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DOCUMENTED
BRIEFING

Health and Medical Research in Canada

Observatory on Health Research Systems

Edward Nason

The research described in this report was prepared as part of RAND Europe's Health Research System Observatory Documented Briefing series, funded by the English Department of Health.

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Preface

This documented briefing provides an overview of health and medical research in Canada. The report is part of a series of country-specific reports available from RAND Europe's Observatory on Health Research Systems, funded by the English Department of Health.

The report is divided into three parts. In the first part, the *Structure of the Canadian Health Research System*, including funding sources, sectors performing health and medical research, and health research priority setting, is presented. The second part, *Processes and Performance of the Canadian Health Research System*, focuses on the types of funding available and how funding activities are conducted, and provides exemplars of the system's performance. The third part presents an *Outlook* and considers current and emerging health research issues in Canada.

The report is based on desk-based document review and will be updated on a regular basis. It does not attempt to discuss current policy options, or make recommendations for future strategy. The report will be of interest to government officials dealing with health and medical research policy, medical research councils, health and medical research charities, public and private institutions engaged in health research, and researchers.

The use of $ throughout this report stands for Canadian dollars, unless stated otherwise.

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Contents

Summary

Summary: Key Points

- Funding by endowment; providing lump sums to research and funding from the interest on that sum as opposed to traditional research funding
- Prevalence of higher education field in *funding* research as well as performing research
- Focus on aboriginal health
- Translational activities; explicit focus on translating research to commercial gains through government funding

One of the most interesting aspects of the Canadian health research system is the use of endowment funding, a system more commonly associated with university funding. The funding of the Canadian Health Services Research Foundation (CHSRF) is mainly funded by endowments from the major federal funders of health or services research: the then Medical Research Council of Canada (MRCC; now the Canadian Institutes of Health Research [CIHR]); Health Canada (the federal healthcare funder); and the Social Sciences and Humanities Research Council (SSHRC). Between 1997 and 2002, the CHSRF has received endowments totalling over $150 million,[2] of which the endowment exclusively controlled by CHSRF amounts to $110 million. This gives the organisation an annual operating budget of around $16 million (the interest accrued annually on the endowment), which is supplemented by additional federal grant funding.[3] Another example of endowment funding is the Alberta Heritage Foundation for Medical Research, who receives endowments from the Alberta Provincial Government, and now have an endowment fund of over $1 billion (Alberta Heritage Foundation for Medical Research, 2005).

[2] CHSRF, "History: Where did CHSRF Come From?" http://www.chsrf.ca/about/history_e.php (as of March 26, 2007).

[3] CHSRF, "Organizational Structure," http://www.chsrf.ca/about/structure_e.php (as of March 26, 2007).

Another interesting aspect of the Canadian system is the prevalence of the higher education sector in the funding of health R&D; in fact, 2005 figures (Statistics Canada, 2006a) suggest that the higher education sector spend more than the federal government, and nearly as much as industry, on health R&D. This is partly a reporting issue based on the use of total R&D expenditures that include indirect expenditure on research and researchers, therefore boosting HE spend on R&D.

As with many other countries with a minority indigenous population, Canada has a number of health problems that are specifically relevant to their aboriginal population. CIHR have a specific institute in aboriginal health which in 2005/06 spent nearly $6.5 million on R&D for aboriginal issues. CIHR also spent an additional $12 million outside of the funding from the aboriginal institute (CIHR, Institute of Aboriginal Peoples' Health, 2006). Politically, there is great importance attached to the issues faced by aboriginal population.

Also of note is the emphasis on translation that is evident in the government-funded sector of the health research system, in which CIHR has several specific programmes to foster translation to practice and economic benefit. CIHR also participates in the Networks of Centres of Excellence (NCE) programme that aims to improve research and translation through extensive virtual networks of academic researchers, industry, government, and hospitals.

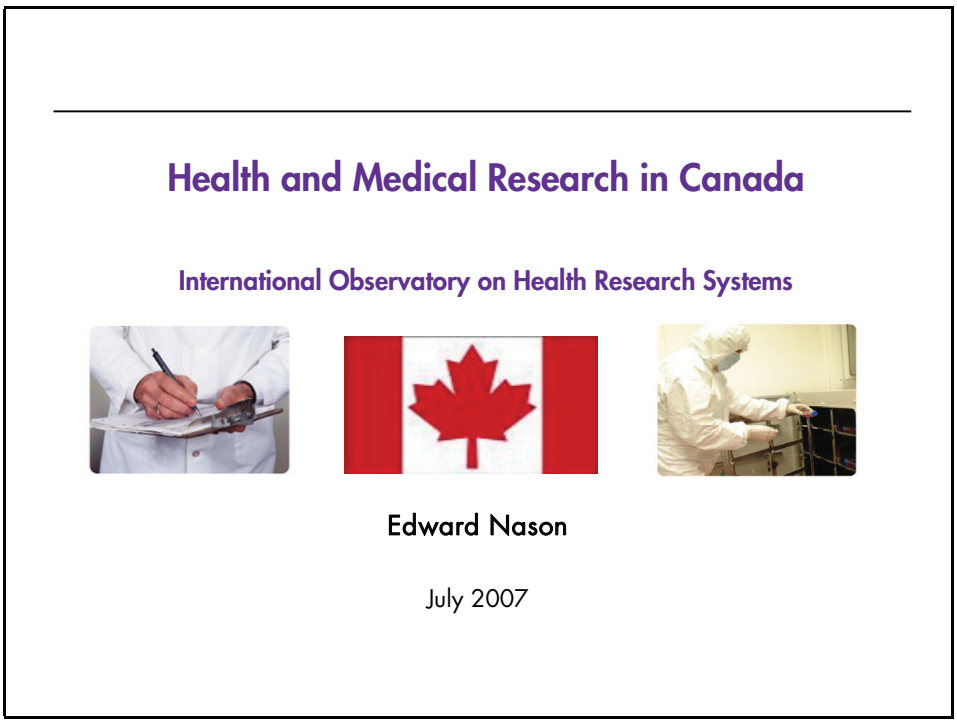
Acknowledgments

The author would like to give thanks for the valuable input of Observatory team members Amanda Scoggins, Tom Ling, Sally Hargreaves, Miriam Shergold and Jan Tiessen, as well as careful editing by Lucy Bailey. Further constrictive comments were provided by Quality Assurance reviewers Jonathan Grant and Charlene Rohr.

Abbreviations and terms

BCMA	British Columbia Medical Association
CFI	Canada Foundation for Innovation
CHSRF	Canadian Health Services Research Foundation
CIHR	Canadian Institutes of Health Research
CRC	Canadian Research Chairs
GDP	Gross domestic product
HSFC	Heart and Stroke Foundation of Canada
ICRP	Indirect Costs of Research Program
IT	Information technology
MRCC	Medical Research Council of Canada
NCE	Networks of Centres of Excellence
NSERC	Natural Science and Engineering Research Council
Rx&D	Canada's Research-based Pharmaceutical Companies
SSHRC	Social Sciences and Humanities Research Council

Introduction



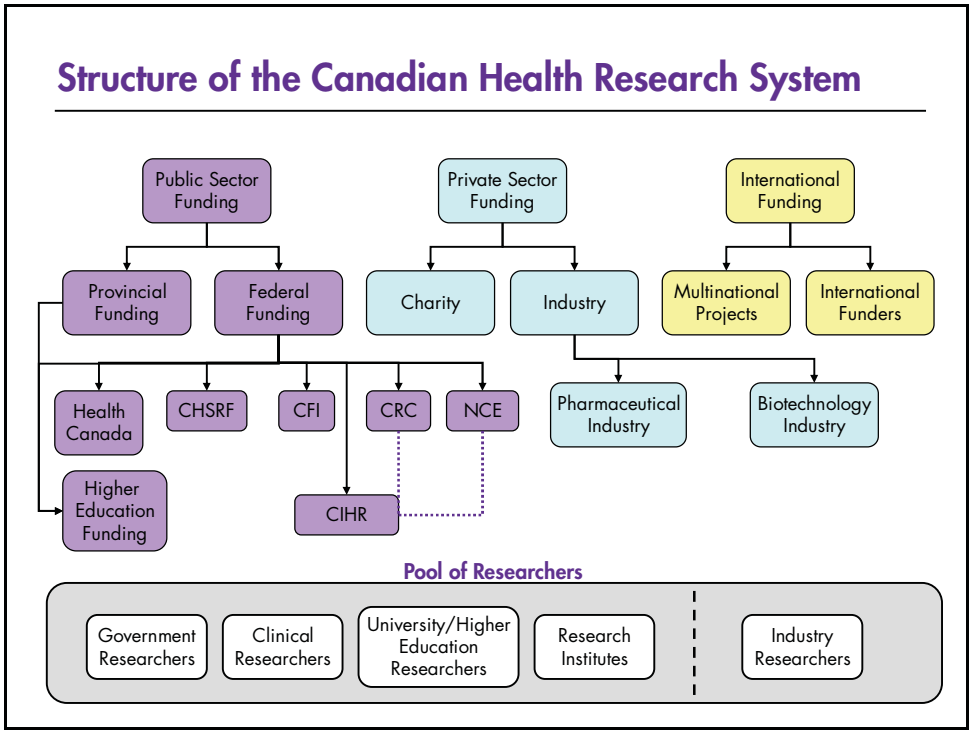
To understand the key players in any health research system it is first vital to understand how the components of the system fit together. The first section of this report covers the structure of the Canadian health research system; addressing the funding and responsibility flows within the system and an overview of the mission and governance of the key players involved in funding and performing health research in Canada.

The second section provides details on the issues that are pertinent to funding health systems, rather than to specific funders. As such it covers the context within which the health research system fits, the methods of funding used (e.g. project or fellowship), overheads for research projects and researchers, translation of research, peer review, research capacity, and the setting of overall research priorities.

The final section identifies some of the issues that are of most interest to the Canadian health research system at the time of writing. It does not aim to be a comprehensive study of the challenges facing the system, and will not be able to capture future issues that arise.

Although this briefing will cover the Canadian health research system as a whole, it is important to note that details within the system may be lost in a large overview. As such, a number of specifics that are of particular interest because they stand out within the system are covered here.

Structure of the Canadian Health Research System

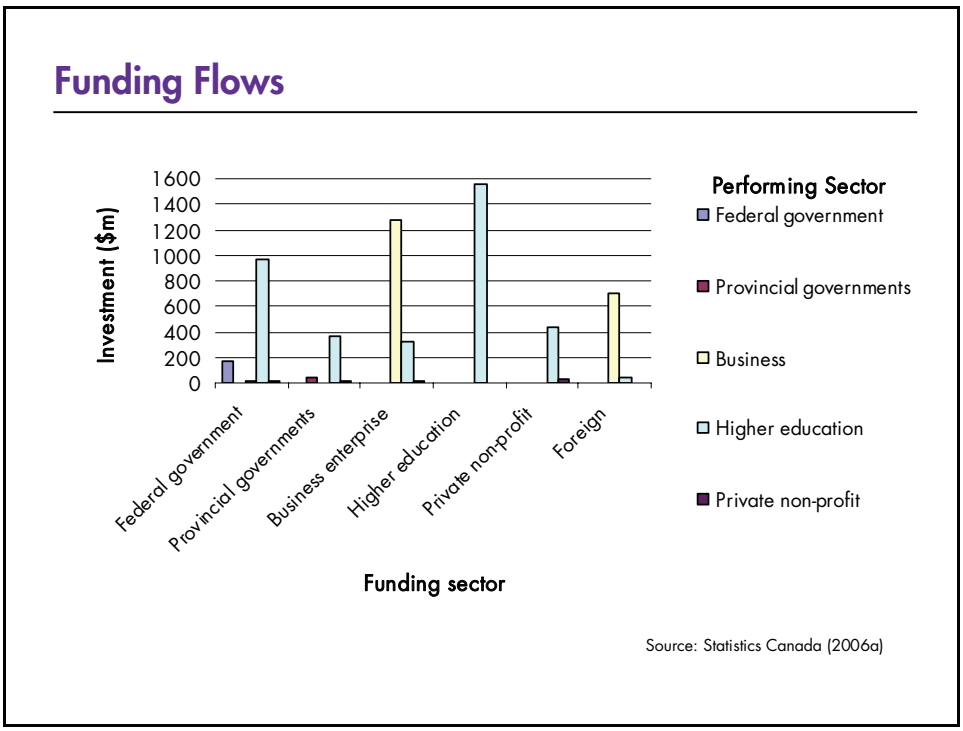


The Canadian health research system can be split into three broad groups. At the top level, are R&D funding bodies, which in Canada encompass public sector (government) funding, private sector funding (charities and industry), and international funders. Public sector funding is split between federal and provincial government funds. Although the majority of R&D funding comes from federal government, the majority of funding to higher education comes from provincial governments.

At mid-level are specific bodies that distribute research funds; this is most specifically seen in the public funding sector, in which the two main funders are CIHR and Health Canada. Aside from the two main funders for health research, other government bodies are involved in funding research for health, the main players are as follows: CHSRF, the Canada Foundation for Innovation (CFI), the Canadian Health Research Chairs Scheme, the NCE Scheme, and the higher education sector. Defence R&D Canada also has a stream of biotechnology research that interacts with CIHR research, but this is difficult to quantify.

At the lowest level (in terms of flows of R&D funding) are the practitioners of research. In Canada, this constitutes a pool of researchers in government institutions (such as researchers at CIHR and Health Canada), clinical researchers in hospitals, researchers in higher education establishments, researchers in designated research institutes (outside both

higher education and hospitals), and researchers in industry. Funding bodies fund more than just one of these groups, and may in fact fund across all the groups (even industry receives some funding from government sources).



In 2005, funding to Canadian health R&D was just under $6 billion (0.44% of GDP[4]) (Statistics Canada, 2006a), this represents a rise of 7 percent on the 2004 figures (equivalent to $379 million additional funding). In fact, the growth in health R&D funding has been substantial in the last ten years, and has trebled from just over $2 billion (0.25% of GDP) in 1995. In terms of the percentage gross expenditure on R&D in Canada, it has risen to 23 percent from 16 percent in 1995. During this time, gross estimate of R&D as a percentage of GDP has risen slightly from 1.7 percent to 2 percent (Statistics Canada, 2006b).

Splitting the health R&D funding into funding and performing sectors allows analysis of the flow of funds through the Canadian system. The major funders of health research are business enterprise and higher education (in 2005, providing $1.5 billion (0.11% of GDP) and $1.6 billion (0.12% of GDP), respectively), with government providing around $1.6 billion (0.12% of GDP) between federal and provincial branches. These three funding bodies provide around 80 percent of the Canadian health research funds (around 27 percent each).

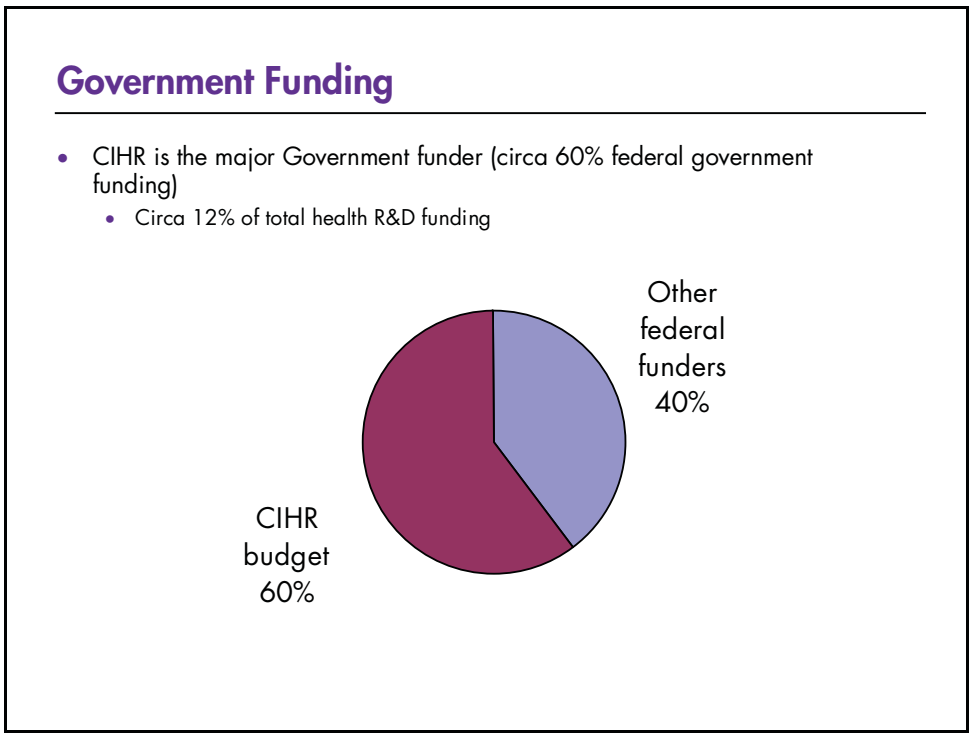
The pool of researchers that can contribute to the performance of health research does not take evenly from the research funders. By far the majority of research is done by the higher education sector, which performs 62 percent of the research (by total funds allocated). Funding comes to Higher Education Institutes from all research funders. By contrast, the second largest performer of research, the business enterprise sector (34 percent), is funded

[4] Percentage of gross domestic product (GDP) statistics are calculate using OECD Statistics: GDP, Annual in millions Current Prices (National Currency). http://stats.oecd.org.

almost entirely by their own sector and foreign investment (totalling 99.3 percent of their funding).

Funding flows from research funder to research performer tell part of the story of funding flows; however, in the world's second largest country, there is also an issue over where funding flows geographically. Using the higher education sector as a proxy for research performance, the majority of Canada's research funds are taken up by Ontario and Quebec (totalling 71 percent of R&D funding in 2003). If funds are considered per capita population, then Nova Scotia and Alberta both become important players in the health research system (despite only accounting for 14 percent of funding; Statistics Canada, 2006a).

Since most of research is funded by the federal government, business enterprise, and the higher education field, this document focuses mainly on those streams of funding. It does identify other major funders in the not-for-profit and international funding sectors, but does not go into detail on them.



The majority of direct funding to R&D through government sources comes from the federal government (73 percent) rather than the provincial governments (27 percent; Statistics Canada, 2006a). Provincial government funding often takes the form of matched funding for nationwide initiatives, such as matched funding for Genome Canada projects in individual provinces. As such, it is prudent to focus on federal government funding when discussing government funds for health R&D. Also, provincial funding for research is through university funding (part of the provincial government's education budgets) and this aspect will be picked up on when discussing higher education research funding.

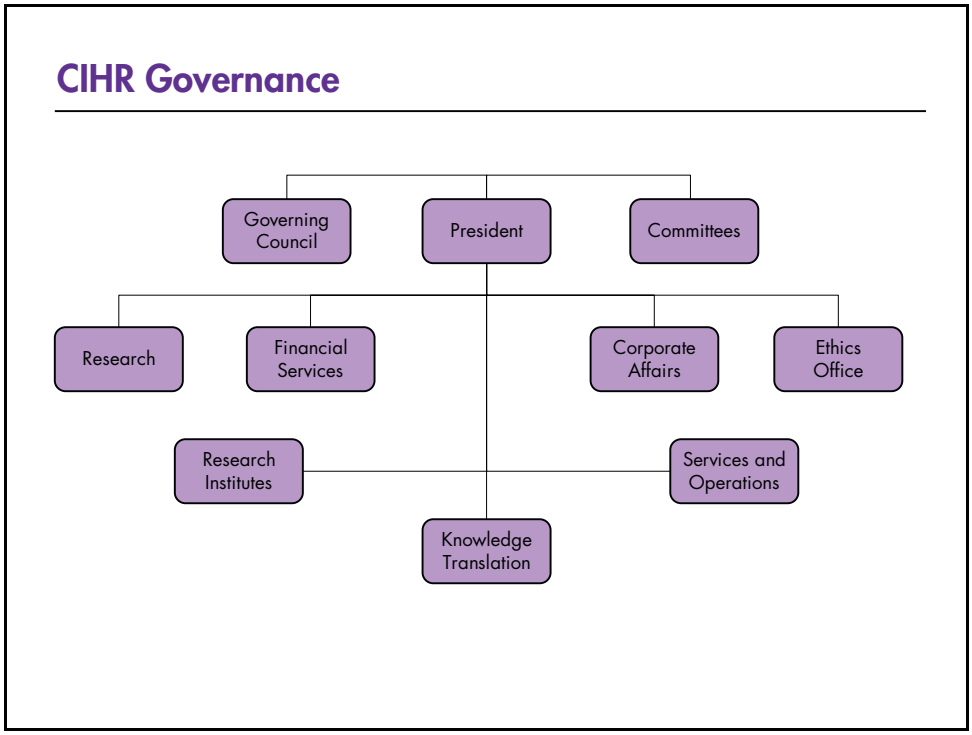
In terms of federal government funding, the main provider is CIHR, who, based on 2005 figures, are responsible for around 60 percent of all federal R&D funding.[5] In fact, CIHR were responsible for around 12 percent of all R&D funding for health in 2005, making them the largest single funder of health R&D in Canada.[6]

Other government research funders in health R&D include the government health system, Health Canada, CHSRF, and CFI, although their contribution to health research is individually not as large as CIHR. Health Canada is responsible for public health and their research is in that area. The office of the Chief Scientist of Canada is also part of Health Canada. CHSRF funds a small amount of research (only $5 million in 2004; CHSRF, 2005, p. 20) into management of healthcare, primary healthcare, and nursing. The

[5] This is based on the CIHR reported spending of $700 million, as reported on their Web site, and the total spend on R&D for health by federal government identified by Statistics Canada (2006a).

[6] CIHR, "July Web Profile—CIHR Stimulates the Introduction of Novel Life Sciences Innovations," http://www.cihr-irsc.gc.ca/e/31753.html (as of April 5, 2007).

Canadian Research Chairs (CRC) and NCE programmes also fund health research, with their funding for health (representing around one third of CRC funding and one half of NCE funding) being distributed through CIHR.



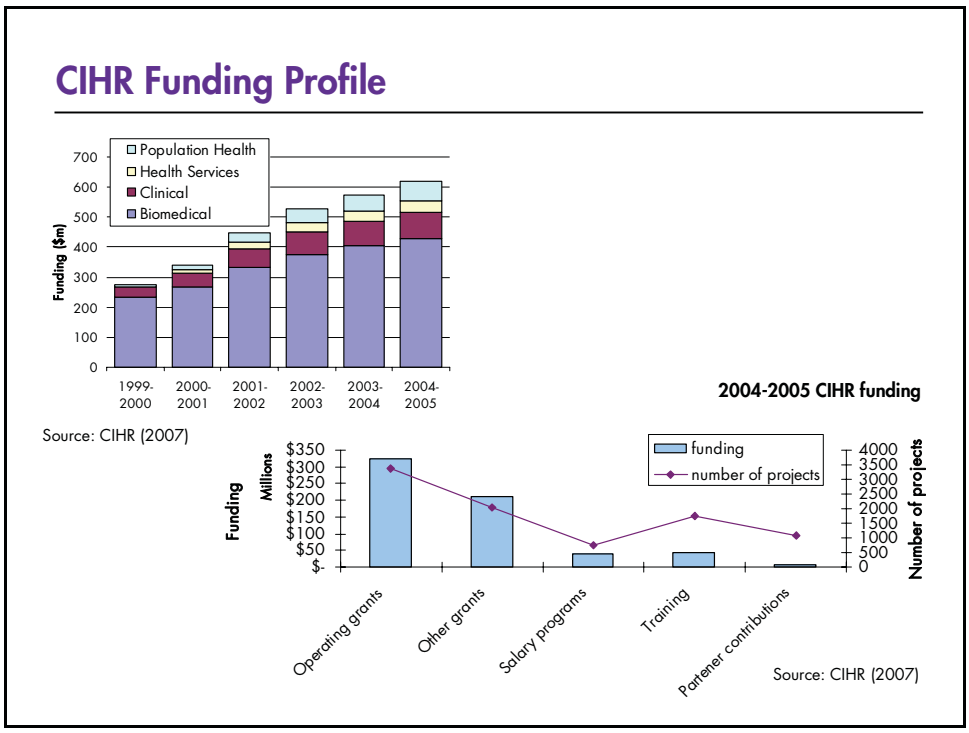
CIHR was established in 2000 as a Departmental Corporation and separate employer listed in Schedule II of the Financial Administration Act by the CIHR Act (2000).[7] It was developed as a body at arms length from government that is accountable for its funding to the Health Minister.

The governance structure of CIHR incorporates the main streams of the organisation, and gives an idea of the goals CIHR sets and the issues it faces. At the highest level, the President of CIHR is Dr Alan Bernstein, who has been president since the inception of the CIHR in 2000. As a former researcher, his research interests lie in embryonic development, haematopoiesis, and cancer.

At the top level, alongside the President and balancing his powers are the governing council and the various governing committees that support the governing council in their duties. The governing council has a responsibility for the strategy and accountability of the CIHR, and includes the deputy Health Minister.

At the level below, several bodies are responsible for specific aspects of CIHR's responsibilities. These include: the financial, corporate, and services groups who act on the operational side of CIHR; the research group is responsible for all the research support activities of CIHR outside of the research institutes, which are represented separately; and ethics support and knowledge translation, which are also represented at this level.

[7] The CIHR Act, http://www2.parl.gc.ca/HousePublications/Publication.aspx?pub=bill&doc=C-13&parl=36&ses=2&File=28&Language=E (as of April 5, 2007).



CIHR has a mandate for their work, which is:

> "To excel, according to internationally accepted standards of scientific excellence, in the creation of new knowledge and its translation into improved health for Canadians, more effective health services and products and a strengthened Canadian health care system."[8]

Within the scope of this mandate are a number of ways in which CIHR splits its research funding to achieve excellence and translation of research. CIHR research falls into four broad themes,[9] often referred to as the four pillars of CIHR research:

- *Biomedical research*: to understand normal and abnormal human functioning, at the molecular, cellular, organ system and whole body levels.
- *Clinical research*: to improve the diagnosis and treatment (including rehabilitation) of disease and injury; and improving the health and quality of life of individuals.
- *Health Services Research*: to improve the efficiency and effectiveness of health professionals and the health care system, through changes to practice and policy.
- *Social, Cultural, Environmental, and Population Health Research*: to improve the health of the Canadian population, or of defined sub-populations.

The use of the "four pillars" as a funding strategy aims to produce a balanced portfolio of research that can address all the health problems faced by Canadians. Since CIHR began

[8] CIHR, "An Overview of CIHR," http://www.cihr-irsc.gc.ca/e/30240.html (as of April 5, 2007).

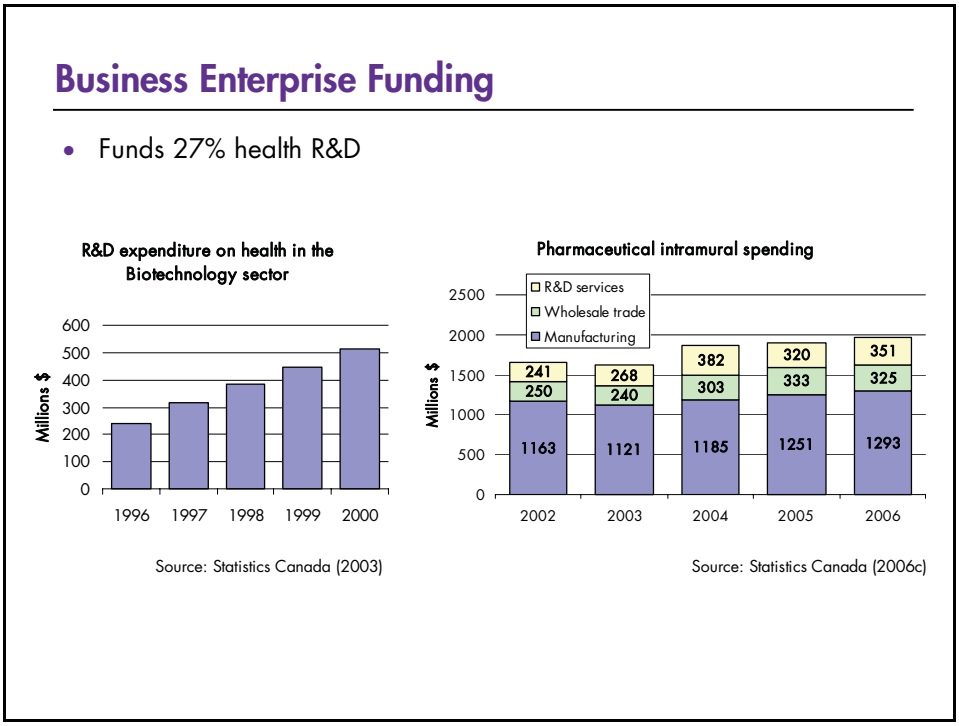
[9] CIHR, "CIHR Funding Policy: 2006–2007 CIHR Grants and Awards Guide," Section 1-A1.1, http://www.cihr.ca/e/22630.html (as of April 5, 2007).

funding, they have been steadily growing both the total funding provided and the spread of those funds. However, basic biomedical science is still by far the majority of CIHR funding (nearly 70 percent in 2005).[10]

CIHR funds across the four pillars, as mentioned above, and these funds are available as project, support, and people funding. Operating grants cover the majority of project funding and in 2005 totalled $324 million (52 percent of all funds). Funding for people through salary programmes constituted only $42 million (7 percent) in comparison.[11]

[10] CIHR (2005), "Research Funding Overview," http://www.cihr-irsc.gc.ca/e/22955.html (as of April 5, 2007).

[11] *Ibid*



Trying to understand the specifics of business enterprise funding is difficult in all countries because of the need for business to protect its own interests. In Canada the situation is no different. Identifying any commonality in governance structure or mission statement can only be restricted to identifying that business enterprises run with a Chief Executive Officer and Executive Board, and that their guiding principal is return on investment.

However, Canada's Research-based Pharmaceutical Companies (referred to collectively as Rx&D)[12] and Statistics Canada do collect information on funding flows from the pharmaceutical and biotechnology industries. This is important since business enterprise is the largest single funder of health research by sector, accounting for 27 percent of all health R&D funds (Statistics Canada, 2006a).

Rx&D figures show the huge rises in R&D funding by the Canadian pharmaceutical industry, from just $69 million in 1984 to $1.17 billion (0.09% of GDP) in 2004 (a rise of around 1600 percent), and that the pharmaceutical industry employed over 22,000 people in 2004 (Rx&D, 2005).

Statistics Canada identified the R&D spend by business enterprise at $14.9 billion (1.06% of GDP) for all industry in 2006. In the pharmaceutical industry, this figure was $1.29 billion (0.09% of GDP) (the third largest sector by spend), and in the scientific R&D services the figure was $1.14 billion (0.08% of GDP). When combining the intramural

[12] Rx&D represents over 50 Canadian research companies, covering around 10,000 employees. Their mission is to improve the quality of life of Canadians and enhance the health-care system by fostering the discovery, development, and availability of new medicines and vaccines. Rx&D funds themed grants on an annual basis and research studentships. However, their research funding is very small (only $23 million since 1980). More details at http://www.canadapharma.org/About_RxD/Overview/index_e.html (as of April 5, 2007).

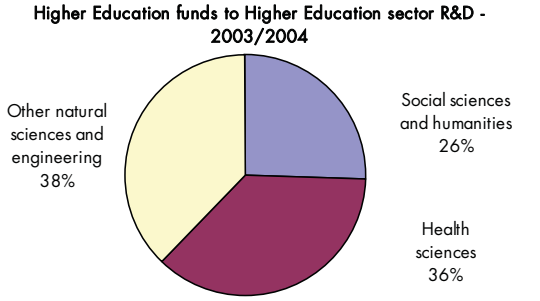
spend on pharmaceutical and medicine R&D, the total for 2006 was nearly $2 billion (0.14% of GDP), most of which (66 percent) was spent on manufacturing R&D (Statistics Canada, 2006c).

In a 2000 analysis of the biotechnology R&D in industry, a total of $516 million (0.04% of GDP) was devoted to biotechnology research for health, representing 72 percent of all R&D spend on biotechnology (Statistics Canada, 2003). This health biotechnology spend was also 41 percent of the total R&D spend by those companies performing any biotechnology research, and 4.2 percent of total R&D spend (not just on health).[13]

[13] Based on the biotechnology for health figures shown and the total R&D spend by industry in 2000 (Statistics Canada, 2006c)

Higher Education Funding

- Fund 26% and perform 62% of health R&D
- Funding comes through funding of researchers and research infrastructure
- Majority of funding comes into universities from Provincial Governments



Source: Bellefeuille (2005)

Since higher education funding forms such a large proportion of funding for health R&D (26 percent), it is important to understand where that money comes from and goes to. Although higher education is the largest performing sector for research in health, interestingly higher education researchers in natural sciences (within which health is the largest subject area) are outnumbered by around 3:1 by researchers in the business enterprise sector (Statistics Canada, 2007, p. 27).

The large funding that is associated with the higher education sector is different to the activity funding that form the basis for government funding profiles. Statistics Canada classifies R&D funding by the higher education sector as including salaries, equipment, supplies, patent costs, administration, and other overheads.[14] This has the effect of including a number of indirect expenditures that are not covered in the R&D funding measures for other sectors (such as government and business enterprise). The largest funding category is salaries, but infrastructure and overhead costs are not insubstantial.

Higher Education Institutes receive the majority of their funding (that not directly for research) from provincial governments and tuition fees for students. In 1998–1999, the two sources accounted for 47 percent and 20 percent, respectively, of all university revenues across Canada.[15] This funding is then distributed to support the items that constitute Statistics Canada's definition of R&D expenditure (both direct and indirect).

[14] This is a selection of the costs included (full list in Bellefeuille, 2005, p. 10).

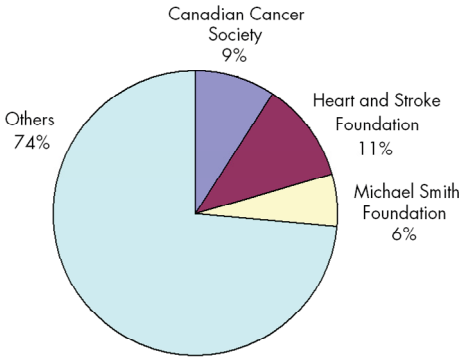
[15] Statistics Canada, "The Daily, Tuesday, July 25, 2000: University Finances," http://www.statcan.ca/Daily/English/000725/d000725c.htm (as of April 5, 2007).

Of the R&D activities funded by and performed at university level, there is a relatively even split between research areas. Health research constituted 36 percent of these R&D funds in 2003–2004, representing an R&D investment into health by the higher education sector of around $1.3 billion (0.05% of GDP) (Bellefeuille, 2005).

Not-for-profit and International Funding

Not-for-profit organisations

- Fund just 8% of health R&D
- Major charities include
  - Heart and Stroke Foundation Canada
  - Canadian Cancer Society
  - Michael Smith Foundation for Health Research



International organisations

- Fund 12% of health R&D
- Major international funders are industry, but some philanthropic (e.g. Gates Foundation)

As the not-for-profit and international sectors are small in terms of funding within the Canadian health research system, they will not be covered in detail here. However, identifying examples of research funders in both the not-for-profit and international sectors does provide some contextual information on the scope that these sectors cover.

With the not-for-profit sector providing just eight percent of Canadian R&D funding, the amounts funded by individual charities are relatively small. No single charity dominates the funding sector. As examples of three of the larger charities that fund in health, we identify two large disease specific research charities and one large province specific foundation.

The Canadian Cancer Society is the largest independent funder of cancer research in Canada, with a research budget in 2005 of $42.3 million (Canadian Cancer Society, 2006, p. 15). This funds research into all types of cancers and includes support for clinical trials, care and prevention, and genetics research.

The Heart and Stroke Foundation of Canada (HSFC) fund research into all aspects of cardiovascular disease, with particular emphasis on heart disease and stroke (the leading cause of death in Canada). In 2005, the HSFC spent $53 million on research, and more on health promotion and community programmes (HSFC, 2007, p. 20). Over its 50-year history, HSFC has spent over $1 billion on research, and they fund researchers and research projects.[16]

[16] HSFC, "All About Research," http://ww2.heartandstroke.ca/Page.asp?PageID=1366&ArticleID=5533&Src=blank&From=SubCategory (as of April 5, 2007).

The Michael Smith Foundation is an example of a charity that does not focus on a disease state, but is geographically constrained. Based in Vancouver, British Columbia, the Foundation seeks to build British Columbia's capacity for excellence in health research, from biomedical and clinical through to health services and population research. In 2005, the Foundation funded awards, programmes, researchers, training, units and institutions to the tune of $27 million (Michael Smith Foundation, 2006).

Taken together, these foundations and charities constitute only 26 percent of the total funding to health R&D in the not-for-profit sector.[17]

Internationally, the majority of research funding goes to the business enterprise sector (95 percent; Statistics Canada, 2006a), suggesting that this funding comes from international businesses (if it follows the Canadian pattern of business mainly funding business). The remaining 5 percent of foreign funding comes from a mixture of international funders funding projects in Canada and international projects with a component in Canada.

An example of a major international funder in Canada is the Bill and Melinda Gates Foundation, which funds several projects. A good example of this is the recent collaboration between the Canadian government and the Gates Foundation to support the Canadian HIV vaccine initiative, for which the Gates Foundation pledged $28 million to the initiative, with the government pledging $111 million.[18]

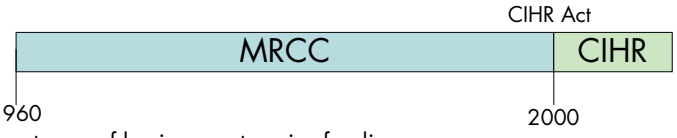
[17] Based on the total R&D funding of the three named charities taken from their annual reports and the recorded gross estimate of R&D for health during 2005 that comes from the not-for-profit sector.

[18] Bill and Melinda Gates Foundation, http://www.gatesfoundation.org/GlobalHealth/Pri_Diseases/HIVAIDS/Announcements/Announce-070220.htm (as of April 5, 2007).

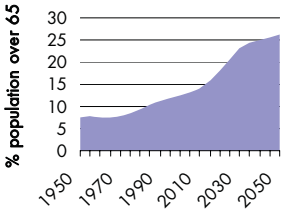
Processes and Performance of the Canadian Health Research System

Contextual Information

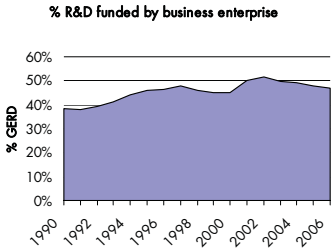
- History:



- Increase in importance of business enterprise funding
- Ageing population



Source: OECD Factbook 2007



Source: Statistics Canada (2006)

- R&D specifically for aboriginal group issues

Historically, the institutional make up of the Canadian health research system has been relatively stable. The predecessor to the CIHR was the Medical Research Council of Canada (MRCC), and was established in 1960. The MRCC ran for 40 years, although the Act that officially bought it into being was only passed in 1968. Initially there were tensions over who decided health research priorities, since the Department of Defence and National Health and Welfare Department contributed more money to health research. In the late 1960s, the establishment of a government-funded health-care system led to an increased community interest in health-care issues, making the work of the MRCC more high profile, and thus easier to fund. It was in 1992 that the MRCC board voted to become part of the CIHR, to increase the scope of their research (MRCC, 2000). The CIHR Act in 2000 established CIHR as the government funding body responsible for health research in 2000.

As government funding has moved to the domain of CIHR, the business enterprise funding sector has become more important as a funding source for health R&D. As an example of this, the percentage of R&D funded by business has grown by around 10 percent over the last 26 years (Statistics Canada, 2006b). Aligned with this funding growth has been the growth in health research in private settings since the 1970s—rising from just 9 percent in 1976, to 29 percent in 1996 (Silversides, 1998).

Demographically, as seen in many other developed nations, there has been a shift in the population structure in Canada. The percentage of the population aged over 65 years increased from 7.6 percent in 1950 to 13.1 percent in 2005,[19] and has placed new stresses on the health system. This aging of the Canadian population is predicted to continue, and is likely to lead to changing priorities for health research.

As mentioned in the earlier discussion of interesting issues surrounding the Canadian health research system, there is a perceived need for research specifically for aboriginal populations. The aboriginal population was just below one million when measured in the last census, representing around 3 percent of the total population of Canada.[20] However, there are very specific political initiatives to increase the spending on aboriginal health research, such as the CIHR Institute of Aboriginal People's Health.[21]

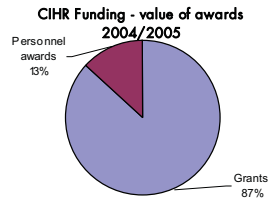
[19] OECD, "OECD Factbook 2007: Economic, Environmental and Social Statistics—Ageing Societies," (with link to tables), http://miranda.sourceoecd.org/vl=280392/cl=16/nw=1/rpsv/factbook/01-02-01.htm (as of April 5, 2007).

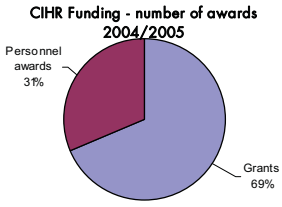
[20] Population measurements taken from Statistics Canada's Census (2001), http://www12.statcan.ca/english/census01

[21] Institute of Aboriginal People's Health, http://www.irsc.gc.ca/e/8668.html (as of April 5, 2007).

Funding Packages

- CIHR
  - Funded 7,648 grants and awards in 2004-2005 (69:31 split)
  - RCTs are considered grant funding
  - CIHR research grants are for between 1 anc 6 years
  - CIHR Personnel awards are for up to 6 year
- Health Canada
  - Programme grants are for up to 2 years, within programmes that last longer
  - Fellowships are for up to 2 years
- Canadian Research Chairs
  - Tier 1 funding is for 7 years and is renewable; Tier 2 funding is for 5 years and is renewable once
- Networks of Centres of Excellence
  - Funding awarded on a 7 year basis, with th opportunity to extend for another 7 years





Source: CIHR (2007)

Funding for health research traditionally comes as activity or person funding. In Canada, activity funding would cover project grants, programme grants, randomised controlled trials (by the CIHR definition), strategic grants, group grants, maintenance and equipment grants, knowledge translation grants, and institute support grants. Personnel awards are salary awards, fellowships, and training grants.

CIHR funded 7,648 grants and awards in the 2004–2005 financial year, to a total of $619 million.[22] The split of activity to personnel funding is 69:31 for the number of funding awards, but 87:13 for the funding following the award. This is unsurprising since activity awards includes large-scale project grants and programme grants. Research grants from CIHR range between one and six years, depending on the nature of the project. Personnel awards can be up to six years long.

Health Canada's research stream funds programmes that are strategic to the public health work that Health Canada performs. Examples of programmes that have run recently are the Health Policy Research Program, the Natural Health Products Research Program, and the Toxic Substances Research Initiative ($40m over five years).[23] Within these programmes, individual projects are funded that fulfil the requirements of the programme. Health Canada also funds personnel awards, with two fellowship programmes: the

[22] CIHR, "Research Funding Overview," September 2005, http://www.irsc.gc.ca/e/22955.html (as of April 5, 2007).

[23] Health Canada, "Science and Research: Funding," http://www.hc-sc.gc.ca/sr-sr/finance/index_e.html (as of April 5, 2007).

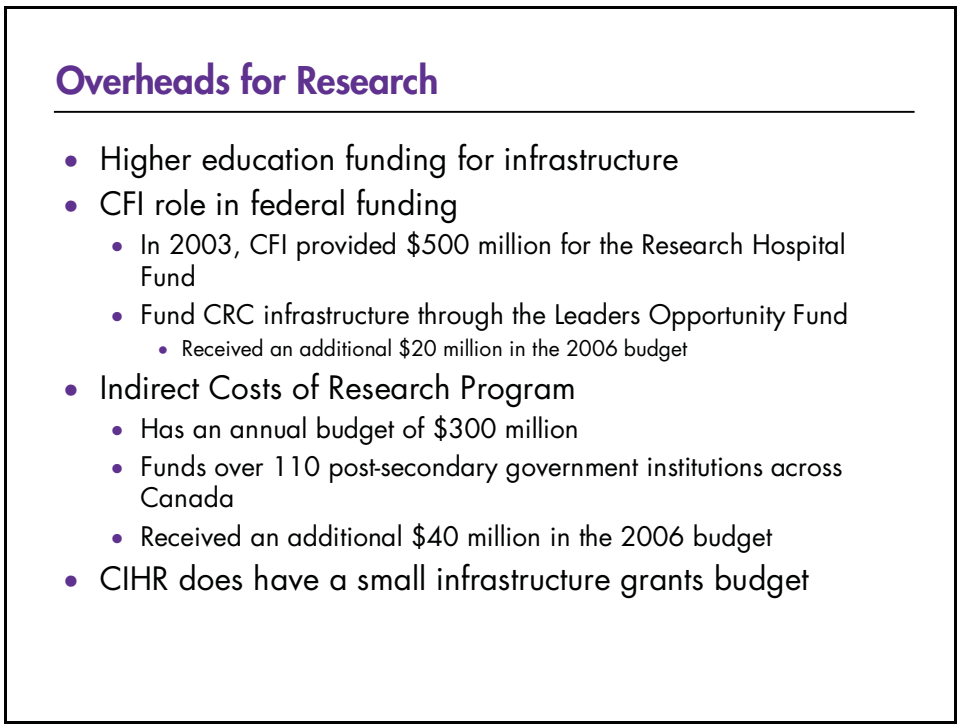
Postdoctoral and Visiting fellowship programmes. There are 20 postdoctoral fellows per year.[24]

The two other main funders of activity and people are the CRC and the NCE programmes. Each of these is an R&D-wide federal government initiative, so do not focus specifically on health. The CRC funding is entirely personnel awards, with two tiers of funding. Tier 1 is for senior investigators, provides $200,000 per year and lasts for seven years and can be renewed; tier 2 funding is for junior investigators, provides $100,000 per year and is for five years (with one renewal possible). CRC funding is paid to universities who then distribute Chairs. NCE funding is for establishing networks of researchers (across academia, policy, and business) and initial funding is for seven years, with an opportunity to renew. The CRC and NCE contributions to health research were $83.6 million and $27.5 million respectively in 2005–2006.[25]

Other funders, such as CFHSR, also fund research grants and capacity development (personnel awards). Research grants include commissioned research that can be either short term (12–24 months) or mid term (up to five years).

[24] Health Canada, "Science and Research: Health Canada Fellowship Programmes," August 2005, http://www.hc-sc.gc.ca/sr-sr/rescar/fellow-bours/index_e.html (as of April 5, 2007).

[25] CIHR, "Financial Overview: Current Budget," September 2005, http://www.cihr-irsc.gc.ca/e/22953.html (as of April 5, 2007).



Since activity funding is covered by grants and awards, the costs associated with research, such as infrastructure costs, need to be covered by someone else. This is where higher education funding for health research is a key contributing factor, since the universities and hospitals fund buildings and equipment that is used across research as a whole through their own budgets.

However, there is a government funder whose main role is to pay for the associated costs of research—the Canadian Foundation for Innovation (CFI). The CFI was created by the Canadian government in 1997 as an independent corporation to fund research infrastructure. Their role is to strengthen the capacity of Canadian universities, colleges, research hospitals, and non-profit research institutions to carry out research for the benefit of Canadians. The CFI fund the infrastructure costs associated specifically with the CRC programme, as well as having a separate research infrastructure fund for hospitals, the Research Hospital Fund, which is expected to invest $500 million between 2004 and 2008, funding at 40 percent of research grant allocation.[26] By the end of 2005, CFI had spent around $250 million on the infrastructure associated with the CRC programme,[27] with an additional $20 million added to the budget from the federal government in the 2006 budget.[28] Overheads are paid at 40 percent in this programme, unless the research is

[26] CFI, "Research Hospital Fund 2004: Call for Proposals," June 13, 2003, http://www.innovation.ca/whatsnew/dsp_news.cfm?newsid=89 (as of April 5, 2007).

[27] CFI, "Programs: Canada Research Chairs Infrastructure Fund," http://www.innovation.ca/programs/index.cfm?websiteid=60 (as of April 5, 2007).

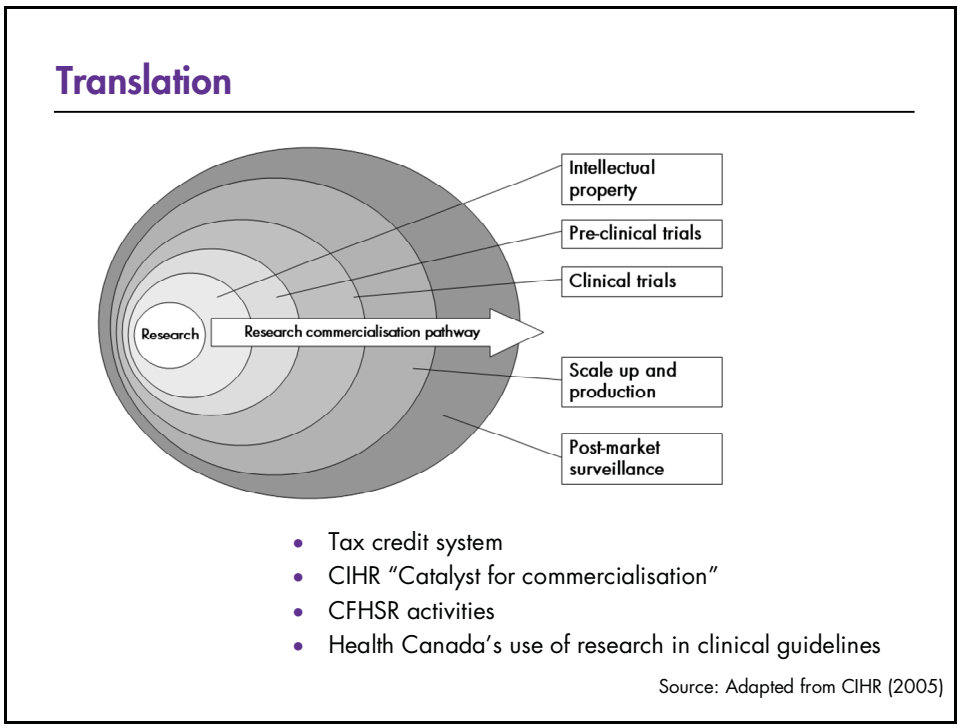
[28] Department of Finance Canada, "Budget 2006: Focusing on Priorities. Chapter 3—Building a Better Canada," http://www.fin.gc.ca/budget06/bp/bpc3be.htm (as of April 5, 2007).

being conducted at a small university and is worth less than $75,000, in which case the institution can apply for 100 percent of costs.

The Indirect Costs of Research Program (ICRP) received an additional $40 million in the 2006 budget, which allows it to fund infrastructure in universities and colleges across Canada. The ICRP budget is now around $300 million a year.[29]

CIHR does fund some infrastructure costs for its research, but the amount spent on those infrastructure grants is very small in comparison to the other infrastructure granting bodies.

[29] ICRP, "Indirect Costs Program. About the Program: Budget," http://www.indirectcosts.gc.ca/about/index_e.asp (as of April 5, 2007).



By defining translation here as the application of research to a non-academic end, we can encompass both translation of research to industry (commercialisation) and translation to clinical practice (evidence-based medicine).

Commercialisation of research is actively supported in Canada through several mechanisms. At the highest level, the government has R&D tax credits for companies, making it cost effective to invest in research.[30] CIHR have a knowledge translation strategy that runs from 2004 to 2009 (CIHR, 2004), which identifies the need to use the benefits of research to strengthen the Canadian economy and health system. This strategy aims to assist health research at all the points in the commercialisation pathway. Within the scope of this strategy are commercialisation initiatives, which include the following: drug development initiatives, proof of principle grants, intellectual property mobilisation programme, the randomised controlled trials mentoring programme, and the Science to Business (S^2B) programme. Overall, between 2000 and 2005, CIHR funded commercialisation activities to the tune of $55 million (CIHR, 2005).

CFHSR has a specific remit as the funder of health services research, and that is to inform evidence-based decision making in health service delivery. It achieves this through a "linkage and exchange" model (Lomas, 2000), in which researchers are encouraged to interact with decision makers in healthcare delivery systems at all points in the research process. 60 percent of CFHSR funding goes to research aimed at health system managers and those making policies for the health system (to the exclusion of practioners; Lomas, 2000). Examples of programmes run by CFHSR are the Capacity for Applied

[30] For example, Canada Revenue Agency, "Scientific Research and Experimental Development: Tax Incentive Program", http://www.cra-arc.gc.ca/taxcredit/sred/menu-e.html (as of April 5, 2007).

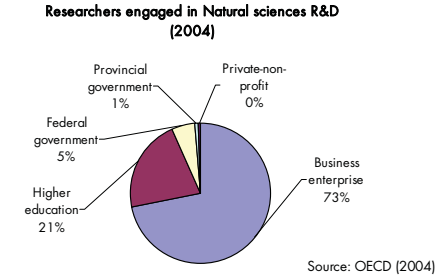
Developmental Research and Evaluation (CADRE) programme and Executive Training for Research Application (EXTRA) programme. Both of these are capacity building initiatives that train researchers and policy makers to understand the issues and challenges faced by the other community.

Health Canada has a key role in establishing evidence-based medicine, since it has a remit to produce clinical guidelines for the Canadian health system.[31] Health Canada use both their own and other's research to support this evidence base in medicine, and the use of evidence is summarised in their 2006 publication (Health Canada, 2006).

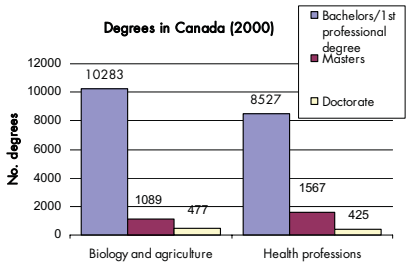
[31] Health Canada, "About Health Canada—Guidelines," http://www.hc-sc.gc.ca/ahc-asc/legislation/guide-ld/index_e.html (as of April 5, 2007).

Research Capacity

- Majority of researchers housed in industry
- Health professions are 7% of all degrees, but 11% of doctorates
- CRC aims to reduce 'brain drain', and encourage migration to Canada



Source: OECD (2004)



Source: Statistics Canada (2007)

In any R&D system, there are many determining factors for the success of the system. Having covered the funding and infrastructure issues, it is important to address the human resource issue.

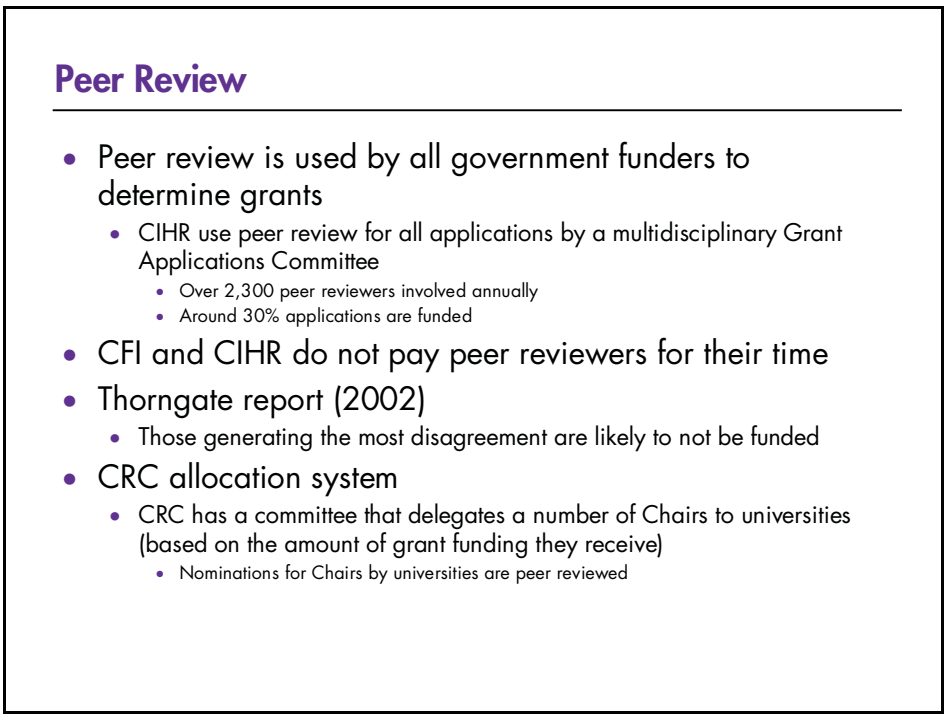
In Canada, the majority of researchers (84 percent) are in natural sciences R&D (data on the number of R&D personnel in health alone is not readily available; Statistics Canada, 2007). Of these natural science researchers, by far the majority are based in industry, in which the number of personnel involved in R&D in 2004 was more than three times larger than that in the next largest sector (i.e. higher education; Statistics Canada, 2007, p. 27).

In terms of supply of scientists, the health professions and biological sciences produced 14 percent of all degrees in Canada in 2000. Interestingly, the percentage of doctorates allocated to biology and health students was much higher, at 24 percent of all doctorates (OECD, 2004, p. 6).

To maintain those researchers qualifying in Canada and to bring back those who have left to move to other countries to undertake research, the CRC programme explicitly aims to target expatriate and foreign researchers ('brain gain'). This has been relatively successful with 31 percent of the Chair holders recruited from outside Canada by 2006 (including over 240 expatriate researchers returning to the country).[32] The CRC programme has also had the knock on effect of encouraging young researchers into the laboratory, with Chair

[32] CRC, "Program statistics," March 2006, http://www.chairs.gc.ca/web/about/statistics_e.asp (as of April 5, 2007).

holders supporting more doctoral students and postdoctoral researchers than non-Chairs (Malatest, 2004, p. iv).

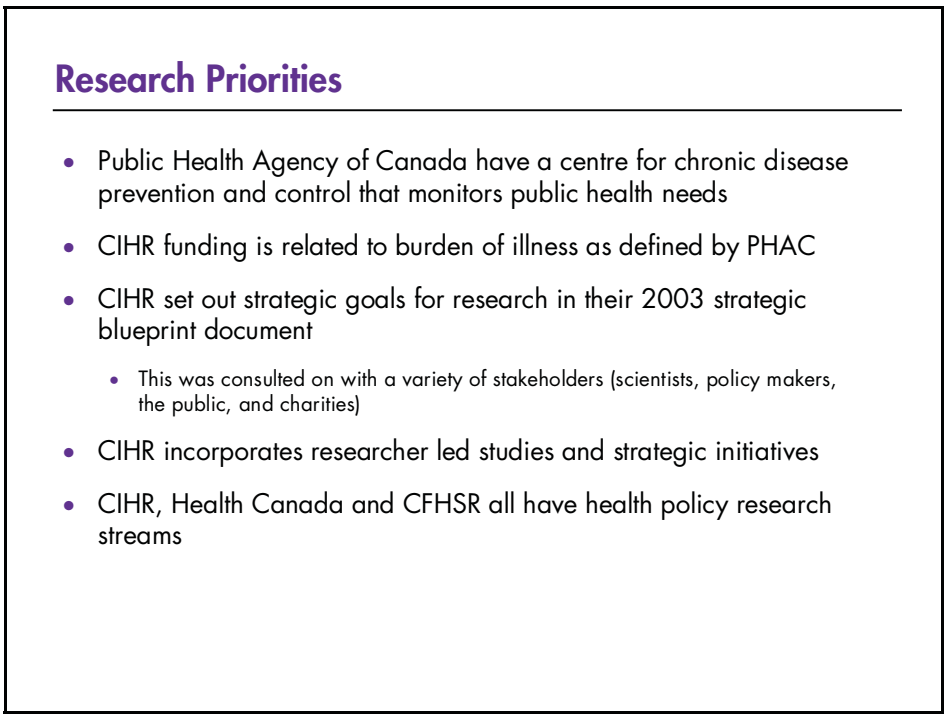


Peer review is the accepted method of funding allocation in Canada, with all of the major government funders using the mechanism in one form or another. In the case of CIHR, every year their peer review process involves over 2,300 reviewers, leading to a success rate for applications of around 30 percent (Thorngate, 2002). Peer review is still seen as a part of an academic's role within most funding organisations and reviewers are generally not compensated for their time.

CIHR are interesting in that their peer review process has been investigated by academics, with the Thorngate Report providing insight into how the peer review system works in practice (Thorngate, 2002). The report looks at a sample of peer reviews for CIHR and analyses the reasons for funding and not funding of particular grants. The key finding is that where there is a lack of consensus, projects invariably do not get funded. This suggests that risky projects are the ones that are least likely to be funded since they cause the most division between peer reviewers.

The other interesting aspect of the Canadian peer review system is the way that Chairs are allocated in the CRC programme. Each university that is eligible for CRC funding receives an allocation of Chairs based on the amount of grant funding they receive from the main government funders (CIHR, NSERC, and SSHRC) in the three years prior to the Chair allocation. Universities then nominate researchers for particular Chairs to a CRC run college of reviewers who assess the suitability of the applicant.[33] As such, there is peer-review involved in the process, but at an institutional level of action rather than a national level.

[33] CRC, "Program Details," http://www.chairs.gc.ca/web/program/index_e.asp (as of April 5, 2007).



Setting research priorities within a system is often a matter of including the views of relevant stakeholders. At the highest level in Canada, the Public Health Agency of Canada (the government agency that deals specifically with public health issues in Canada) monitors the public health problems and issues through their Centre for Chronic Disease Prevention.[34]

The Centre for Chronic Disease Prevention provides burden of illness statistics for Canada, and CIHR are responsive to these statistics in identifying their research priorities for strategic research. CIHR set out their research priorities in their strategic blueprint document in 2003, which identifies the challenges to health facing Canadians and where CIHR plans to focus research (e.g. the severe acute respiratory syndrome and West Nile fever outbreaks; CIHR, 2003). The strategy for CIHR research was arrived at after lengthy open consultation with multiple stakeholders in the research system, including policy makers, scientists, charities, and the public.[35]

With part of their funding investigator led and part strategic, CIHR do not exclusively identify what the positioning of all their research should be. In total, strategic initiatives represent only 27 percent of CIHR funding.[36] Because operating expenditures represent 7 percent of CIHR expenditure, the remaining 66 percent of funding is investigator led (i.e.

[34] CCDPC Web site, http://www.phac-aspc.gc.ca/ccdpc-cpcmc/index_e.html (as of April 5, 2007).

[35] CIHR, "Consultation on CIHR's Strategic Plan 'Blueprint 2007'," http://www.cihr-irsc.gc.ca/e/19322.html (as of April 5, 2007).

[36] CIHR, "Research Funding Overview," (Comparison of CIHR data for 2004–2005 with the corresponding data for 1999-2000), http://www.irsc.gc.ca/e/22955.html (as of April 5, 2007).

driven by curiosity on the part of the scientific and medical community as opposed to directed by the strategic goals of CIHR).[37]

The policy research that is often involved in identifying research strategies is conducted across a number of agencies. CIHR, Health Canada, and CHSRF all have dedicated research streams into health-care policy, with CHSRF even having the explicit goal of changing the way policy makers in the health-care system use evidence to underpin decision making.

[37] The remaining 6 percent cover operating expenses of CIHR.

Outlook

Hot Topics

- Patient wait times; continuing requirements to reduce wait times and government guidelines to do so
- IT and medical records; federal funding for provinces to install systems with mixed success and concerns over data protection
- Physician supply; ageing physicians and reduced funding for medical students could lead to demand outstripping supply
- Public-private partnerships (P3s); how to maintain quality with private providers
- Stem-cell research; Canada is increasing its stem cell research capacity

As with all countries, Canada has a specific set of health research problems and issues that it is currently seeking to address. These can be identified through a number of potential sources, from official government sites documenting advances in health research, through to think-tank research organisations identifying current issues that are of interest. Unlike in the United Kingdom,[38] there is no single publication that documents interesting stories or opinion pieces, so documenting health research policy questions requires accessing this information from various sources. As a snapshot of the news stories in Canadian health and health research, the selected stories are those that continually crop up in different places in the health research debate in Canada.

As an ongoing issue in the Canadian health system, patient wait times are something that continually reappear as problematic. This has manifested itself in early 2007 with a government 'patient wait times guarantee' announced as part of the 2007 budget. This is not a single guarantee, but several guarantees across disease areas, populations, and provinces.[39]

[38] In the United Kingdom, the Wellcome Trust produce a short document that paraphrases current stories in R&D, called SPIN (Science Policy and Information News).

[39] For example, in Manitoba, there is a wait time guarantee in place specifically for First Nations people who have diabetes. See Health Canada, "News Release, January 05, 2007," http://www.hc-sc.gc.ca/ahc-asc/media/nr-cp/2007/2007_02_e.html (as of April 5, 2007).

One of the integral factors in the wait times initiative is the use of electronic medical records and information technology (IT) systems in health care. The government has introduced a funding structure to implement an effective IT system for health care: the Canada Health Infoway.[40] The merits and methods of implementing this IT system are not universally agreed, and several interest groups have produced position papers on the subject.[41] One of the key worries, as in many other countries initiating electronic medical records, is data protection and privacy.

Having discussed the issue of the number of researchers within the Canadian system, there is still a question over the supply of physicians in Canada. This has been an issue for many years: as Canada's physicians age, and funding for medical students is reduced, the numbers of physicians available is gradually decreasing. This is still ongoing and the Fraser Institute, a free-market economy-based think tank, recently produced a paper outlining the situation (Esmail, 2006).

Public–Private Partnerships (P3s) in health care are a continuing policy problem across Canada, and there is a wide range of opinions surrounding them. The main issue with P3s is that of continuing quality of patient care in the health system. The health coalition (an interest group advocating medicare in the health system) are perhaps unsurprisingly against the use of P3s (Canadian Health Coalition, 2003), but medical association position papers suggest that to physicians P3s have some merit.[42]

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[40] Health Canada, "Information, March 2007, Canada Health Infoway," http://www.hc-sc.gc.ca/ahc-asc/media/nr-cp/2007/2007_wait-delai-bk2_e.html (as of April 5, 2007).

[41] For example, the British Columbia Medical Association produced a position paper in 2004 that outlined concerns and ways to implement IT effectively in British Columbia. See BCMA, "Getting IT Right: Patient Centred Information Technology, January 23, 2004," http://www.bcma.org/public/news_publications/publications/policy_backgrounders/ITPaperFactSheet.asp (as of April 5, 2007).

[42] For example, see BCMA, "Public-Private Partnerships in Health Care—March 2004," http://www.bcma.org/public/news_publications/publications/policy_backgrounders/P3sInHealthcare.asp (as of April 5, 2007).

On a more research-based level, there are debates within the Canadian system about the use of stem-cell research.[43] The presence of a stem-cell network in Canada (part of the NCE programme) has led to an increased interaction between researchers. This is one of the reasons why a leading Canadian stem-cell researcher has returned to Toronto to head a research unit.[44]

This section has provided only a sample of issues facing the health system, and by association, the health R&D system. However, the issues mentioned are those that seem to recur.

[43] For news stories related to stem cells, see Medical News Today, "Stem Cell Research News," http://www.medicalnewstoday.com/sections/stem_cell/ (as of April 5, 2007).

[44] CBC News, "Stem Cell Research Centre Attracts Leading Scientist Back to Canada," October 25, 2006, http://www.cbc.ca/canada/toronto/story/2006/10/25/keller-stem-cells.html (as of April 5, 2007).

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