.S.	Mortality at 30 days declined by an average of 0.28 percentage points less per year in Quebec ($p<0.05$). For AMI patients 75 years and over, 30-day mortality declined approximately twice as rapidly in the U.S. as in Quebec ($p<0.01$). No significant difference found for those 65 to 74.	No significant difference in decline in one-year mortality for those aged 65–74. For patients 75+, one-year mortality declined about twice as rapidly in the U.S. as in Quebec.
Kaul et al. (2004)[19]	Patients with ST-elevation AMI at participating hospitals across Canada and the U.S.	1990–1993	U.S. rates of angioplasty and bypass surgery during a patient's first hospitalization were significantly higher than those in Canada.	Not measured.	Canadian participants had a higher chance of death within five years than those in the U.S. after adjustments were made.
Tu et al. (1997)[20]	Ontario age 65+; U.S. age 65+	1991	U.S. rates for angiography, angioplasty and bypass surgery in the first 30 days after AMI were significantly higher than those in Canada.	Unadjusted mortality was lower in the U.S. (21.4% vs. 22.3%).	No difference in unadjusted one-year mortality.
Fu et al. (2000)[21]	Patients with non ST-elevation AMI at participating hospitals across Canada and the U.S.	1994–1995[22]	Interventions (angiography, angioplasty and bypass surgery) were performed significantly more often and sooner in the U.S.	No significant difference between Canada and the U.S. after adjusting for baseline characteristics, for example, smoking status.	No significant difference at six months and one year between Canada and the U.S. after adjustment made for baseline characteristics.

Information Gaps: Some Examples

What We Know

- How mortality rates (adjusted for age, sex and selected comorbidities) in the first 30 days after initial hospitalization with an AMI or stroke compare at the provincial and regional levels.
- How 30-day in-hospital AMI and stroke mortality rates are changing over time, overall and by province.
- How survival rates for different types of stroke vary.
- How many regions have 30-day in-hospital AMI and stroke mortality rates that either decreased, stayed about the same or increased in recent years.

What We Don't Know

- How does short-term survival following a new AMI and stroke compare in regions where rates cannot currently be calculated? What variations exist in longer-term survival and other health outcomes?
- What explains regional differences and trends in 30-day in-hospital AMI and stroke mortality?
- How do results in Canada compare with those in other countries? What factors explain international differences in the frequency of heart attacks and strokes, as well as in patient outcomes?

What's Happening

- The OECD Health Care Quality Indicators Project will continue to address comparability issues between participating countries and to investigate variations in 30-day in-hospital AMI and stroke mortality rates. Planned future work also includes updating current indicators and developing new ones in areas such as diabetes, patient safety, primary care and prevention.
- The registry of the Canadian Stroke Network, in collaboration with the Institute for Clinical Evaluative Sciences, continues to collect data on stroke patients at participating hospitals in eight provinces. Data are collected on demographics, stroke severity, risk factor profiles, care received, outcomes and more.

For More Information

1 Organisation for Economic Co-operation and Development, *Health at a Glance—OECD Indicators 2005* (Paris, France: OECD Publishing, 2005).

2 J. V. Tu and C. Cameron, "Impact of an Acute Myocardial Infarction Report Card in Ontario, Canada," *International Journal for Quality in Health Care* 15, 2 (2003): pp. 131–37.

3 Heart and Stroke Foundation of Ontario, *The Growing Burden of Heart Disease and Stroke in Canada, 2003* (Ottawa: Heart and Stroke Foundation of Canada, 2003).

4 J. V. Tu, P. C. Austin, C. D. Naylor, K. Iron and H. Zhang, *Acute Myocardial Infarction Outcomes in Ontario*, eds. C. D. Naylor and P. Slaughter (Toronto: Institute for Clinical Evaluative Sciences, 1999), pp. 83–110.

5 Canadian Institute for Health Information, *Inpatient Hospitalizations and Average Length of Stay Trends in Canada, 2003–2004 and 2004–2005* (Ottawa: CIHI, 2005).

6 S. Yusuf, S. Hawken, S. Ounpuu, T. Dans, A. Avezum, F. Lanas, M. McQueen, A. Budaj, P. Pais, J. Varigos, L. Lisheng and INTERHEART Study Investigators, "Effect of Potentially Modifiable Risk Factors Associated With Myocardial Infarction in 52 Countries (the INTERHEART Study): Case-Control Study," *Lancet* 364, 9438 (2004): pp. 937–52.

7 World Health Organization, *The Atlas of Heart Disease and Stroke*, eds. J. Mackay and G. A. Mensah (Geneva: WHO, 2004).

8 I. Andersen, M. Gamborg, M. Osler, E. Prescott and F. Diderichsen, "Income as Mediator of the Effect of Occupation on the Risk of Myocardial Infarction: Does the Income Measurement Matter?," *Journal of Epidemiology and Community Health* 59, 12 (2005): pp. 1080–85.

9 M. K. Kapral, H. Wang, M. Mamdani, J. V. Tu, B. Boden-Albala and R. L. Sacco, "Effect of Socioeconomic Status on Treatment and Mortality After Stroke," *Stroke* 33, 1 (2002): pp. 268–75.

10 ICONS, *ICONS Website* (2004), [online], cited April 20, 2006, from <www.icons.ns.ca>.

11 Centre for Chronic Disease Prevention and Control Cardiovascular Disease, *Inventory of Canadian Cardiovascular Disease Databases* (Public Health Agency of Canada, December 29, 2003), [online], from <www.phac-aspc.gc.ca/ccdpc-cpcmc/cvd-mcv/ccdb/cvd46_e.html>.

12 D. A. Alter, C. D. Naylor, P. Austin and J. V. Tu, "Effects of Socioeconomic Status on Access to Invasive Cardiac Procedures and on Mortality After Acute Myocardial Infarction," *New England Journal of Medicine* 341, 18 (1999): pp. 1359-1367.

13 A. D. Brown, H. Bhimani and H. MacLeod, "Making Performance Reports Work," *Healthcare Papers* 6, 2 (2005): pp. 8-22.

14 Canadian Institute for Health Information, *Health Indicators 2002* (Ottawa: Canadian Institute for Health Information, 2002), p. 9.

15 M. R. Le May, R. Dionne, J. Maloney, J. Trickett, I. Watpool, M. Ruest, M. Labinaz, P. Doucette, S. Ryan and R. F. Davies, "Paramedics Independently Triage Patients for Primary Percutaneous Angioplasty (Oral Abstract Presentation, CCC 2005)," *Canadian Journal of Cardiology* 21, Suppl. C (2005): p. 194C.

16 D. Y. F. So, A. C. T. Ha, M. A. Turek, J. P. Maloney, L. A. Higginson, R. F. Davies, S. C. Ryan and M. R. Le May, "Comparison of Mortality Patterns in Patients With ST-Elevation Myocardial Infarction Arriving by Emergency Medical Services Versus Self-Transport (From the Prospective Ottawa Hospital STEMI Registry)," *The American Journal of Cardiology* 97, 4 (2006): pp. 458–61.

17 S. Mattke, E. Kelley, P. Scherer, J. Hurst, M. L. Gil Lapetra and the HCQI Expert Group Members, *Health Care Quality Indicators Project Initial Indicators Report* (Paris: OECD, 2006).

18 L. Pilote, O. Saynina, F. Lavoie and F. McClellan, "Cardiac Procedure Use and Outcomes in Elderly Patients With Acute Myocardial Infarction in the United States and Quebec, Canada, 1988 to 1994," *Medical Care* 41, 7 (2003): pp. 813–22.

19 P. Kaul, P. W. Armstrong, W. C. Chang, C. D. Naylor, C. B. Granger, K. L. Lee, E. D. Peterson, R. M. Califf, E. J. Topol and D. B. Mark, "Long-Term Mortality of Patients With Acute Myocardial Infarction in the United States and Canada: Comparison of Patients Enrolled in Global Utilization of Streptokinase and T-PA for Occluded Coronary Arteries (GUSTO)-I," *Circulation* 110, 13 (2004): pp. 1754–60.

20 J. V. Tu, C. L. Pashos, C. D. Naylor, E. Chen, S. L. Normand, J. P. Newhouse and B. J. McNeil, "Use of Cardiac Procedures and Outcomes in Elderly Patients With Myocardial Infarction in the United States and Canada," *The New England Journal of Medicine* 336, 21 (1997): pp. 1500–05.

21 Y. Fu, W. C. Chang, D. Mark, R. M. Califf, B. Mackenzie, C. B. Granger, E. J. Topol, M. Hlatky and P. W. Armstrong, "Canadian-American Differences in the Management of Acute Coronary Syndromes in the GUSTO IIb Trial: One-Year Follow-Up of Patients Without ST-Segment Elevation," *Circulation* 102, 12 (2000): pp. 1375–81.

22 The Global Use of Strategies to Open Occluded Coronary Arteries (GUSTO) IIb Investigators, "A Comparison of Recombinant Hirudin With Heparin for the Treatment of Acute Coronary Syndromes," *The New England Journal of Medicine* 335, 11 (1996): pp. 775–82.

4

Who Is at Most Risk?

4 Who Is at Most Risk?

Heart attack and stroke patients in some regions are older or have more health problems than in others. All else being equal, they are more likely to die. To make comparisons between regions as fair as possible, we adjust mortality rates based on the distribution of age, sex and health problems among patients in each region. The data used in this process also provide interesting insights into how much more likely some people are to die after a heart attack or stroke than others.

This chapter highlights findings for three specific factors—age, sex and comorbidities (that is, other conditions noted in the data in addition to the heart attack or stroke). We adjust for each of these factors when calculating risk-adjusted, 30-day in-hospital mortality rates following admission with a new heart attack or stroke. In addition, we take into account the type of stroke experienced because research has shown that patients with different types of strokes have very different risks of dying. Our approach builds on methods developed for use with administrative data. Similar models were validated in studies in Ontario, Manitoba, the U.S. and elsewhere.[1]

The Risk of Dying Rises With Age

The chance of having a heart attack or stroke rises with age—as does the risk of dying after having had one.[9–11] New analyses conducted for this report show that, even after adjusting for sex and comorbidities, the chance that a person aged 50 to 64 admitted to hospital with a new heart attack will die in hospital in the next 30 days is more than two times higher than for those under 50.† Risks are even greater for seniors. The risk of dying is 6 times higher for those aged 65 to 74 and 14 times higher for those aged 75 and older. (All risks are relative to those aged 50 years or less.)

Differences are not quite as large for patients who have strokes, but they are still important. The risk of dying is two times higher for those aged 65 to 74 and four times for those aged 75 and older than for those under 50.

† Throughout this chapter, results are based on data for 2004–2005 from all parts of Canada except B.C., Quebec and Newfoundland and Labrador (for AMI only). For more information about the inclusion and exclusion criteria, see Chapter 3 and the technical notes at www.cihi.ca.

Income Matters

Many factors may influence regional variations in short-term mortality rates, not all of which are well understood. For example, researchers have shown that the underlying health status of a population; socio-economic status; family and social support; severity of illness; preventive interventions; and care before, during and after a hospital stay can all matter.[2–4]

A number of studies have focused on the relationship between the risk of dying from cardiovascular disease and socio-economic status. Overall mortality rates for cardiovascular disease tend to be higher for men and women with lower incomes than for the population as a whole.[5] The relationship persists—but is less marked—even when other factors, such as pre-existing conditions, are taken into account. For instance, a recent study found that differences in two-year crude mortality rates across high- and low-income groups dropped by 40% after demographic factors such as age were adjusted for.[6] They fell an additional 27% after pre-existing risks for cardiovascular disease were taken into consideration. Thus, the distribution of demographic factors and pre-existing risks partly explains differences in mortality rates across low- and high-income earners, but it does not explain all of the differences.

Another study showed a relationship between neighbourhood income and stroke mortality rates.[2] For every $10,000 increase in median neighbourhood income, the risk of death at 30 days after a stroke dropped by 9%.† Long-term survival was also affected. There was a 5% reduction in the risk of death within one year of a stroke for every $10,000 increase in median neighbourhood income.‡ This relationship between median neighbourhood income and short- and long-term stroke mortality held even after adjusting for age, sex and comorbidities, as well as physician and hospital characteristics. The study did not adjust for the severity of illness, but the authors stated that there was no documented association between stroke severity and socio-economic status.

Differences in processes of care have also been linked to income. For example, research shows that people with lower incomes, or those from lower-income neighbourhoods, are less likely to:

- be admitted to a high-volume hospital following a stroke[2]
- be treated by a specialist for a stroke or heart attack[2, 6]
- receive invasive cardiac procedures after a heart attack[7, 8]

† This study found an odds ratio of 0.91, with a 95% confidence interval (0.87 to 0.96). The difference was statistically significant ($p<0.001$).
‡ This study found an odds ratio of 0.95 with a 95% confidence interval (0.92 to 0.99). The difference was statistically significant ($p<0.01$).

The Experience of Men and Women

Men and women face different risks of having and dying from a heart attack or stroke.[11, 14–16] Our analysis found that more men than women were admitted to hospital with a heart attack. They were also younger than female patients. In contrast, stroke patients were about equally split between the sexes, but there were differences in the types of stroke experienced. For example, more women than men were admitted to hospital with a subarachnoid hemorrhagic stroke.

Mortality rates also differ by sex. Women with a new heart attack were 16% more likely to die in hospital within 30 days of admission than men in 2004–2005, after age and comorbidity were taken into account. For stroke, death risks were also higher for women than for men, but the difference was less pronounced. Women were 11% more likely to die in hospital within 30 days of admission with a new stroke than men, all else being equal.

22

Differences by Sex

In 2004–2005, there were a number of differences between male and female patients admitted to hospital with a new heart attack (acute myocardial infarction, or AMI) or stroke, as the table below shows. In some cases, however, these differences disappeared after other factors were taken into account. For example, women who had heart attacks had more comorbidities on average than did men. But this difference was no longer statistically significant after adjusting for age differences among men and women who have heart attacks.

	Male	Female	Statistically Significant Difference Between Men and Women (p <.05)
% New AMI Episodes (n = 27,503)	63	37	Yes
% New Stroke Episodes (n = 19,197)	49	51	Yes
Average Age at Admission With AMI	66	74	Yes
Average Age at Admission With Stroke	71	75	Yes
% Hemorrhagic Stroke (n = 4,256)	48	52	No
% Intracerebral Hemorrhage (n = 2,088)	48	52	No
% Subarachnoid Hemorrhage (n = 1,061)	36	64	Yes
% Other or Unspecified Hemorrhage (n = 1,107)	61	39	Yes
AMI—Average Number of Selected Comorbidities (Age-Adjusted)	0.34	0.46	No
Stroke—Average Number of Selected Comorbidities (Age-Adjusted)	0.17	0.18	No

Notes: The hemorrhagic types of stroke in the table above are ranked from highest to lowest mortality rate. The comorbidities considered in the average number are limited to those included in the risk adjustment. Data from B.C. and Quebec are excluded due to historically different coding of admissions from the emergency room and diagnosis types, respectively. Data from Newfoundland and Labrador are additionally excluded for AMI due to different coding of this condition.

Source: Discharge Abstract Database, CIHI.

Co-Existing Illnesses

AMI or stroke patients sometimes suffer from other ("comorbid") conditions in addition to their heart attack or stroke. These conditions may increase the risk of death for affected individuals. For example, patients admitted with a new heart attack or stroke who also have cancer are more likely to die in hospital than those who do not.

CIHI's 30-day in-hospital regional mortality rates adjust for a number of comorbid conditions that are known to increase the risk of short-term death for AMI or stroke patients.[17, 18] Clinical experts and a review of previous outcome studies helped us to identify the specific conditions that we included.

Some conditions matter more than others. For example, even after taking age, sex and other health problems into account, new heart attack and stroke patients admitted with shock were over ten times more likely to die in hospital within 30 days than those who did not have this condition. In contrast, patients admitted with chronic renal disease in addition to their heart attack were 31% more likely to die than those without the disease. For stroke, patients who also had chronic renal disease were not significantly more likely to die than those who did not have chronic renal disease.

Thinking About Data Quality

In any data analysis, the quality of the information being used is an important consideration. For example, if there are systematic differences in data collection or coding from place to place (or over time), this may affect results.

Reabstraction studies suggest that accuracy rates for many of the data elements that we use to calculate mortality rates—such as birth date, admission and discharge dates, death, sex and health card number—are between 97% and 100%. The accuracy of diagnosis information varies by condition.[19] Previous multicentre audits of AMI coding accuracy have shown a sensitivity of 95% and a specificity of 88% for the coding of the most responsible diagnosis of AMI in the Ontario portion of the Discharge Abstract Database.[20] Furthermore, in a reabstraction study conducted in Ontario, all hospitals but one reported self-audit accuracy rates of 94% or more.[17]

Researchers have also explored whether the accuracy with which comorbidities are coded or the fact that not all risk factors (or comorbidities) could be included in the statistical models is likely to affect results. On the first question, researchers examined the prevalence of comorbidities across institutions in relation to mortality rates. Additionally, they conducted sensitivity analyses by comparing risk-adjusted mortality rates that either included or excluded comorbid conditions and found a very high correlation ($r = 0.95$) between the two rates.[17] In other words, after adjusting for age and sex, researchers found that differences in comorbidities led to relatively small changes in hospitals' mortality rates. All changes lay within the 99% confidence interval of a hospital's risk-adjusted mortality rate.[17]

Likewise, results from a model to predict mortality based on administrative data were shown to be very similar to the model based on clinical registry data.[1] A 1996 California AMI validation study also showed that unmeasured clinical risk factors account for less than 10% of observed differences in risk-adjusted mortality rates across hospitals.[21]

For more information about data quality, please see www.cihi.ca.

Putting It All Together

Age, sex and comorbidities are each related to a patient's risk of dying, but they are also often related to one another. For example, older patients are more likely to have multiple pre-existing conditions when they are admitted to hospital with a new heart attack or stroke.

In this analysis, we were particularly interested in how each factor affects the odds of dying, after adjusting for the effect of the others. For example, even after taking age, sex and a selection of comorbidities into account, hemorrhagic strokes are at least twice as likely to be fatal as ischemic strokes.

Other factors present on admission to hospital may also matter, although we were not able to take them into account when calculating regional mortality rates. For example, some studies suggest that the severity of illness[2] (beyond comorbidities), patients' socio-economic status[2, 6, 22] and even the time from symptom recognition to presentation, as well as treatment delays may be related to the risk of dying from a heart attack or stroke.[23]

Likewise, patients' experiences and care during and after their hospital stay may affect their outcomes. We explore a number of factors of this type in Chapters 5 and 6.

Overall, age and a diagnosis of shock tended to have the largest effect on mortality risk for patients with a new heart attack. These factors, plus the type of stroke experienced, were also among the most important predictors of mortality following a new stroke.

What Is an Odds Ratio?

An odds ratio indicates the strength of the association between a predictor and an outcome—for example, age and mortality.[12] It is also a way of comparing the *likelihood* of an outcome for multiple groups.[12] For instance, using males as the reference group, suppose the odds ratio for females is 1. This means that the event is equally likely for both sexes. If the number is greater than 1, the event is more likely for females. If it is less than 1, women are less likely to experience the outcome in question.[12, 13]

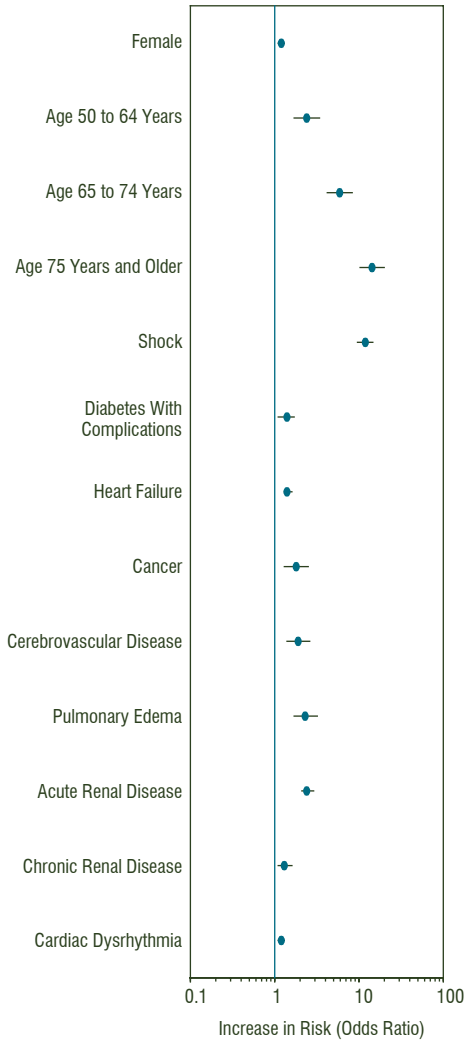
When patients with an intracerebral hemorrhage (rupture of a blood vessel within the brain) are compared to patients with ischemic strokes, our data show that the odds ratio is about 5. This means that patients with an intracerebral hemorrhage are, on average, five times more likely to die in hospital within 30 days than patients who experienced an ischemic stroke.

An odds ratio is a point estimate of the strength of the association.[13] Confidence intervals tell us how precise the estimate is and help determine whether differences between groups are statistically significant. A 95% confidence interval provides a range within which the true value falls 19 times out of 20. For example, the odds ratio for mortality in hospital within 30 days of admission with a new AMI was 1.16 for women relative to men. Thus the risk of dying was 16% higher for women than for men. The 95% confidence interval associated with this odds ratio was 1.1 and 1.3. Because 1.0 is outside the confidence interval of 1.1 to 1.3, this association is statistically significant, based on our study sample.

Mortality Risk Following an AMI

23

The graph below shows how the factors that we take into consideration when calculating 30-day in-hospital mortality rates affect the risk of dying for patients admitted with a new AMI. The circles show the odds ratios or estimated increases in risk relative to others (for example, females relative to males) for 2004–2005, taking into account the effect of other factors considered in the model. The odds ratios are estimated to be accurate to within the range indicated by the horizontal bars 19 times out of 20 (that is, the 95% confidence intervals). For example, patients admitted to hospital with a new AMI who also have a diagnosis of shock are almost 12 times more likely to die in hospital within 30 days than those without this condition, all else being equal.



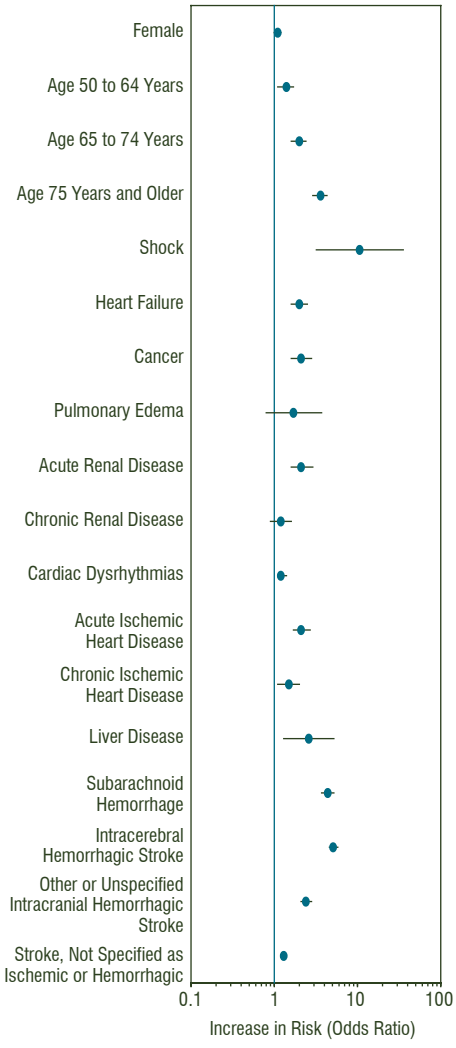
Notes: Data from B.C., Quebec and Newfoundland and Labrador are excluded due to different coding of admissions from the emergency room, diagnosis types and AMI, respectively.

Source: Discharge Abstract Database, CIHI.

Mortality Risk Following a Stroke

24

The graph below shows how the factors that we take into consideration when calculating 30-day in-hospital mortality rates affect the risk of dying for patients admitted with a new stroke. The circles show the odds ratios or estimated increases in risk relative to others (for example, females relative to males) for 2004–2005, taking into account the effect of other factors considered in the model. The odds ratios are estimated to be accurate to within the range indicated by the horizontal bars 19 times out of 20 (that is, the 95% confidence intervals). For example, patients admitted to hospital with a new stroke who also have a diagnosis of shock are almost 11 times more likely to die in hospital within 30 days than those without this condition, all else being equal.



Notes: Data from B.C. and Quebec are excluded due to different coding of admissions from the emergency room and diagnosis types respectively.

Source: Discharge Abstract Database, CIHI.

For More Information

1 J. V. Tu, P. C. Austin, R. Walld and L. Roos, "Development and Validation of the Ontario Acute Myocardial Infarction Mortality Prediction Rules," *Journal of the American College of Cardiology* 37, 4 (2001): pp. 992–97.

2 M. K. Kapral, H. Wang, M. Mamdani, J. V. Tu, B. Boden-Albala and R. L. Sacco, "Effect of Socioeconomic Status on Treatment and Mortality After Stroke * Editorial Comment," *Stroke* 33, 1 (2002): pp. 268–75.

3 G. W. Stone, C. L. Grines, K. F. Browne, J. Marco, D. Rothbaum, J. O'Keefe, G. Hartzler, P. Overlie, B. Donohue, N. Chelliah, G. C. Timmis, R. Vlietstra, M. Strezelecki, S. Puchrowicz-Ochocki and W. W. O'Neill, "Predictors of in-Hospital and 6-Month Outcome After Acute Myocardial Infarction in the Reperfusion Era: The Primary Angioplasty in Myocardial Infarction (PAMI) Trial," *Journal of the American College of Cardiology* 25, 2 (1995): pp. 370–77.

4 P. S. Romano, L. L. Remy and H. S. Luft, *Second Report of the California Hospital Outcomes Project (1996): Acute Myocardial Infarction Volume Two: Technical Appendix—Chapter014* (1996), [online], from <http://repositories.cdlib.org/chsrpc/coshpd/chapter014>.

5 R. Wilkins, J.-M. Berthelot and E. Ng, *Trends in Mortality by Neighbourhood Income in Urban Canada From 1971 to 1996* (Ottawa: Statistics Canada, 2002).

6 D. A. Alter, A. Chong, P. C. Austin, C. Mustard, K. Iron, J. I. Williams, C. D. Morgan, J. V. Tu, J. Irvine and C. D. Naylor for the SESAMI Study Group, "Socioeconomic Status and Mortality After Acute Myocardial Infarction," *Annals of Internal Medicine* 144, 2 (2006): pp. 82–93.

7 L. Pilote, C. A. Beck, I. Karp, D. Alter, P. Austin, J. Cox, K. Humphries, C. Jackevicius, H. Richard, J. V. Tu and Canadian Cardiovascular Outcomes Research Team, "Secondary Prevention After Acute Myocardial Infarction in Four Canadian Provinces, 1997–2000," *Canadian Journal of Cardiology* 20, 1 (2004): pp. 61–67.

8 D. A. Alter, K. Iron, P. C. Austin and C. D. Naylor, "Socioeconomic Status, Service Patterns, and Perceptions of Care Among Survivors of Acute Myocardial Infarction in Canada," *Journal of the American Medical Association* 291, 9 (2004): pp. 1100–07.

9 V. Vaccarino, R. I. Horwitz, T. P. Meehan, M. K. Petrillo, M. J. Radford and H. M. Krumholz, "Sex Differences in Mortality After Myocardial Infarction: Evidence for a Sex-Age Interaction," *Archives of Internal Medicine* 158, 18 (1998): pp. 2054–62.

10 J. M. Boucher, N. Racine, T. H. Thanh, E. Rahme, J. Brophy, J. LeLorier and P. Theroux, "Age-Related Differences in in-Hospital Mortality and the Use of Thrombolytic Therapy for Acute Myocardial Infarction," *Canadian Medical Association Journal* 164, 9 (2001): pp. 1285–90.

11 J. M. Holroyd-Leduc, M. K. Kapral, P. C. Austin and J. V. Tu, "Sex Differences and Similarities in the Management and Outcome of Stroke Patients," *Stroke* 31, 8 (2000): pp. 1833–37.

12 C. H. Hennekens, J. E. Buring and S. L. Mayrent, *Epidemiology in Medicine* (Boston, Massachusetts: Little Brown & Co., 1987).

13 A. Worster and B. H. Rowe, "Measures of Association: An Overview With Examples From Canadian Emergency Medicine Research," *Canadian Journal of Emergency Medicine* 3, 3 (2001).

14 J. Marrugat, M. Gil, R. Masia, J. Sala, R. Elosua, J. M. Anto and R. the REGICOR Investigators, "Role of Age and Sex in Short-Term and Long Term Mortality After a First Q Wave Myocardial Infarction," *Journal of Epidemiology and Community Health* 55, 7 (2001): pp. 487–93.

15 J. Roquer, A. R. Campello and M. Gomis, "Sex Differences in First-Ever Acute Stroke," *Stroke* 34, 7 (2003): pp. 1581–85.

16 S. C. Gan, S. K. Beaver, P. M. Houck, R. F. MacLehose, H. W. Lawson and L. Chan, "Treatment of Acute Myocardial Infarction and 30-Day Mortality Among Women and Men," *The New England Journal of Medicine* 343, 1 (2000): pp. 8–15.

17 J. V. Tu, P. C. Austin, C. D. Naylor, K. Iron and H. Zhang, *Acute Myocardial Infarction Outcomes in Ontario*, eds. C. David Naylor and P. Slaughter (Toronto: Institute for Clinical Evaluative Sciences, 1999), pp. 83–110.

18 N. Weir and M. S. Dennis, "Towards a National System for Monitoring the Quality of Hospital-Based Stroke Services," *Stroke* 32, 6 (2001): pp. 1415–21.

19 Canadian Institute for Health Information, *Data Quality of the Discharge Abstract Database Following the First-Year Implementation of ICD-10-CA/CCI—Final Report* (Ottawa: CIHI, 2004), [online], from <http://www.cihi.ca>.

20 J. Cox, M. P. Melady, E. Chen and C. D. Naylor, "Towards Improved Coding of Acute Myocardial Infarction in Hospital Discharge Abstracts: A Pilot Project," *The Canadian Journal of Cardiology* 13, 4 (1997): pp. 351–58.

21 P. S. Romano, L. L. Remy and H. S. Luft, *Second Report of the California Hospital Outcomes Project (1996): Acute Myocardial Infarction Volume Two: Technical Appendix—Chapter015* (1996), [online], from <http://repositories.cdlib.org/chsrpc/coshpd/chapter014>.

22 L. Pilote, L. Joseph, P. Belisle and J. Penrod, "Universal Health Insurance Coverage Does Not Eliminate Inequities in Access to Cardiac Procedures After Acute Myocardial Infarction," *American Heart Journal* 146, 6 (2003): pp. 1030–37.

23 L. K. Newby, W. R. Rutsch, R. M. Califf, M. L. Simoons, P. E. Aylward, P. W. Armstrong, L. H. Woodlief, K. L. Lee, E. J. Topol and F. Van de Werf, "Time From Symptom Onset to Treatment and Outcomes After Thrombolytic Therapy," *Journal of the American College of Cardiology* 27, 7 (1996): pp. 1646–55.

5

The Care

The Care

5

When Tim first felt his chest tightening, he decided to wait and see if the pain would go away. He continued working, as he needed to make his deadline. He didn't realize he was having a heart attack. Across town, John was experiencing similar symptoms. He remembered that these were signs of a heart attack and called 911 immediately. Tim's delay in accessing care resulted in greater damage to his heart muscle. John, on the other hand, made a full recovery.

A heart attack (also called an acute myocardial infarction, or AMI) may seem sudden and unexpected. But often, the seeds of the problem were sown years, or even decades, earlier. Your genetics, demographics, physical and social environment, health behaviours and history, and other long-standing factors, may influence your chances of surviving a heart attack. So too may the health care you receive before, during and after the event. The same is true for strokes.

This chapter explores what we know and don't know about the care that Canadians who have heart attacks and strokes receive. In some cases, links between different types of care and patient outcomes are well understood; in others, our knowledge is still developing. The level of information available about various types of care also differs. We tend to know more, for example, about care of a patient in the hospital than we do about what happens before admission or after discharge.

Accessing Care

Timely access to appropriate care can affect the likelihood that someone who has a heart attack or a stroke will survive the event.[1] This depends on the patient recognizing initial symptoms early, seeking help quickly and receiving prompt treatment.

Symptom Recognition and Getting to Help in Time

A number of public education campaigns have attempted to raise awareness of key risk factors and warning signs for heart attacks and strokes. Chest pain is one of the best-known signs of a heart attack, but not all people who have chest pain related to a heart attack seek medical help immediately. And not all people who have heart attacks have chest pain. An American study conducted between 1994 and 1998 found that a third of patients diagnosed with an acute myocardial infarction did not have chest pain when they arrived at the hospital.[2] These individuals tended to delay seeking treatment and were less likely to receive potentially life-saving therapies. They were also twice as likely to die in hospital as those who did have chest pain.

In this study, women were more likely than men—and the old more likely than the young—to experience these "painless heart attacks." A recent Irish study echoed this finding.[3] The researchers found that women who had a heart attack were more likely than men to delay going to a hospital emergency department. They partly attributed this delay to the women's failure to recognize that their symptoms had an underlying cardiac cause. The study also showed that seniors were more likely to delay seeking treatment than those under the age of 65.

Time to Initial Treatment

Initial drug treatment or other interventions tend to be most effective when administered shortly after the onset of a heart attack or stroke.[11, 13]

In the case of a heart attack, this may involve either clot-busting (or *thrombolytic*) drugs to reintroduce blood flow and minimize tissue damage or a revascularization procedure (also called *percutaneous coronary intervention*, or PCI). Many international studies have compared outcomes of care among eligible heart attack patients who receive these two therapies. A recent meta-analysis suggests that those who have primary angioplasty tend to have better outcomes, but that the difference between their outcomes and those who receive drug therapy decreases over time.[5] For example, a 2003 study found that outcomes of the two treatments were about the same after a 62-minute delay.[6]

Nevertheless, not all hospitals—in Canada or elsewhere—perform angioplasties since they require specialized staff and technology that is often concentrated in centres of excellence. Still fewer can do so within minutes of a patient arriving at the emergency department. Therefore, thrombolytic drugs remain an important and widely used treatment.

Recent Canadian studies suggest that most eligible heart attack patients do receive drug therapy or PCI.[9, 10] But less than half do so within the 30-minute door-to-needle time recommended by Canadian guidelines[11, 12] as well as the American College of Cardiology and the American Heart Association guidelines.[1] For example, a study found that about a quarter of patients between 1999 and 2002 had door-to-needle time of more than one hour.[9]

Did You Know?

In 2004, Ipsos-Reid asked British Columbians about risk factors, physical symptoms and warning signs of a stroke. Less than a third (31%) of those polled correctly identified at least three risk factors for a stroke, such as smoking, being overweight and having high blood pressure. Fewer, 15%, correctly named three or more warning signs of a stroke (for example, sudden temporary loss of speech; sudden weakness; numbness or tingling in the face, arm or leg; and sudden loss of vision in one eye). That was up from 8% the year before.[4]

Pre-Hospital Treatment

Many patients who have heart attacks arrive at the hospital by ambulance. Given that minutes may matter, some experts argue that paramedics should begin tests and/or thrombolytic drug therapy. Some focus on early diagnosis. For example, Calgary's paramedics may conduct electrocardiograms (ECGs) en route to the hospital.[7] If the ECG results suggest a particular type of heart attack, the patient is taken directly to the catheterization lab, bypassing the emergency department. Other research focuses on early treatment. A number of studies have explored whether (or under what circumstances) it is best to administer thrombolytic drugs en route to the hospital.[5, 8]

Rapid treatment with thrombolytic drugs may also benefit patients who have ischemic strokes (clots), but not those with hemorrhagic strokes (bleeds). A CT scan is often used to distinguish between the two. A systematic review of the literature published in 2004 found that the best outcomes occur in patients treated with clot-busting drugs within 90 minutes of symptom onset.[13] Comprehensive data on door-to-needle time for ischemic strokes is not currently available in Canada. A 1997–1998 review in Ontario found that half of all urgent stroke patients admitted to a hospital with on-site CT technology waited two hours or less for their scan; the rest had longer waits.[14] The median wait time was 12 hours for those admitted to hospitals that did not have this technology. More recent data from the registry of the Canadian Stroke Network in September of 2005 reported the median wait time to CT scans of emergency department stroke patients to be 31 minutes.[15] For many patients, a CT scan is a necessary first step before drugs could be administered.

In the Hospital

Canadian hospitals treat thousands of patients with heart attacks and strokes each year. Emerging evidence is beginning to link the types of care patients receive and the organization of health services to patient outcomes, although the relationships are not fully understood.

Taking Advantage of Technology?

Experts suggest that the effectiveness of drug therapy drops steadily after the onset of a stroke. Since clot-busting drugs are not appropriate for all types of strokes, a consultation with a neurologist may be needed to determine if a stroke patient should receive the therapy. Most neurologists work in urban centres. Patients who live far away may not be able to reach them quickly, or at all. Telestroke programs aim to address this gap. They connect rural physicians with specialists who may live many miles away. German researchers found that patients who received the clot-busting drug tPA (tissue plasminogen activator) after a teleconsultation had similar complication rates to those who received the drug after an on-site consultation.[16] Telestroke in Canada is relatively new, so little is known about our health outcomes.

Where Patients Get Care

Most heart attack and stroke patients seek treatment at their nearest hospital, but they may not always be able to get all the care that they need there. Some patients subsequently transfer to other facilities, perhaps because their nearest hospital does not have the staff or technology required for specialized treatment.

In 2004–2005, 26% of patients with new heart attacks and 8% of those with new strokes were transferred at least once after admission.† Among AMI patients, transfers were most common in New Brunswick (37%) and least common in Manitoba (15%). Stroke patients in Ontario, New Brunswick, Nova Scotia and Newfoundland and Labrador were significantly less likely to change hospitals (5 to 7% did so) than those in Alberta, Saskatchewan and Manitoba (11 to 19%).

Across the country, some types of patients are more likely to be transferred than others. For example, younger patients and those without comorbidities have higher transfer rates. This may partly reflect the fact that these types of patients tend to be easier to stabilize, a prerequisite for many transfers.[17]

† Results are based on data for 2004–2005 from all parts of Canada except B.C., Quebec and Newfoundland and Labrador (for AMI only). For more information about the inclusion and exclusion criteria, see Chapter 3 and the Technical Notes at www.cihi.ca.

On the other hand, patients initially admitted to higher-volume centres and centres with specialized services are less likely to be transferred than others. To see what the differences were, we divided hospitals into three groups based on the number of patients they cared for each year. Hospitals with the highest volumes admitted more than 45 heart attack patients or 21 stroke patients in 2004–2005. These facilities were much less likely to transfer patients (only 25% of heart attack patients moved) than the lowest-volume centres (40% transferred).

Often, patients change hospitals in order to receive specialized diagnosis or treatment. For example, patients with new heart attacks who were transferred were more likely to receive PCI or bypass surgery than those who stayed in the hospital where they were first admitted. Half (52%) of new AMI patients admitted to hospitals with on-site services receive revascularization within one year, compared to 35% of patients admitted to other hospitals.[18]

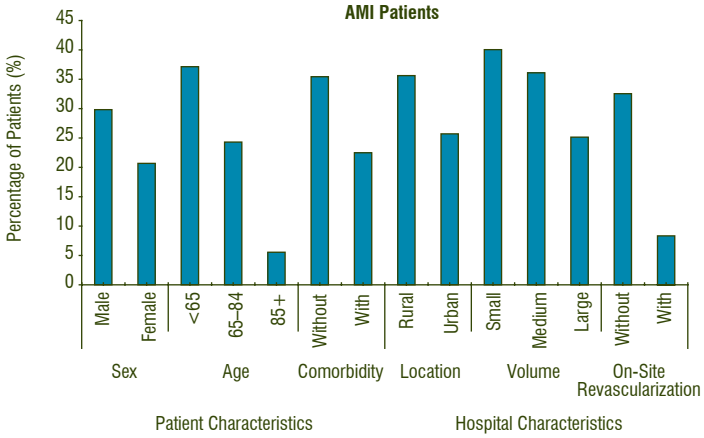
Patterns of care also differed. In hospitals with on-site revascularization, half of all patients who had an angioplasty in 2004–2005 had their procedure within a day of their admission. The median time to angioplasty in other centres was seven days. Similarly, waits for bypass surgery diverged. The median time to surgery in hospitals with on-site revascularization was 12 days, compared to 20 days in other facilities.

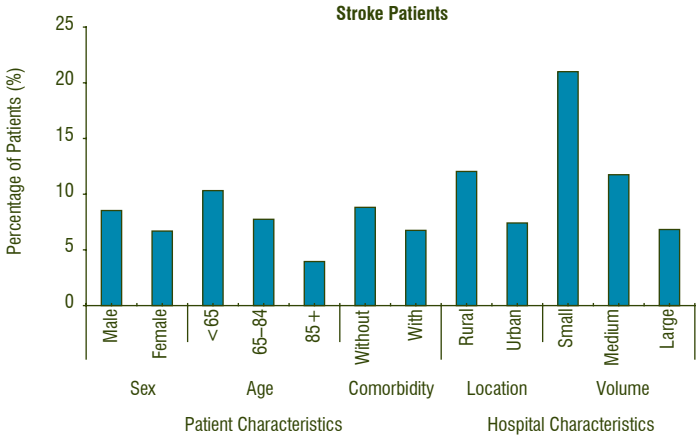
Revascularization procedures are not appropriate for all types of AMI patients, but more patients are receiving bypass surgery and PCI than in the past.[18, 19] Overall, about 40% of new AMI patients received some type of revascularization within a year of their initial admission with a heart attack in 2004–2005, up from 34% the year before. Younger patients and men are more likely to receive PCI than other patients with new heart attacks.

Moving Around

25

When patients need care that cannot be provided by their initial hospital, a transfer to another facility may be an option. The graph below shows the proportion of patients with new heart attacks or strokes who were transferred from the hospital where they were first admitted in 2004–2005. Rates are higher for males, younger patients and those without comorbidities. In addition, patients were more likely to be transferred if they were initially admitted to a rural or small facility.





Notes: Data from B.C. and Quebec are excluded due to different coding of admissions from the emergency room and diagnosis types, respectively. Data from Newfoundland and Labrador are additionally excluded for AMI due to different coding of this condition.

Source: Discharge Abstract Database, CIHI.

Who Provides Care?

It takes a team of care providers to treat patients with complex health problems. Many different types of health professionals—nurses, doctors, physiotherapists, pharmacists and others—may each play an important role. Within this team, hospitals identify the attending physician most responsible for the care of each patient.

In 2004–2005, approximately 36% of patients had a cardiologist or a cardiac surgeon as the physician most responsible for their care during their first admission with a new AMI. The average age of this group of patients was 66 years. This is lower than the average age for patients whose most responsible physician was *not* a cardiac specialist (71 years). Male patients were more likely than females (38% versus 32%) to be treated by a cardiac specialist.

A neurologist or neurosurgeon was the most responsible physician for 26% of new stroke patients in 2004–2005. The average age of these patients was 67 years. As for AMI patients, stroke patients whose primary physician was *not* a neurological specialist tended to be older. Their average age was almost 75 years.

Who Provides Care for AMI and Stroke Patients? 26

Patients with a new AMI in 2004–2005 tended to have a cardiologist, internal medicine specialist or family physician/general practitioner as their main attending physician. Patients with new strokes were more likely to have a family physician or general practitioner as their most responsible care provider—47% compared to 29% for patients with a new AMI.

	AMI Patients	Stroke Patients
Family physician/general practitioner	29%	47%
Internal medicine	31%	21%
Cardiology	35%	n/a
Cardiac surgery	1%	n/a
Neurology	n/a	17%
Neurosurgery	n/a	9%
Other	5%	7%

Notes: Data from B.C. and Quebec are excluded due to historical differences in coding of admissions from the emergency room and diagnosis types, respectively. Data from Newfoundland and Labrador are additionally excluded for AMI due to different coding of this condition. Neurologists/neurosurgeons are included in the "other" category for AMI patients; cardiologists and cardiac surgeons are included in the "other" category for stroke patients.

View Data

Source: Discharge Abstract Database, CIHI.

The Big Picture: What Affects Mortality Rates?

Chapter 4 showed that the risk of dying from a heart attack or stroke is related to a patient's age, sex and health problems. Researchers also suggest that outcomes vary by type of hospital and by how care is structured within a facility. For example, studies have shown better cardiac outcomes in centres that treat more patients,[20–21] urban facilities,[22] hospitals with academic affiliations,[23] centres with on-site revascularization[23, 24] and hospitals with higher guideline adherence.[25]

Other research has focused on what types of physicians care for patients. Several studies have found that AMI patients treated by cardiologists tend to have better outcomes.[26–31] Experts suggest that this may be because these specialists tend to adhere more strongly to current care guidelines or best practices than other physicians.[26, 28, 32] For example, research indicates that hospitals with cardiology departments or cardiologists on staff are more likely to deliver recommended drug prescriptions and therapies.[27, 28] Studies also show that cardiologists refer more patients for specialized interventions.[27, 28, 33]

Intervening for Better Health?

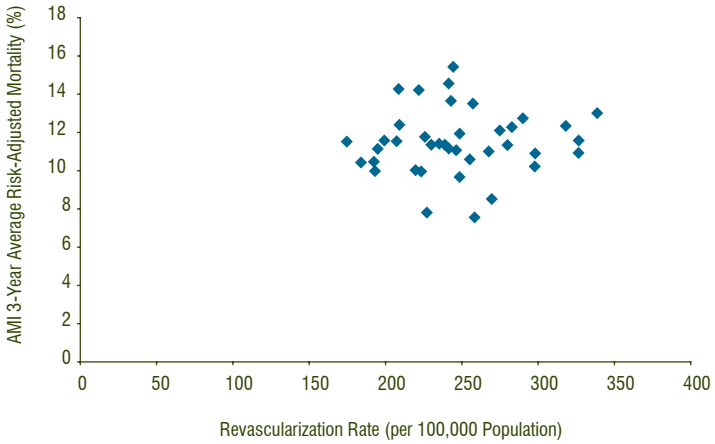
Not all patients with heart attacks need revascularization procedures such as angioplasty or bypass surgery, but some researchers have found that higher rates are associated with better outcomes, at least for certain types of patients.[34–36]

At a population level, however, other factors also matter. For example, there was little relationship between a health region's three-year pooled risk-adjusted 30-day in-hospital mortality rate (for 2002–2003 to 2004–2005) and its revascularization rate in 2003–2004. Health regions with similar revascularization rates had very different death rates, and regions with similar mortality rates had widely varying intervention rates. For instance, regions with death rates of 12 to 13% had age-standardized revascularization rates of 209 to 339 per 100,000 population.

27

Comparing Regional Revascularization and Mortality Rates

The graph below shows revascularization rates (2003–2004) and three-year average risk-adjusted 30-day in-hospital mortality rates (2002–2003 to 2004–2005) following admission with a new heart attack for the 39 reportable health regions for which both sets of data were available.



Notes: Revascularization rates are age-standardized using the 1991 Canada population. Only reportable health regions for which both sets of data were available were included.

View Data

Sources: Discharge Abstract Database, CIHI; National Ambulatory Care Reporting System, CIHI.

Although research studies often look at links between specific patient, hospital or physician characteristics and outcomes, these factors are often intertwined. For instance, urban hospitals tend to treat more patients, to have on-site revascularization capacities and to have more specialists on staff. Likewise, hospitals that treat larger numbers of patients are often centres of excellence with greater expertise and advanced technology. As a result, they are less likely to transfer patients to other facilities for treatment. These inter-relationships make it more difficult to understand what types of care benefit patients, and under what circumstances the effect is the largest.

New analysis conducted for this report looks at the relationship between several hospital or physician factors and patient outcomes. We first considered each factor separately. In many cases, these findings support those from the international literature. For instance, we found that in 2004–2005:†

- More than two-thirds of new AMI and stroke patients were admitted to hospitals with higher patient volumes (those with more than 45 AMI patients in a year or more than 21 stroke patients). For every 10 additional cases, patients with a new heart attack or stroke were about 1% less likely to die in hospital within 30 days of admission.

- Patients were more likely to survive when admitted to an urban versus a rural facility. Survival chances were 31% higher for patients with a new stroke admitted to an urban hospital compared to those admitted to a rural hospital and 20% for those with a new AMI.

- Patients with a new heart attack or stroke who were transferred at least once after admission were 63% less likely to die within 30 days compared to patients who were not transferred.

- Patients admitted to a facility with on-site revascularization capacity had better 30-day in-hospital mortality outcomes compared to patients admitted to a facility with no such capacity. Survival chances were 12% higher for new AMI patients.

- Patients with new heart attacks and strokes were more likely to survive if cared for by physicians specializing in their disease. In 2004–2005, 11% of new heart attack patients and 19% of new stroke patients died in hospital within 30 days of their admission. Those mainly cared for by cardiologists had a risk-adjusted death rate of 8% compared with 13% for other patients. Their risk of dying was 47% lower than those of other patients once age, sex and comorbidities of the patient were taken into account. Stroke patients who saw a specialist also tended to have better outcomes. Those primarily cared for by a neurologist or neurosurgeon were 44% less likely to die than other patients (risk-adjusted death rate of 14% versus 20%). Some experts suggest that this may be because specialists tend to follow current care guidelines more closely than other physicians do.[32]

† These results take into account the age, sex and comorbid conditions of patients. For stroke, they also take into account the type of stroke.

These types of analyses, however, do not answer more complex questions such as, "Does the type of physician who treats you still matter after the type of hospital you are in is taken into account?" Accordingly, we next looked to see if relationships with patient outcomes persisted when possible interactions among hospital, physician and patient characteristics were taken into account.‡

The answer was sometimes yes and sometimes no. In the case of stroke, patients with a neurologist or neurosurgeon as their most responsible physician still tended to have lower risks of dying (39% lower) after hospital and patient characteristics were taken into account. But there was no longer a statistically significant relationship between patient outcomes and the type of hospital to which patients were admitted (for example, the number of patients treated, rural/urban, location or transfer status). The picture was different for patients with a new heart attack. Specifically, hospital patient volume, the patient's transfer status and the type of most responsible provider all remained statistically significant predictors of 30-day in-hospital mortality, even after accounting for the other factors in the analysis.

What about other factors? It is important to note that we could take into account some, but not all, of the factors that may influence patient outcomes. For example, we could not directly account for the severity of patients' illnesses, time to initial treatment or drug therapy while in hospital or after discharge.

What About the Relationship Between Sex and In-Hospital Mortality?

Research shows that women who have experienced AMI or stroke are more likely to die in hospital than men.[39] In addition, studies show that women suffering from ischemic stroke have higher morbidity rates than men.[40–42]

Our analysis supports these findings. In 2004–2005, the risk of dying in hospital within 30 days of admission with a new heart attack or stroke was higher for female than male patients, even after age and comorbidity were adjusted for. Specifically, women had an 11% higher risk of dying after a stroke and a 16% higher risk of dying after an AMI, compared to their male counterparts.

Experts suggest that differences in care may partly explain why women are more likely to die following a heart attack or stroke than men.[41, 43] New analysis conducted for this report found that men were more likely than women to have a specialist as their main provider and to be transferred to a higher-volume hospital in 2004–2005. Some researchers have suggested that this effect may disappear when interactions between age and sex are taken into account.[39, 44] However, we found that the increased risk of mortality for women remains for both stroke and AMI patients, even after a myriad of patient and hospital factors and their potential interactions are taken into account (see Technical Report for more details).

‡ See the Technical Notes posted at www.cihi.ca for more detailed methodological information.

Likewise, while we explored some of the ways in which the organization of care might affect outcomes, we could not take all possible combinations into account. For instance, a systematic review of 23 randomized and quasi-randomized trials comparing inpatient stroke unit care with alternative forms of care found that patients treated in stroke units were less likely to die and more likely to be independent and return to live at home.[37] The median follow-up time across the studies was one year. Other studies have looked at different outcomes. For example, an evaluation following the establishment of a stroke unit in Halifax found that the mean and median lengths of stay fell by two days, amounting to a savings of over $2,000 per patient, and the odds of having a deep vein thrombosis fell by 68%.[38]

With hundreds of clinical studies published each year, our understanding of what affects patients' survival chances is evolving over time. As new knowledge emerges, understanding the interactions between population-level, patient-level, structural and other factors will be key to informing decisions about what types of care work best for whom and in what circumstances.

What Is a Stroke Unit?

A stroke unit has a team of health care providers (including, for example, doctors, nurses, therapists, pharmacists and social workers) that specializes in the treatment of patients with stroke. Often located in one central area, stroke units can have an acute care component, a rehabilitation component or both. In 1975, Sunnybrook Hospital in Toronto (now the Sunnybrook and Women's College Health Sciences Centre) set up the first stroke unit in Canada. In 2002, 12 of the 21 institutions participating in the registry of the Canadian Stroke Network (mostly in Ontario) reported having stroke units.

Information Gaps: Some Examples

What We Know

- How many patients admitted to hospital with a new AMI or a new stroke are cared for in high- or low-volume centres, are transferred to other facilities after their initial admission or have surgical or other procedures during their stay.
- Types of physicians most responsible for the care of patients admitted to hospital with a new AMI or a new stroke.
- How these factors—individually and collectively—relate to a patient's chances of dying in hospital within 30 days of admission.

What We Don't Know

- How long do AMI and stroke patients wait before seeking medical care after the onset of symptoms? Why? How does this affect their outcomes?
- To what extent do health services before admission to hospital affect mortality rates, other patient outcomes and costs?
- To what extent do variations in hospital characteristics and other processes of care explain regional variations in mortality and other outcomes?
- Which combinations of care processes, ways of organizing and delivering health services and other structural factors are most effective and efficient in different circumstances?

What's Happening

- CIHI, in collaboration with the B.C. Ministry of Health Services and the Provincial Health Services Authority, is undertaking The Cardiovascular Registry Project, which will define a comprehensive approach for matching data from clinical registries with administrative databases (such as the Discharge Abstract Database as well as the Medical Service Plan, PharmaNet and Vital Statistics databases).
- An expert group and 21 countries, as well as the World Health Organization, the European Commission, the World Bank and leading research organizations, have launched the OECD Health Care Quality Indicators Project to identify priority areas for initial development of indicators in five areas, including cardiac care and patient safety.
- The Canadian Stroke Network started in 1999 and consists of over 100 researchers from 24 Canadian universities (www.canadianstrokenetwork.ca/aboutus/overview.php). The network focusses on five thematic areas: prevention, optimizing care, minimizing stroke damage, post-stroke repair and recovery and knowledge translation. Research on the second theme—optimizing care—has resulted in the development of 23 core indicators of care for stroke patients.

For More Information

1 E. M. Antman, D. T. Anbe, P. W. Armstrong, E. R. Bates, L. A. Green, M. Hand, J. S. Hochman, H. M. Krumholz, F. G. Kushner, G. A. Lamas, C. J. Mullany, J. P. Ornato, D. L. Pearle, M. A. Sloan and S. C. Smith, *ACC/AHA Guidelines for the Management of Patients With ST-Elevation Myocardial Infarction—Executive Summary: A Report of the American College of Cardiology/American Heart Association Task Force on Practice Guidelines* (Bethesda, MD: American College of Cardiology Foundation and the American Heart Association, Inc., 2004).

2 J. G. Canto, M. G. Shlipak, W. J. Rogers, J. A. Malmgren, P. D. Frederick, C. T. Lambrew, J. P. Ornato, H. V. Barron and C. I. Kiefe, "Prevalence, Clinical Characteristics, and Mortality Among Patients With Myocardial Infarction Presenting Without Chest Pain," *The Journal of the American Medical Association* 283, 24 (2000): pp. 3223–29.

3 S. O'Donnell, S. Condell, C. Begley and T. Fitzgerald, "Prehospital Care Pathway Delays: Gender and Myocardial Infarction," *Journal of Advanced Nursing* 53, 3 (2004): pp. 268–76.

4 Heart and Stroke Foundation of Ontario, *Heart and Stroke Foundation of Canada Annual Report 2004* (Ottawa: Heart and Stroke Foundation of Canada, 2004), pp. 1–24.

5 M. Labinaz, T. Swabey, R. Watson, M. Natarajan, W. Fucile, B. Lubelsky, B. Sawadsky, E. Cohen, K. Glasgow and The CCN Consensus Panel on Access to Urgent PCI for ST Segment Elevation Myocardial Infarction, "Delivery of Primary Percutaneous Coronary Intervention for the Management of Acute ST Segment Elevation Myocardial Infarction: Summary of the Cardiac Care Network of Ontario Consensus Report," *Canadian Journal of Cardiology* 22, 3 (2006): pp. 243–50.

6 B. K. Nallamothu and E. R. Bates, "Percutaneous Coronary Intervention Versus Fibrinolytic Therapy in Acute Myocardial Infarction: Is Timing (Almost) Everything?," *American Journal of Cardiology* 92, 7 (2006): pp. 824–26.

7 Calgary Health Region, *Committed to Excellence: Calgary Heath Region Report to the Community 2004* (Calgary, Alberta: Calgary Health Region, 2004), [online], from <http://www.calgaryhealthregion.ca/communications/report_to_the_community.pdf>.

8 L. J. Morrison, P. R. Verbeek, A. C. McDonald, B. V. Sawadsky and D. J. Cook, "Mortality and Prehospital Thrombolysis for Acute Myocardial Infarction: A Meta-Analysis," *The Journal of the American Medical Association* 283, 20 (2000): pp. 2686–92.

9 C. Jackevicius, D. Alter, J. Cox, P. Daly, S. Goodman, W. Filate, A. Newman, J. V. Tu and Canadian Cardiovascular Outcomes Research Team, "Acute Treatment of Myocardial Infarction in Canada 1999–2002," *Canadian Journal of Cardiology* 21, 2 (2005): pp. 145–52.

10 C. Davies, J. Christenson and A. Campbell, "Fibrinolytic Therapy in Acute Myocardial Infarction: Time to Treatment in Canada," *Canadian Journal of Cardiology* 20, 8 (2004): pp. 801–05.

11 The Heart and Stroke Foundation of Canada, the Canadian Cardiovascular Society and the Canadian Association of Emergency Physicians for the Emergency Cardiac Care Coalition, "Recommendations for Ensuring Early Thrombolytic Therapy for Acute Myocardial Infarction," *Canadian Medical Association Journal* 154, 4 (1996): pp. 483–87.

12 P. Liu, J. M. Arnold, I. Belenkie, C. Demers, P. Dorian, N. Gianetti, H. Haddad, J. Howlett, A. Ignazewski, P. Jong, R. McKelvie, G. Moe, J. D. Parker, V. Rao, J. L. Rouleau, K. Teo, J. Niznick, H. Ross, S. Roth, D. Roy, S. Smith, B. Sussex, S. Yusuf and Canadian Cardiovascular Society, "The 2002/3 Canadian Cardiovascular Society Consensus Guideline Update for the Diagnosis and Management of Heart Failure," *Canadian Journal of Cardiology* 19, 4 (2003): pp. 347–56.

13 W. Hacke, G. A. Donnan, C. Fieschi, M. Kaste, R. von Kummer, J. P. Broderick, T. Brott, M. Frankel, J. C. Grotta, E. C. Haley, T. Kwiatkowski, S. R. Levine, C. Lewandowski, M. Lu, P. Lyden, J. P. Marler, S. Patel, B. C. Tilley, G. Albers, E. Bluhmki, M. Wilhelm, S. Hamilton, ATLANTIS Trials Investigators, ECASS Trials Investigators and NINDS rt-PA Study Group Investigators, "Association of Outcome With Early Stroke Treatment: Pooled Analysis of ATLANTIS, ECASS, and NINDS Rt-PA Stroke Trials," *The Lancet* 363, 9411 (2004): pp. 768–74.

14 J. V. Tu and J. Porter, *Stroke Care in Ontario: Hospital Survey Results* (Toronto: Ontario Hospital Association, Heart and Stroke Foundation, Institute for Clinical Evaluative Sciences, 1999).

15 M. K. Kapral, F. L. Silver, J. A. Richards, M. P. Lindsay, J. Fang, S. Shi, M. D. Hill, S. J. Phillips, A. Robertson and J. V. Tu, *Registry of the Canadian Stroke Network: Progress Report 2001–2005* (Toronto: Institute for Clinical Evaluative Sciences, 2005).

16 H. J. Audebert, C. Kukla, S. Clarmann von Claranau, J. Kuhn, B. Vatankhah, J. Schenkel, G. W. Ickenstein, R. L. Haberl, M. Horn and on behalf of the TEMPiS Group, "Telemedicine for Safe and Extended Use of Thrombolysis in Stroke: The Telemedic Pilot Project for Integrative Stroke Care (TEMPiS) in Bavaria," *Stroke* 36, 2 (2005): pp. 287–91.

17 J. Gurwitz, "Hospital Transfer of Patients With Acute Myocardial Infarction: the Effects of Age, Race, and Insurance Type," *American Journal of Medicine* 112, 7 (2006): pp. 528–34.

18 Canadian Institute for Health Information, *Waiting for Health Care in Canada: What We Know and What We Don't Know* (Ottawa: CIHI, 2006), from <http://www.cihi.ca>.

19 D. A. Alter, T. A. Stukel and A. Newman, "Proliferation of Cardiac Technology in Canada: A Challenge to the Sustainability of Medicare," *Circulation* 113, 3 (2006): pp. 380–87.

20 Canadian Institute for Health Information, *Health Care in Canada 2005* (Ottawa: CIHI, 2005), from <http://www.cihi.ca>.

21 J. D. Birkmeyer, A. E. Siewers, E. V. A. Finlayson, T. A. Stukel, F. L. Lucas, I. Batista, H. G. Welch and D. E. Wennberg, "Hospital Volume and Surgical Mortality in the United States," *The New England Journal of Medicine* 346, 15 (2002): pp. 1128–37.

22 H. D. Vu, R. F. Heller, L. L. Y. Lim, C. D'Este and R. L. O'Connell, "Mortality After Acute Myocardial Infarction Is Lower in Metropolitan Regions Than in Non-Metropolitan Regions," *Journal of Epidemiology and Community Health* 54, 8 (2000): pp. 590–95.

23 D. A. Alter, P. C. Austin, J. V. Tu and Canadian Cardiovascular Outcomes Research Team, "Community Factors, Hospital Characteristics and Inter-Regional Outcome Variations Following Acute Myocardial Infarction in Canada," *The Canadian Journal of Cardiology* 21, 3 (2005): pp. 247–55.

24 D. A. Alter, C. D. Naylor, P. C. Austin and J. V. Tu, "Long-Term MI Outcomes at Hospitals With or Without On-Site Revascularization," *The Journal of the American Medical Association* 285, 16 (2001): pp. 2101–08.

25 E. D. Peterson, M. T. Roe, J. Mulgund, E. R. DeLong, B. L. Lyte, R. G. Brindis, S. C. Smith, C. V. Pollack, L. K Newby, R. A. Harrington, W. B. Gibler and E .M. Ohman, "Association Between Hospital Process Performance and Outcomes Among Patients With Acute Coronary Syndromes," *The Journal of the American Medical Association* 295, 16 (2006):pp.1912–20.

26 P. N. Casale, J. L. Jones, F. E. Wolf, Y. M. S. Pei and L. M. Eby, "Patients Treated by Cardiologists Have a Lower in-Hospital Mortality for Acute Myocardial Infarction," *Journal of the American College of Cardiology* 32, 4 (1998): pp. 885–89.

27 M. Gottwik, R. Zahn, R. Schiele, S. Schneider, A. K. Gitt, L. Fraunberger, C. Bossaller, H. G. Glunz, E. Altmann, W. Rosahl and J. Senges for the Maximal Individual Therapy in Acute Myocardial Infarction and the Myocardial Infarction Registry Study Groups, "Differences in Treatment and Outcome of Patients With Acute Myocardial Infarction Admitted to Hospitals With Compared to Without Departments of Cardiology. Results From the Pooled Data of the Maximal Individual Therapy in Acute Myocardial Infarction (MITRA 1+2) Registries and the Myocardial Infarction Registry (MIR)," *European Heart Journal* 22, 19 (2001): pp. 1794–801.

28 I. Abubakar, D. Kanka, B. Arch, J. Porter and P. Weissberg, "Outcome After Acute Myocardial Infarction: A Comparison of Patients Seen by Cardiologists and General Physicians," *BMC Cardiovascular Disorders* 4, 14 (2004).

29 J. G. Jollis, E. R. DeLong, E. D. Peterson, L. H. Muhlbaier, D. F. Fortin, R. M. Califf and D. B. Mark, "Outcome of Acute Myocardial Infarction According to the Specialty of the Admitting Physician," *The New England Journal of Medicine* 335, 25 (1996): pp. 1880–87.

30 J. J. Norcini, H. R. Kimball and R. S. Lipner, "Certification and Specialization: Do They Matter in the Outcome of Acute Myocardial Infarction?," *Academic Medicine* 75, 12 (2000): pp. 1193–98.

31 I. S. Nash, D. B. Nash and V. Fuster, "Do Cardiologists Do It Better?," *Journal of the American College of Cardiology* 29, 3 (1997): pp. 475–78.

32 M. F. Dorsch, R. A. Lawrance, R. J. Sapsford, N. Durham, R. Das, B. M. Jackson, C. Morrel, S. G. Ball, M. B. Robinson, A. S. Hall and EMMACE, "An Evaluation of the Relationship Between Specialist Training in Cardiology and Implementation of Evidence-Based Care of Patients Following Acute Myocardial Infarction," *International Journal of Cardiology* 96, 3 (2004): pp. 335–40.

33 Y. Khaykin, P. C. Austin, J. V. Tu and D. A. Alter, "Utilisation of Coronary Angiography After Acute Myocardial Infarction in Ontario Over Time: Have Referral Patterns Changed?," *Heart* 88, 5 (2002): pp. 460–66.

34 L. Pilote, F. Lavoie, V. Ho and M. J. Eisenberg, "Changes in the Treatment and Outcomes of Acute Myocardial Infarction in Quebec, 1988–1995," *Canadian Medical Association Journal* 163, 1 (2000): pp. 31–36.

35 L. Pilote, O. Saynina and F. Lavoie, "Cardiac Procedure Use and Outcomes in Elderly Patients With Acute Myocardial Infarction in the United States and Quebec, Canada, 1988 to 1994," *Medical Care* 41, 7 (2003): pp. 813–22.

36 D. R. Urbach and N. N. Baxter, "Does It Matter What a Hospital Is "High Volume" For? Specificity of Hospital Volume-Outcome Associations for Surgical Procedures: Analysis of Administrative Data," *BMJ* 328, 7442 (2004): pp. 737–40.

37 Stroke Unit Trialists' Collaboration, "Organised Inpatient (Stroke Unit) Care for Stroke (Review)," *The Cochrane Database of Systematic Reviews*, 3 (2001).

38 S. J. Phillips, G. A. Eskes, G. J. Gubitz on behalf of the Queen Elizabeth II Health Sciences Centre Acute Stroke Team "Description and Evaluation of an Acute Stroke Unit," *Canadian Medical Association Journal* 167, 6 (2002): pp. 655–60.

39 V. Vaccarino, R. I. Horwitz, T. P. Meehan, M. K. Petrillo, M. J. Radford and H. M. Krumholz, "Sex Differences in Mortality After Myocardial Infarction: Evidence for a Sex-Age Interaction," *Archives of Internal Medicine* 158, 18 (1998): pp. 2054–62.

40 J. Roquer, A. R. Campello and M. Gomis, "Sex Differences in First-Ever Acute Stroke," *Stroke* 34, 7 (2003): pp. 1581–85.

41 J. M. Holroyd-Leduc, M. K. Kapral, P. C. Austin and J. V. Tu, "Sex Differences and Similarities in the Management and Outcome of Stroke Patients," *Stroke* 31, 8 (2000): pp. 1833–37.

42 M. K. Kapral, J. Fang, M. D. Hill, F. Silver, J. Richards, C. Jaigobin, A. M. Cheung and for the Investigators of the Registry of the Canadian Stroke Network, "Sex Differences in Stroke Care and Outcomes: Results From the Registry of the Canadian Stroke Network," *Stroke* 36, 4 (2005): pp. 809–14.

43 P. J. Kudenchuck, C. Maynard, J. S. Martin, M. Wirkus and W. D. Weaver, "Comparison of Presentation, Treatment, and Outcome of Acute Myocardial Infarction in Men Versus Women (the Myocardial Infarction Triage and Intervention Registry)," *American Journal of Cardiology* 78, 1 (1996): pp. 9–14.

44 D. A. Alter, C. D. Naylor, P. C. Austin and J. V. Tu, "Biology or Bias: Practice Patterns and Long-Term Outcomes for Men and Women With Acute Myocardial Infarction," *Journal of the American College of Cardiology* 39, 12 (2002): pp. 1909–15.

6

After Leaving Hospital

6 After Leaving Hospital

Fortunately, most heart attacks and strokes are not fatal. In 2003, Statistics Canada estimated that more than half a million adults† living in Canadian households had survived a heart attack. About half that number faced the after-effects of a stroke. These figures don't include those who reside in other settings, such as nursing homes.

The challenge of ensuring the best possible outcomes for these patients, regardless of where they live, does not stop at the hospital door. This chapter examines a selection of topics related to care received after a heart attack or stroke, including the challenge of preventing further heart attacks or strokes.

When Acute Care Is Not Enough—Inpatient Rehabilitation

Some patients recover quickly after their heart attack or stroke and need only follow-up care in the community after they go home. Others require hospital-based inpatient rehabilitation. These services are generally intended to help individuals achieve maximum independence in daily living.

Quality of Life After a Heart Attack or Stroke

According to the 2003 Canadian Community Health Survey (CCHS), over 567,000 people living in Canadian households had survived a heart attack, and close to 270,000 were suffering from the effects of a stroke.

Indicator	Had a Heart Attack	Suffering From the Effects of a Stroke	Overall
Rate their health as fair or poor	51%	61%	12%
Feel unsatisfied with life in general	8%	11%	3%
Have difficulty with activities such as hearing, seeing, walking or learning	65%	81%	26%
Need help in carrying out personal care activities such as grooming and dressing	9%	23%	2%
Have difficulty (for health reasons) with social situations such as making and maintaining friendships, dealing with people they don't know well and starting or maintaining conversations	10%	25%	4%

Source: Canadian Community Health Survey 2003 (Cycle 2.1), Statistics Canada.

† Only respondents aged 20 years and older were included in CCHS results reported in this chapter.

The National Rehabilitation Reporting System (NRS) tracks changes in the physical and cognitive functioning of clients between admission to and discharge from inpatient rehabilitation. In 2003–2004, the NRS gathered data on 26,800 clients from 79 participating facilities in Newfoundland and Labrador, Nova Scotia, Ontario, Saskatchewan, Alberta and B.C.

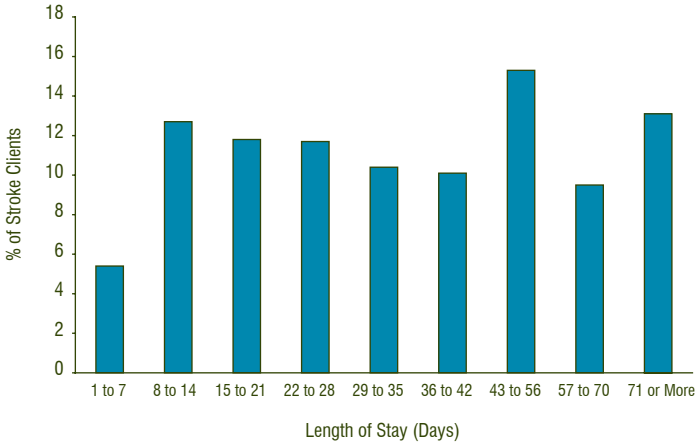
Admissions to inpatient rehabilitation following a heart attack are rare. They accounted for less than 1% of all inpatient rehabilitation clients seen in facilities participating in the NRS in 2003–2004. In contrast, stroke clients are the second most common type of inpatient rehabilitation client (17% of the total), after orthopedics (48%).

The vast majority of inpatient rehabilitation clients with a heart attack or stroke come directly from an acute care hospital. For those receiving inpatient rehabilitation following a stroke, 41% were transferred from the same hospital where they had their acute care. Most of the rest (52%) were referred from a different inpatient acute care hospital. About two in five clients with a stroke (38%) entered an inpatient rehabilitation unit on the day that they were deemed clinically ready to begin the program. In a few cases, however, patients waited more than a week to begin the inpatient rehabilitation phase of their care.

Length of Stay in Inpatient Rehabilitation Care

28

The severity of illness, among other factors, can affect the degree of functional loss sustained and the length of time spent in inpatient rehabilitation. In 2003–2004, almost 30% of stroke clients stayed less than three weeks, while over 38% spent more than six weeks in inpatient rehabilitation.



Note: In 2003–2004, the NRS gathered data on 26,800 clients from 79 participating facilities in B.C., Alberta, Saskatchewan, Ontario, Nova Scotia and Newfoundland and Labrador.

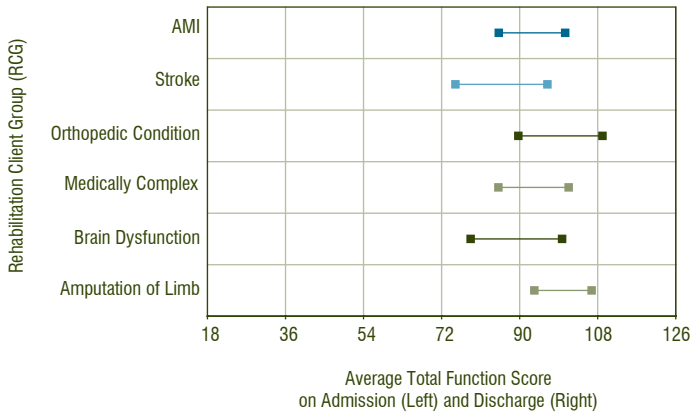
View Data

Source: National Rehabilitation Reporting System, CIHI.

Improvements in Functioning

29

The chart below shows the average changes in functional scores for different inpatient rehabilitation client groups in 2003–2004.



Note: In 2003–2004, the NRS gathered data on 26,800 clients from 79 participating facilities in B.C., Alberta, Saskatchewan, Ontario, Nova Scotia and Newfoundland and Labrador.

View Data

Source: National Rehabilitation Reporting System, CIHI.

Inpatient rehabilitation typically aims to increase the functional ability of clients during their stay. One way of quantifying this improvement is through data collected with the FIM™ instrument, a measure of functional independence. This tool rates a person's ability to perform 18 activities of daily living. These activities require motor skills, such as those needed for bathing and dressing, or cognitive skills, such as those used for problem solving. Higher scores indicate that less assistance from other people or special equipment is needed to perform the activities. The maximum possible total FIM™ instrument score is 126. The difference between a client's total FIM™ score on admission and on discharge reflects the improvement in that patient's functional ability during his or her stay in inpatient rehabilitation.

Stroke clients had some of the lowest levels of functional ability on admission in 2003–2004 (average score of 75). On discharge, they still had lower average scores than several other client groups, but they tended to have bigger improvements in functioning since admission. On average, their scores on discharge were 21 points higher than on admission.

Home Care Services Following a Heart Attack or Stroke

Home care is an increasingly important part of the health system. For some clients, it substitutes for care in hospital or a long-term care facility, or inpatient rehabilitation. For others, the goal is to remain independent in their own home and community or to provide preventive services with a view to reducing long-term care needs. Services may include home support (such as housekeeping) and clinical care (such as the administration of intravenous medication).[1]

Many of those who survive a stroke or a heart attack require home care services, because of either this event or other health problems. According to the 2003 Canadian Community Health Survey (CCHS), about 32% of adult Canadians who are living in households and who are suffering from the effects of a stroke and 21% of those who survived a heart attack received home care assistance.

Home care programs across Canada deliver a variety of services, including help with daily activities and nursing. CCHS data on the type of in-home health care and support services received suggest that approximately 39% of AMI survivors who received home care in 2003 had help with personal care, such as bathing and dressing. This percentage was higher for home care users suffering from the effects of a stroke (50%), perhaps because of higher levels of disability. Almost half of these AMI and stroke survivors receiving home care got help exclusively from a public home care agency (44% and 41%, respectively). Another 28 to 29% got help from friends and family. The rest received home care from a private agency or received some combination of public, private and informal care.

Returning to Hospital

Most patients recover at home or in other health care facilities once discharged from the hospital. However, some must return to hospital within a short time because they experience further health problems or need additional care. Our work on unplanned readmissions to hospital following discharge builds on previous research related to cardiac readmissions.[2–4]

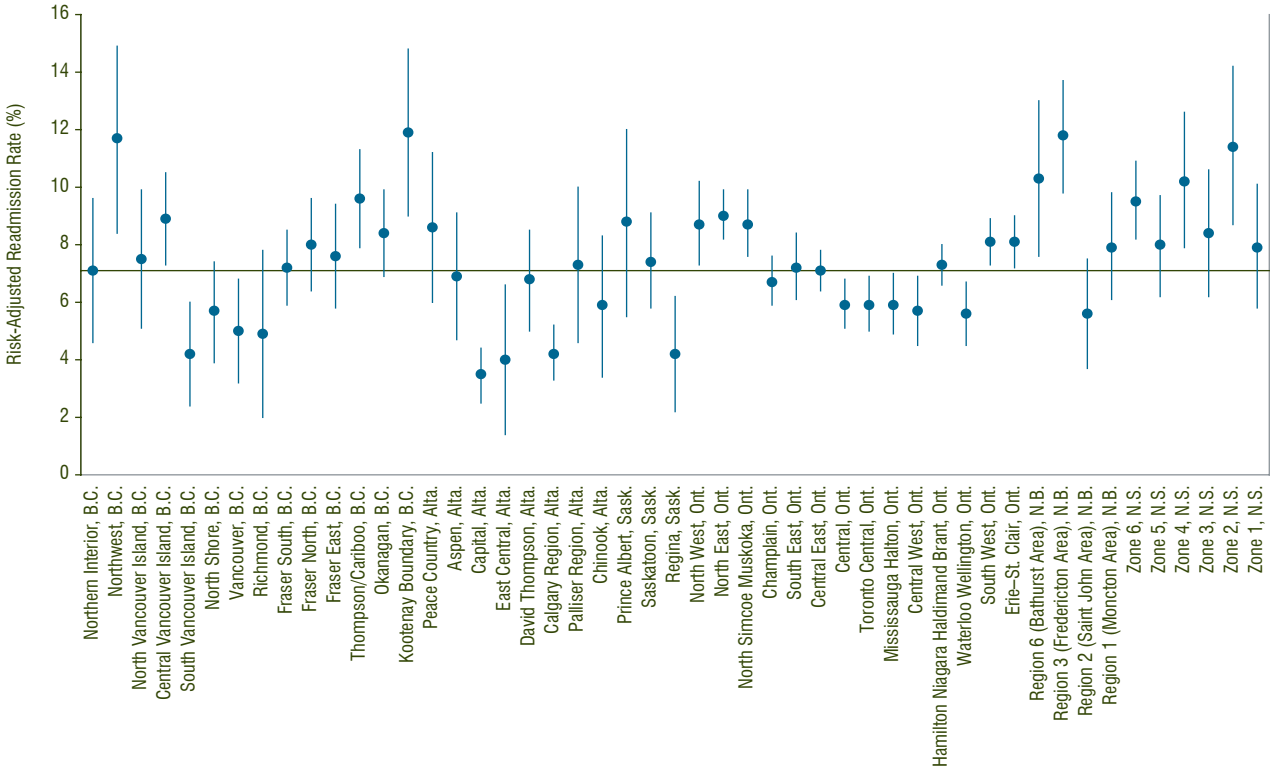
Some experts suggest that readmissions are an indication of disease severity or of the quality of inpatient and outpatient health services and delivery.[3] Studies suggest that care in and out of hospital, patient demographics, discharge arrangements, compliance with discharge plans and other factors can all affect the likelihood that a patient will have an unplanned return to hospital.[4, 5]

Overall, 7.1% of patients hospitalized with an AMI between 2002–2003 and 2004–2005 had an unplanned return to hospital within 28 days due to a related health problem.

30

Returning to Hospital After a Heart Attack

The chances of a patient being readmitted to hospital unexpectedly within 28 days of discharge from an initial hospitalization with a heart attack (after adjustment is made for age, sex and other co-existing illnesses) vary from region to region. Risk-adjusted readmission rates for patients hospitalized between 2002–2003 and 2004–2005 by health region are shown below. The rates are estimated to be accurate to within the range shown by the vertical bars 19 times out of 20 (95% confidence interval). The solid line shows the overall rate of unplanned readmissions (7.1%).



Notes: Data from Manitoba, Quebec and Newfoundland and Labrador are not available due to differences in coding practices. Regions not shown in the graph are excluded due to small numbers. Data for Nunavut are unavailable due to incomplete submission.

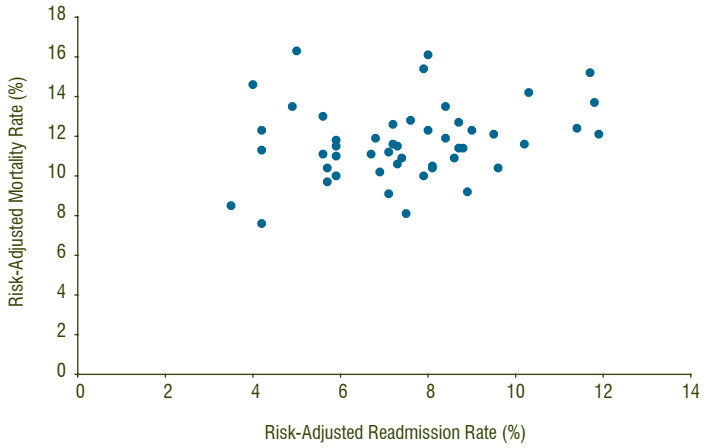
Link to E-publication

Sources: Hospital Morbidity Database, Discharge Abstract Database, CIHI; National Ambulatory Care Reporting System, CIHI.

31

Are Mortality Rates and Readmission Rates Related?

The graph below shows risk-adjusted 28-day readmission rates and 30-day in-hospital mortality rates following admission with a new heart attack for 49 health regions with large populations for 2002–2003 to 2004–2005. Each circle represents one region. Our analysis showed a slight but not statistically significant link between regional readmission and mortality rates for patients admitted with heart attacks.



Notes: Data from Manitoba, Quebec and Newfoundland and Labrador are not available due to differences in coding practices. Data from Nunavut are unavailable due to incomplete submission.

Sources: Hospital Morbidity Database, CIHI; Discharge Abstract Database, CIHI; National Ambulatory Care Reporting System, CIHI.

View Data

Many regions' results are similar to the overall readmission rate for AMI. But some had higher or lower rates, even after adjustment was made for differences in risk factors (age, sex and comorbidity). For example, six health regions had AMI readmission rates that were less than 5%, while another six had rates over 10%.

Not all unplanned readmissions are avoidable or preventable, based on what we know today. However, low readmission rates may suggest opportunities to learn from practices, care models or other factors contributing to good outcomes. Likewise, high rates may prompt further analysis of potential factors (for example, hospital factors during the initial hospitalization, patient characteristics, follow-up care after discharge) and their relative contribution to AMI readmissions. As always, these measures need to be considered in the context of other information, such as patient and community characteristics, patient care and health services in and out of hospital.[7]

Using 1999–2000 data from CIHI and Statistics Canada, a study published in early 2006 found that stroke patients spent an average of 21 days in hospital.[6] The same study looked at readmission to hospital within one year of a first admission with a stroke. Ten percent of those who survived their admission returned to hospital within one year with a recurrent stroke. In total, 37% were readmitted for any reason, including stroke.

Thinking Ahead—Reducing Risk

Patterns of health and disease are largely a consequence of how we learn, live, work and play. Across the country, many efforts to prevent heart disease and stroke start from this premise. For example, Saskatchewan *in motion* is a province-wide physical activity promotion program. Through partnerships with community leaders, as well as community awareness and other targeted strategies, it aims to have all Saskatchewan residents integrate regular physical activity into their daily lives. In 2005, over half of the people living in Saskatchewan (54%) were active enough to receive health benefits, up from 48% in 2003 (before the program's launch).[8]

Other efforts take a more clinical focus and aim to reach those most at risk of future health problems. For instance, more and more stroke prevention clinics are springing up across the country. People identified as being at high risk for experiencing stroke are referred to the clinic by their family physician, emergency department physician or other care provider. While the clinics' main role is primary prevention, they may also offer secondary prevention to those who have already suffered a stroke. Data from the registry of the Canadian Stroke Network covering 12 sites in Ontario and one in Nova Scotia show that approximately one in four stroke patients received follow-up care in a stroke prevention clinic.[9]

Living With Chronic Illness

Chronic illnesses usually develop gradually but have long-term effects, often for the rest of a person's life. Conditions such as hypertension/high blood pressure and diabetes are known risk factors for heart attacks and strokes. Management of these conditions can help to avoid these events in the first place and to reduce the risk of future health problems after one occurs.

Research suggests that not all individuals with chronic illnesses receive all recommended care.[10] For example, a Commonwealth Fund survey asked adults with health problems in six countries about the care that they received. Between 72% and 91% of those with hypertension said that they had had both their blood pressure and cholesterol checked in the last year—two of the many types of services typically recommended for this condition. Canada's rate (85%) was higher than the level in New Zealand and the UK, but lower than in Germany.[11]

Different types of patients in different circumstances need different types of care, but there is emerging (and evolving) consensus about sets of therapies that benefit many patients who have a heart attack or a stroke. For example, the Safer Healthcare Now! campaign, a collaborative initiative to improve patient safety by implementing evidence-based intervention guidelines, identified six

32

Receiving Recommended Care for Chronic Conditions

In 2005, the Commonwealth Fund International Health Policy Survey interviewed adults 18 years of age or older, from six countries, who had health problems. For example, those with hypertension and diabetes were asked whether they had received certain screening tests/exams during the past year. Although the results varied from country to country, adults with hypertension were more likely to have received the two screening tests included in the survey than respondents with diabetes were to have had their hemoglobin A1C, cholesterol, feet and eyes checked.

	% Adults With Hypertension Who Had Their Blood Pressure and Cholesterol Checked in the Last Year	% Adults With Diabetes Who Had Their Hemoglobin A1c and Cholesterol Checked and Feet and Eyes Examined in the Last Year
Australia	78[e, f]	41[d, e, f]
Canada	85[c, d, f]	38[d, e, f]
New Zealand	77[e, f]	40[d, e, f]
UK	72[e, f]	58
U.S.	85[f]	56
Germany	91	55

Notes:
b Significantly different from Canada at $p<.05$.
c Significantly different from New Zealand at $p<.05$.
d Significantly different from UK at $p<.05$.
e Significantly different from the U.S. at $p<.05$.
f Significantly different from Germany at $p<.05$.

Source: C. Schoen, R. Osborn, P. T. Huynh, M. Doty, K. Zapert, J. Peugh and K. Davis, "Taking the Pulse of Health Care Systems: Experiences of Patients With Heath Problems in Six Countries," *Health Affairs* 24, 6 (2005): pp. W5-509–W5-525.

components of hospital-based care that individually and collectively reduce the risk of subsequent vascular event or mortality:

- early administration of aspirin
- aspirin at discharge
- beta-blocker at discharge
- timely initiation of reperfusion (thrombolysis or percutaneous intervention)
- ACE-inhibitor or angiotensin receptor blockers (ARB) at discharge for patients with systolic dysfunction
- smoking cessation counselling/nicotine replacement/serotonin uptake inhibitor/referral to cardiac rehabilitation program[12]

Managing Chronic Disease in B.C.

In 2001, B.C. embarked on a wide-ranging chronic disease management program. One component is a series of collaboratives, cooperative efforts that aim to integrate chronic care best practices into clinical practice. One of the first focus areas was congestive heart failure. At the start of the program in June 2003, 5% of patients had established self-management goals. One year later, 57% had done so—a major improvement, although still short of the goal of 85%. In other areas, however, goals were exceeded. For example, from 21% of patients on ACE-inhibitor or angiotensin receptor blocker (ARB) drugs, rates rose to 93%. Additonally, the proportion of patients on beta-blockers rose from 18% to 89%.[13, 14]

A Canadian study published in 2005 used data from three registries to measure the extent to which several of these practices were in use between 1999 and 2001. Based on results for 19,452 patients at 189 sites in nine provinces, the researchers found that aspirin use rose from 83% to 88% between 1999–2000 and 2000–2001, beta-blocker use from 74% to 88% and ACE-inhibitor use from 54% to 67%.[15] This follows an earlier study[16] that concluded that the use of beta-blockers and ACE-inhibitors after discharge increased in four provinces† between 1997–1998 and 1999–2000. Although the provincial trends were similar, researchers found important regional variations within each province.

Likewise, a literature review conducted for the Canadian Stroke Quality of Care Study reviewed the evidence for six secondary prevention therapies for patients with ischemic stroke:

- acute aspirin therapy (within 48 hours of stroke)
- antithrombotic therapy on discharge (including aspirin, ticlopidine, clopidogrel, dipyridamole and warfarin, unless contraindicated)
- warfarin in atrial fibrillation
- lipid-lowering therapy
- antihypertensive treatment
- smoking cessation[17]

† The study included Nova Scotia, Quebec, Ontario and B.C.

The study gave a grade to each therapy based on the strength of the evidence supporting it. All six were found to have clear benefits except for aspirin therapy in the acute phase of a stroke.[17] Data from Phase 3 of the Registry of the Canadian Stroke Network (for patients enrolled between July 2003 and June 2004, among 12 Ontario hospitals and 1 Nova Scotia hospital) reveal that:

- 87% of patients received aspirin within 48 hours of stroke
- 93% received an antithrombotic agent
- 75% received warfarin for atrial fibrillation
- 57% received lipid-lowering therapy
- 55% received antihypertensive drugs[9]

Taking Action: Coordinating Stroke Care Across the Country

The Canadian Stroke Network (CSN), established in 1999, brings together scientists and clinicians from 24 universities, as well as industry partners and a number of government departments and non-profit agencies, such as national and provincial heart and stroke foundations. The Network's goals include the following:

- **reducing the incidence of stroke in Canada**
- **improving stroke care in hospitals**
- **developing new strategies for protecting the brain from damage**
- **defining ways of repairing the brain and reversing the damage caused by stroke[24]**

The CSN also maintains a registry of stroke patients from participating hospitals in eight provinces. The database includes information on patient demographics, stroke severity, risk factor profile, care received and outcomes.[24]

Concerned with the variations in care across regions, the Network funded the Canadian Stroke Quality of Care Study that identified 23 core indicators to help ensure optimal care of stroke patients.[25] Together with the Heart and Stroke Foundation of Canada, the Network is working "to have a coordinated and integrated stroke strategy in every province and territory by 2013."[19]

Information Gaps: Some Examples

What We Know

- How many Canadians reported having had a heart attack or living with the effects of a stroke and how these and other conditions affect their quality of life.
- How many people underwent inpatient rehabilitation following a heart attack or a stroke, how long they waited to obtain this care and how their functional capacity improved during their stay.
- How many Canadians with a previous heart attack or living with the effects of a stroke report using home care services.
- How readmission rates (adjusted for age, sex and comorbidities) in the first 28 days after initial hospitalization for a heart attack compare across the country.
- Pockets of information on prescription of evidence-based pharmaceutical therapies following a heart attack or a stroke.

What We Don't Know

- What factors might explain higher and lower quality of life measures after a heart attack or a stroke?
- How many people receive rehabilitation services on an outpatient basis after an AMI or a stroke? How many use private rehabilitation services?
- What explains regional differences in readmission rates? What strategies are most effective in reducing unplanned readmissions?
- How often are beneficial medications prescribed to ideal candidates after a heart attack or a stroke? What effect does this have on their quality of life, survival chances and health care use?

What's Happening

- The Safer Healthcare Now! campaign is a Canada-wide initiative that was launched in April 2005. Its goal is to improve health care delivery and patient safety by implementing evidence-based intervention guidelines. It targets six different patient groups and patients with an AMI from one of these groups. One of the six interventions aims to improve heart attack care. Participating facilities are beginning to track and share information on their success in implementing these interventions.
- The Canadian Cardiovascular Outcomes Research Team (CCORT) received a five-year grant from the Canadian Institutes of Health Research (CIHR), beginning April 2006. Research will focus on the theme "Access to Quality Cardiac Care."

For More Information

1 M. Hollander and N. Chappell, *Final Report of the National Evaluation of the Cost-Effectiveness of Home Care: A Report Prepared for the Health Transition Fund, Health Canada* (Victoria, B.C: Health Transition Fund, 2002).

2 J. V. Tu, P. C. Austin, F. A. Woganee, H. L. Johansen, S. E. Brien, L. Pilote and D. A. Alter, "Outcomes of Acute Myocardial Infarction in Canada," *Canadian Journal of Cardiology* 19, 8 (2003): pp. 893–901.

3 K. Donges, R. Schiele, A. Gitt, H. Wienbergen, S. Schneider, R. Zahn, R. Grube, B. Baumgartel, H. G. Glunz and J. Senges, "Incidence, Determinants, and Clinical Course of Reinfarction In-Hospital After Index Acute Myocardial Infarction (Results From the Pooled Data of the Maximal Individual Therapy in Acute Myocardial Infarction [Mitra], and the Myocardial Infarction Registry [MIR])," *American Journal of Cardiology* 87 (2001): pp. 1039–44.

4 J. Benbassat and M. Taragin, "Hospital Readmissions as a Measure of Quality of Health Care," *Archives of Internal Medicine* 160 (2000): pp. 1074–81.

5 J. V. Tu, P. C. Austin, C. D. Naylor, K. Iron and H. Zhang, *Acute Myocardial Infarction Outcomes in Ontario*, eds. C. D. Naylor and P. Slaughter (Toronto: Institute for Clinical Evaluative Sciences, 1999), pp. 83–110.

6 H. L. Johansen, A. T. Wielgosz, K. Nguyen and R. N. Fry, "Incidence, Comorbidity, Case Fatality and Readmission of Hospitalized Stroke Patients in Canada," *Canadian Journal of Cardiology* 22, 1 (2006): pp. 65–71.

7 C. T. T. Tran, D. S. Lee. V. F. Flintoft, L. Higginson, F. C. Grant, J. V. Tu, J. Cox, D. Holder, C. Jackevicius, L. Pilote, P. Tanser, C. Thompson, E. Tsoi, W. Warnica, A. Wielgosz, Canadian Cardiovascular Outcomes Research Team and Acute Myocardial Infarction Quality Indicator Panel, "CCORT/CCS Quality Indicators for Acute Myocardial Infarction Care," *Canadian Journal of Cardiology* 19, 1 (2003): pp. 38–45.

8 Saskatchewan *in motion* Initiative, *in motion* (2006), [online], from <www.saskatchewaninmotion.ca> .

9 M. K. Kapral, F. L. Silver, J. A. Richards, M. P. Lindsay, J. Fang, S. Shi, M. D. Hill, S. J. Phillips, A. Robertson and J. V. Tu, *Registry of the Canadian Stroke Network: Progress Report 2001–2005* (Toronto: Institute for Clinical Evaluative Sciences, 2005).

10 E. A. McGlynn, S. M. Asch, J. Adams, J. Keesey, J. Hicks, A. DeCristofaro and E. A. Kerr, "The Quality of Health Care Delivered to Adults in the United States," *The New England Journal of Medicine* 348, 26 (2003): pp. 2635–45.

11 C. Schoen, R. Osborn, P. T. Huynh, M. Doty, K. Zapert, J. Peugh and K. Davis, "Taking the Pulse of Health Care Systems: Experiences of Patients With Heath Problems in Six Countries," *Health Affairs* 24, 6 (2005): pp. W5-509–W5-525.

12 Safer Healthcare Now! Campaign, *Safer Healthcare Now!* (2006), [online], from <www.saferhealthcarenow.ca> .

13 B.C. Health Services, *B.C. Chronic Disease Management Update, June 2004* (Victoria: B.C. Ministry of Health, 2004).

14 B.C. Health Services, *Chronic Disease Management* (September 21, 2005), cited April 21, 2006, from <www.healthservices.gov.bc.ca/cdm/index.html>.

15 C. Jackevicius, D. Alter, J. Cox, P. Daly, S. Goodman, W. Filate, A. Newman, J. V. Tu and Canadian Cardiovascular Outcomes Research Team, "Acute Treatment of Myocardial Infarction in Canada 1999–2002," *Canadian Journal of Cardiology* 21, 2 (2005): pp. 145–52.

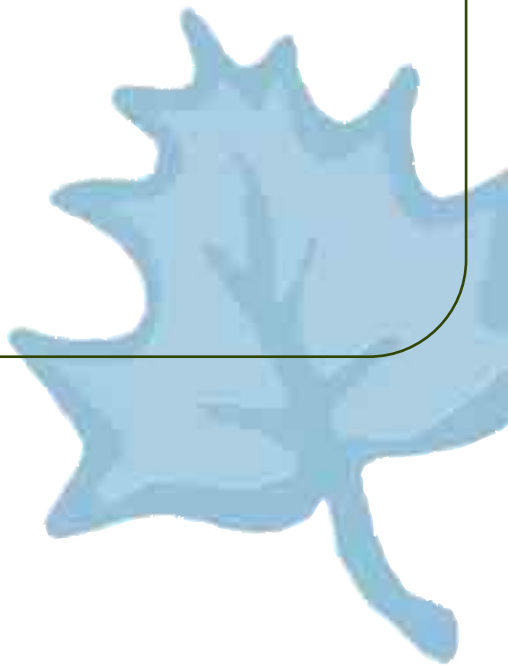
16 L. Pilote, C. A. Beck, I. Karp, D. Alter, P. Austin, J. Cox, K. Humphries, C. Jackevicius, H. Richard, J. V. Tu and Canadian Cardiovascular Outcomes Research Team, "Secondary Prevention After Acute Myocardial Infarction in Four Canadian Provinces, 1997-2000," *Canadian Journal of Cardiology* 20, 1 (2004): pp. 61–67.

17 M. P. Lindsay, M. K. Kapral, D. Gladstone, R. Holloway, J. V. Tu, A. Laupacis and J. M. Grimshaw, "The Canadian Stroke Quality of Care Study: Establishing Indicators for Optimal Acute Stroke Care," *Canadian Medical Association Journal* 172, 3 (2005): pp. 363–65.

18 Institute of Clinical Evaluative Sciences, *Canadian Stroke Quality of Care Study: Draft Quality Indicators and Literature Review* (Toronto: Institute of Clinical Evaluative Sciences, 2004).

19 The Canadian Stroke Network, *The Canadian Stroke Network (2006)* [online], from <www.canadianstrokenetwork.ca>.

Index



Index

Page numbers in italics indicate that the information appears only in a table, figure or sidebar.

Order Form

Name _____

Title _____

Organization _____

Address _____

City/Prov. or Terr./Postal Code _____

_____

Phone _____

Fax _____

Email _____

Method of Payment

❑ A cheque or money order payable to the Canadian Institute for Health Information for $_____ is enclosed.

❑ Visa ❑ MasterCard

Card Number _____

Expiry Date _____

Cardholder Name _____

Authorized Signature _____

Please send payment to:
Order Desk, Canadian Institute for Health Information
495 Richmond Road, Suite 600
Ottawa, Ontario K2A 4H6
Phone: (613) 241-7860 Fax: (613) 241-8120

PRODUCT✤	QUANTITY	PRICE A	PRICE B	TOTAL
Health Care in Canada 2006 (*Printed version*)		**$30.00**	**$40.00**	
Health Care in Canada 2006 (*Web version on www.cihi.ca*)		**$0**	**$0**	**N/A**
Les soins de santé au Canada 2006 (*Printed version*)		**$30.00**	**$40.00**	
Les soins de santé au Canada 2006 (*Web version on www.cihi.ca*)		**$0**	**$0**	**N/A**

GST/HST registration no. R137411641.

Subtotal	
Handling and shipping applicable to orders outside of Canada (minimum $25.00)	
Taxable total	
GST (7%) or HST (15%)*	
TOTAL	

Price A applies to Canadian health care facilities, governments, not-for-profit health agencies, universities, health professionals and researchers from the public sector.

Price B applies to private commercial operations (such as, but not limited to, software vendors and consultants), foreign clients and others not qualifying for Price A.

✤ For information about other CIHI products, please see CIHI's Products and Services Catalogue, available online at www.cihi.ca.

* All Canadian orders are subject to 7% Goods and Services Tax or the 15% Harmonized Sales Tax for Nova Scotia, New Brunswick and Newfoundland and Labrador. (Not applicable to orders shipped outside of Canada.)

Canadian Institute for Health Information
Institut canadien d'information sur la santé

We welcome comments and suggestions on *Health Care in Canada 2006* and about how to make future reports more useful and informative. Please complete this feedback sheet and send it to the address below or email your ideas to healthreports@cihi.ca.

Health Reports Feedback
Canadian Institute for Health Information
90 Eglinton Avenue East, Suite 300
Toronto, Ontario M4P 2Y3

Instructions

For each question, please put an "X" beside the most appropriate response. There are no right or wrong answers; we are interested in your opinions. Our goal is to improve future reports. Individual responses will be kept confidential.

Overall satisfaction with the report

1. How did you obtain your copy of *Health Care in Canada 2006*?
   - ❑ It was mailed to me
   - ❑ From a colleague
   - ❑ Through the Internet
   - ❑ I ordered my own copy
   - ❑ Other (please specify) _____

2. To what extent have you read through the report?
   - ❑ I have read through the entire report
   - ❑ I have read certain chapters and browsed through the entire report
   - ❑ I have browsed through the entire report

3. How satisfied are you with the following aspects of the report?

Clarity	❑ Excellent	❑ Good	❑ Fair	❑ Poor
Organization/format	❑ Excellent	❑ Good	❑ Fair	❑ Poor
Use of figures	❑ Excellent	❑ Good	❑ Fair	❑ Poor
Quality of analysis	❑ Excellent	❑ Good	❑ Fair	❑ Poor
Level of detail presented	❑ Excellent	❑ Good	❑ Fair	❑ Poor
Length of the report	❑ Excellent	❑ Good	❑ Fair	❑ Poor

Usefulness of the report

4. Please indicate how useful you found each of the following sections of the report by putting an "X" where appropriate.

Executive Summary	❑ Very useful	❑ Somewhat useful	❑ Not useful	❑ Did not read
What We Spend	❑ Very useful	❑ Somewhat useful	❑ Not useful	❑ Did not read
Health Human Resources in Canada	❑ Very useful	❑ Somewhat useful	❑ Not useful	❑ Did not read
The Rates	❑ Very useful	❑ Somewhat useful	❑ Not useful	❑ Did not read
Who Is at Most Risk	❑ Very useful	❑ Somewhat useful	❑ Not useful	❑ Did not read
The Care	❑ Very useful	❑ Somewhat useful	❑ Not useful	❑ Did not read
After Leaving Hospital	❑ Very useful	❑ Somewhat useful	❑ Not useful	❑ Did not read
Health Indicators 2006 (insert)	❑ Very useful	❑ Somewhat useful	❑ Not useful	❑ Did not read

5. How do you plan on using the information presented in this report?

6. What did you find most useful about this report?

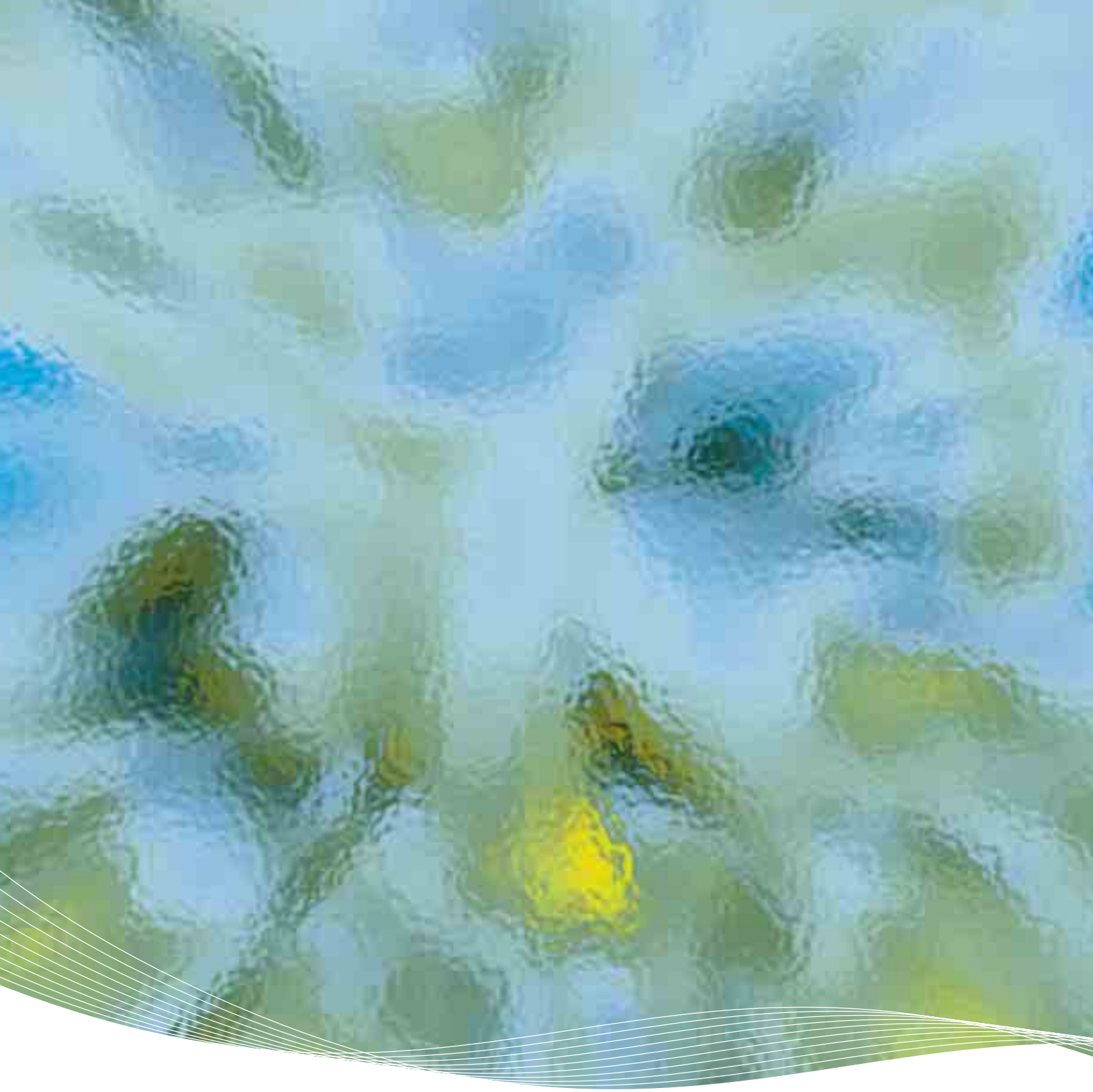
7. How would you improve this report? Do you have any suggestions for future reports?

Reader information

8. Where do you live?

- ❑ Newfoundland and Labrador
- ❑ Nova Scotia
- ❑ New Brunswick
- ❑ Prince Edward Island
- ❑ Quebec
- ❑ Ontario
- ❑ Manitoba
- ❑ Saskatchewan
- ❑ Alberta
- ❑ British Columbia
- ❑ Northwest Territories
- ❑ Yukon Territory
- ❑ Nunavut
- ❑ Outside Canada (please specify country) _____

Thank you for your feedback.



www.cihi.ca *Taking health information further*
www.icis.ca *À l'avant-garde de l'information sur la santé*