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## Estimates of total expenditures on research and development in the health field in Canada, 1988 to 2002<sup>P</sup>

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# **Estimates of total expenditures on research and development in the health field in Canada, 1988 to 2002<sup>P</sup>**

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## Symbols

The following symbols are used in this publication:

r            revised figures  
p            preliminary figures

GERD        Gross Expenditures on Research and Development  
HERD        Higher Education Research and Development  
NAICS        North American Industrial Classification System  
NSE         Natural Sciences and Engineering  
OECD        Organization for Economic Co-operation and Development  
PNP         Private Non-Profit  
R&D         Research and Development  
S&T         Science and Technology  
SIEID        Science, Innovation and Electronic Information Division  
SSH         Social Sciences and Humanities

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## Introduction

### Estimates of Health R&D in Canada

R&D is defined as creative work undertaken on a systematic basis to increase the stock of scientific and technical knowledge and to use this knowledge in new applications. Expenditures on R&D are an important indicator of the effort devoted to creative activity in science and technology.

Gross domestic expenditures on research and development (GERD) is a statistical series, constructed by adding together the intramural expenditures on R&D as reported by the performing sectors. As a term used by OECD Member countries, it is defined as “total intramural expenditure on R&D performed on the national territory during a given period. It includes R&D performed within a country and funded from abroad but excludes payments for R&D performed abroad”.<sup>1</sup> GERD includes R&D expenditures in the Natural Sciences and Engineering (NSE) and the Social Sciences and Humanities (SSH) fields.

Canadian health research is conducted in universities, teaching hospitals, business enterprises, government laboratories and private non-profit organizations. This research is funded from a variety of sources including public, private, domestic and foreign.

This is the fourth time Science, Innovation and Electronic Information Division (SIED) of Statistics Canada has published an estimate of health R&D spending in Canada. Health sciences, being part of the NSE, are not identified in our surveys. It is therefore necessary to estimate R&D expenditures in the health field by incorporating all relevant data available to us.

The following sections contain the definition of health GERD in each of the sectors and also the method used in each sector to prepare these estimates.

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<sup>1</sup> Frascati Manual - Proposed Standard Practice for Surveys on Research and Experimental Development, OECD, Paris, 2002, p. 121.

## Definitions:

National Health GERD is estimated using data from five different surveys. The definition of Health in each of the sectors is as follows:

### Federal and Provincial Governments:

R&D programmes directed towards the protection and improvement of human health. The definition includes R&D on food hygiene and nutrition and also R&D on radiation used for medical purposes, biochemical engineering, medical information, rationalization of treatment and pharmacology (including testing medicines and selected companies in "Scientific research and development services (pharmaceutical)" industries.

### Business Enterprises:

R&D performed in the "pharmaceutical and medicine industry (manufacturing)", "wholesale trade (pharmaceutical)" and selected companies in "scientific research and development services (pharmaceutical)" industries.

### Higher Education:

R&D performed in the health sciences by the "health professions" teaching field.

### Private Non-Profit Organizations:

R&D performed in medical sciences, including medicine, dentistry, pharmacy etc.

## Methodology:

**Federal government sector:** Federal government R&D expenditures in the health field from 1988 until 2002<sup>p</sup>, are derived from the federal survey of government departments and agencies. Data were collected from responses to a question on health as a socio-economic objective for R&D spending. Federal government data are published in Catalogue No. 88-204 XIE.

**Provincial government:** R&D expenditures in the health field are based on values from provincial science surveys which identify intramural R&D expenditures in the health socio-economic objective field.

**Business enterprise sector:** The Pharmaceutical and medicine manufacturing industry is the most significant source of health R&D in the Business enterprise sector. However, since industries are classified by NAICS, which is based on the principal source of revenue, pharmaceutical R&D is also found in Wholesale trade and Scientific research and development services. NAICS code 414510 identifies the pharmaceutical industries within Wholesale trade. In the Scientific research and development services industry, major performers of pharmaceutical R&D were identified on a case by case basis.

**The higher education sector:** Health R&D statistics are derived from Statistics Canada's revised higher education R&D estimates<sup>1</sup> (STC Catalogue 88-001 Vol. 26, No. 6) which identify R&D performed in the health field. The revised estimates are based on the assumption that total R&D expenditures are equal to the sum of: a) sponsored research expenditures (including all teaching hospitals); b) indirect expenditures on sponsored research; c) a value for the fraction of faculty members' time assumed to be devoted to sponsored and non-sponsored research; and d) indirect expenditures related to faculty members' time on research.

**Private non-profit sector:** Values used for estimating health R&D expenditures in the private non-profit sector are those identified as health-related in survey responses. Note that R&D expenditures in the PNP sector have been revised for the period 1992 to 2000. See Volume 26, No. 9 of this publication for further information.

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<sup>1</sup> Statistics Canada 1999. Review of HERD and Health GERD - Report to Statistics Canada, Mireille Brochu

## Limitations of Health GERD

Limitations of the Health GERD are similar to those of the GERD.

The GERD, like any other social or economic statistic, can only be approximately true. Different components are of different accuracy: sector estimates probably vary from  $\pm 5\%$  to  $\pm 15\%$  in accuracy. However, the GERD estimates are sufficiently reliable for their main use as an aggregate indicator for science policy.

One of the most important problems relating to GERD concerns its definition. There remains some ambiguity in defining precisely what constitutes R&D or, for example, in a continuing project, determining the precise point at which the project passes the boundary of R&D and becomes exploitation of a process or product on which it may be said that the R&D stage has been completed. This ambiguity is perhaps less serious in internal time series, where it may be expected that the year-to-year application of the definitions by the same reporting units are at least consistent.

A second difficulty arises with regards to survey design. The people best qualified to apply the R&D definitions and classifications - scientific and technical personnel engaged in the direct management of S&T activity - rarely participate in the statistical agency's data collection process. Because the data collected are concerned not with scientific and technical content, but financial and labour inputs to achieving this content, the questionnaires tend to be addressed to and completed by financial and management staff. This is a fundamental problem of all surveys addressed to large organizations, whether they are public or private.

These two problems account for the limited amount of geographic and scientific detail in the published GERD. The amount of detail presented, for example, in the Canadian GERD as published by Statistics Canada is limited by the nature of the surveys, and the other data collection and analysis instruments. Nor is it possible to increase the amount of detail because this would require switching to new kinds of data collection instruments in a vastly expanded survey operation.

Another reason for the limited detail about sectors stems from the fact that R&D is often a secretive endeavour. Private sector companies usually want to surprise competitors with a new product. Thus the money spent on the R&D may be reported, but details about R&D projects would not. Similarly, a government department such as National Defence might report R&D expenditures but not the nature and detail of the respective R&D projects. At best, the GERD provides broad categories of the nature of the R&D work underway; for example, "Transportation equipment", "Business machines", "Aircraft", etc.

To summarize, the GERD serves as a general indicator of S&T activity and not as a detailed inventory of R&D projects within an organization, sector, or province. It is an estimate and as such can show trends in R&D expenditures by sector and sub-sector, by province and country, from year-to-year. In this capacity, the GERD estimates are sufficiently reliable for their main use as an aggregate indicator for science policy.

## **Statistical Tables**

### Gross domestic expenditures on R&D (GERD) in the health field<sup>1</sup>, 1988<sup>r</sup>

Funding sector	Performing sector					Total
	Federal government	Provincial governments	Business enterprise	Higher education <sup>2</sup>	Private non-profit	
in millions of dollars						
Federal government	41	0	4	192	18	<b>255</b>
Provincial governments	0	17	14	56	8	<b>95</b>
Business enterprise	0	0	157	33	8	<b>198</b>
Higher education <sup>2</sup>	0	0	0	500	0	<b>500</b>
Private non-profit	0	0	0	106	32	<b>138</b>
Foreign	0	0	21	8	6	<b>35</b>
<b>Total</b>	<b>41</b>	<b>17</b>	<b>196</b>	<b>895</b>	<b>72</b>	<b>1,221</b>

<sup>1</sup> As data are not provided specifically by "Health Field", this is STC's best estimate.

<sup>2</sup> Includes teaching hospitals.

### Gross domestic expenditures on R&D (GERD) in the health field<sup>1</sup>, 1989<sup>r</sup>

Funding sector	Performing sector					Total
	Federal government	Provincial governments	Business enterprise	Higher education <sup>2</sup>	Private non-profit	
in millions of dollars						
Federal government	50	0	4	210	18	<b>282</b>
Provincial governments	0	22	16	83	8	<b>129</b>
Business enterprise	0	0	199	46	6	<b>251</b>
Higher education <sup>2</sup>	0	0	0	532	0	<b>532</b>
Private non-profit	0	0	0	102	41	<b>143</b>
Foreign	0	0	14	7	7	<b>28</b>
<b>Total</b>	<b>50</b>	<b>22</b>	<b>233</b>	<b>980</b>	<b>80</b>	<b>1,365</b>

<sup>1</sup> As data are not provided specifically by "Health Field", this is STC's best estimate.

<sup>2</sup> Includes teaching hospitals.



### Gross domestic expenditures on R&D (GERD) in the health field<sup>1</sup>, 1990<sup>r</sup>

Funding sector	Performing sector					Total
	Federal government	Provincial governments	Business enterprise	Higher education <sup>2</sup>	Private non-profit	
in millions of dollars						
Federal government	64	0	9	241	20	<b>334</b>
Provincial governments	0	26	22	85	12	<b>145</b>
Business enterprise	0	0	273	50	10	<b>333</b>
Higher education <sup>2</sup>	0	0	0	558	0	<b>558</b>
Private non-profit	0	0	0	110	42	<b>152</b>
Foreign	0	0	17	5	7	<b>29</b>
<b>Total</b>	<b>64</b>	<b>26</b>	<b>321</b>	<b>1,049</b>	<b>91</b>	<b>1,551</b>

<sup>1</sup> As data are not provided specifically by "Health Field", this is STC's best estimate.

<sup>2</sup> Includes teaching hospitals.

### Gross domestic expenditures on R&D (GERD) in the health field<sup>1</sup>, 1991<sup>r</sup>

Funding sector	Performing sector					Total
	Federal government	Provincial governments	Business enterprise	Higher education <sup>2</sup>	Private non-profit	
in millions of dollars						
Federal government	55	0	9	236	22	<b>322</b>
Provincial governments	0	29	18	87	13	<b>147</b>
Business enterprise	0	0	269	87	11	<b>367</b>
Higher education <sup>2</sup>	0	0	0	616	0	<b>616</b>
Private non-profit	0	0	0	126	47	<b>173</b>
Foreign	0	0	28	4	8	<b>40</b>
<b>Total</b>	<b>55</b>	<b>29</b>	<b>324</b>	<b>1,156</b>	<b>101</b>	<b>1,665</b>

<sup>1</sup> As data are not provided specifically by "Health Field", this is STC's best estimate.

<sup>2</sup> Includes teaching hospitals.

### Gross domestic expenditures on R&D (GERD) in the health field<sup>1</sup>, 1992<sup>r</sup>

Funding sector	Performing sector					Total
	Federal government	Provincial governments	Business enterprise	Higher education <sup>2</sup>	Private non-profit	
in millions of dollars						
Federal government	56	0	10	243	8	<b>317</b>
Provincial governments	0	33	17	88	11	<b>149</b>
Business enterprise	0	0	324	107	11	<b>442</b>
Higher education <sup>2</sup>	0	0	0	670	0	<b>670</b>
Private non-profit	0	0	0	113	25	<b>138</b>
Foreign	0	0	54	8	5	<b>67</b>
<b>Total</b>	<b>56</b>	<b>33</b>	<b>405</b>	<b>1,229</b>	<b>60</b>	<b>1,783</b>

<sup>1</sup> As data are not provided specifically by "Health Field", this is STC's best estimate.

<sup>2</sup> Includes teaching hospitals.

### Gross domestic expenditures on R&D (GERD) in the health field<sup>1</sup>, 1993<sup>r</sup>

Funding sector	Performing sector					Total
	Federal government	Provincial governments	Business enterprise	Higher education <sup>2</sup>	Private non-profit	
in millions of dollars						
Federal government	53	0	7	282	9	<b>351</b>
Provincial governments	0	29	9	94	14	<b>146</b>
Business enterprise	0	0	403	117	13	<b>533</b>
Higher education <sup>2</sup>	0	0	0	713	0	<b>713</b>
Private non-profit	0	0	0	153	25	<b>178</b>
Foreign	0	0	71	8	6	<b>85</b>
<b>Total</b>	<b>53</b>	<b>29</b>	<b>490</b>	<b>1,367</b>	<b>67</b>	<b>2,006</b>

<sup>1</sup> As data are not provided specifically by "Health Field", this is STC's best estimate.

<sup>2</sup> Includes teaching hospitals.

### Gross domestic expenditures on R&D (GERD) in the health field<sup>1</sup>, 1994<sup>r</sup>

Funding sector	Performing sector					Total
	Federal government	Provincial governments	Business enterprise	Higher education <sup>2</sup>	Private non-profit	
in millions of dollars						
Federal government	57	0	6	283	8	<b>354</b>
Provincial governments	0	31	8	94	15	<b>148</b>
Business enterprise	0	0	460	109	12	<b>581</b>
Higher education <sup>2</sup>	0	0	0	721	0	<b>721</b>
Private non-profit	0	0	0	166	34	<b>200</b>
Foreign	0	0	87	9	5	<b>101</b>
<b>Total</b>	<b>57</b>	<b>31</b>	<b>561</b>	<b>1,382</b>	<b>74</b>	<b>2,105</b>

<sup>1</sup> As data are not provided specifically by "Health Field", this is STC's best estimate.

<sup>2</sup> Includes teaching hospitals.

### Gross domestic expenditures on R&D (GERD) in the health field<sup>1</sup>, 1995<sup>r</sup>

Funding sector	Performing sector					Total
	Federal government	Provincial governments	Business enterprise	Higher education <sup>2</sup>	Private non-profit	
in millions of dollars						
Federal government	63	0	9	294	7	<b>373</b>
Provincial governments	0	33	9	97	15	<b>154</b>
Business enterprise	0	0	547	105	15	<b>667</b>
Higher education <sup>2</sup>	0	0	0	753	0	<b>753</b>
Private non-profit	0	0	0	169	37	<b>206</b>
Foreign	0	0	156	10	5	<b>171</b>
<b>Total</b>	<b>63</b>	<b>33</b>	<b>721</b>	<b>1,428</b>	<b>79</b>	<b>2,324</b>

<sup>1</sup> As data are not provided specifically by "Health Field", this is STC's best estimate.

<sup>2</sup> Includes teaching hospitals.

### Gross domestic expenditures on R&D (GERD) in the health field<sup>1</sup>, 1996<sup>r</sup>

Funding sector	Performing sector					Total
	Federal government	Provincial governments	Business enterprise	Higher education <sup>2</sup>	Private non-profit	
	in millions of dollars					
Federal government	76	0	10	255	6	<b>347</b>
Provincial governments	0	32	7	89	16	<b>144</b>
Business enterprise	0	0	609	118	9	<b>736</b>
Higher education <sup>2</sup>	0	0	0	754	0	<b>754</b>
Private non-profit	0	0	0	200	39	<b>239</b>
Foreign	0	0	241	14	7	<b>262</b>
<b>Total</b>	<b>76</b>	<b>32</b>	<b>867</b>	<b>1,430</b>	<b>77</b>	<b>2,482</b>

<sup>1</sup> As data are not provided specifically by "Health Field", this is STC's best estimate.

<sup>2</sup> Includes teaching hospitals.

### Gross domestic expenditures on R&D (GERD) in the health field<sup>1</sup>, 1997<sup>r</sup>

Funding sector	Performing sector					Total
	Federal government	Provincial governments	Business enterprise	Higher education <sup>2</sup>	Private non-profit	
	in millions of dollars					
Federal government	78	0	9	261	6	<b>354</b>
Provincial governments	0	32	7	111	18	<b>168</b>
Business enterprise	0	0	682	134	10	<b>826</b>
Higher education <sup>2</sup>	0	0	0	786	0	<b>786</b>
Private non-profit	0	0	0	208	37	<b>245</b>
Foreign	0	0	273	16	1	<b>290</b>
<b>Total</b>	<b>78</b>	<b>32</b>	<b>971</b>	<b>1,516</b>	<b>72</b>	<b>2,669</b>

<sup>1</sup> As data are not provided specifically by "Health Field", this is STC's best estimate.

<sup>2</sup> Includes teaching hospitals.

## Gross domestic expenditures on R&D (GERD) in the health field<sup>1</sup>, 1998<sup>r</sup>

Funding sector	Performing sector					Total
	Federal government	Provincial governments	Business enterprise	Higher education <sup>2</sup>	Private non-profit	
in millions of dollars						
Federal government	84	0	10	275	10	<b>379</b>
Provincial governments	0	36	9	111	16	<b>172</b>
Business enterprise	0	0	767	145	8	<b>920</b>
Higher education <sup>2</sup>	0	0	0	864	0	<b>864</b>
Private non-profit	0	0	0	213	31	<b>244</b>
Foreign	0	0	309	20	2	<b>331</b>
<b>Total</b>	<b>84</b>	<b>36</b>	<b>1,095</b>	<b>1,628</b>	<b>67</b>	<b>2,910</b>

<sup>1</sup> As data are not provided specifically by "Health Field", this is STC's best estimate.

<sup>2</sup> Includes teaching hospitals.

## Gross domestic expenditures on R&D (GERD) in the health field<sup>1</sup>, 1999<sup>r</sup>

Funding sector	Performing sector					Total
	Federal government	Provincial governments	Business enterprise	Higher education <sup>2</sup>	Private non-profit	
in millions of dollars						
Federal government	103	0	7	362	6	<b>478</b>
Provincial governments	0	31	7	145	12	<b>195</b>
Business enterprise	0	0	813	167	5	<b>985</b>
Higher education <sup>2</sup>	0	0	0	907	0	<b>907</b>
Private non-profit	0	0	0	219	23	<b>242</b>
Foreign	0	0	402	23	2	<b>427</b>
<b>Total</b>	<b>103</b>	<b>31</b>	<b>1,229</b>	<b>1,823</b>	<b>48</b>	<b>3,234</b>

<sup>1</sup> As data are not provided specifically by "Health Field", this is STC's best estimate.

<sup>2</sup> Includes teaching hospitals.

## Gross domestic expenditures on R&D (GERD) in the health field<sup>1</sup>, 2000<sup>r</sup>

Funding sector	Performing sector					Total
	Federal government	Provincial governments	Business enterprise	Higher education <sup>2</sup>	Private non-profit	
in millions of dollars						
Federal government	116	0	9	433	3	<b>561</b>
Provincial governments	0	41	4	176	11	<b>232</b>
Business enterprise	0	0	997	210	8	<b>1,215</b>
Higher education <sup>2</sup>	0	0	0	990	0	<b>990</b>
Private non-profit	0	0	0	264	21	<b>285</b>
Foreign	0	0	437	20	1	<b>458</b>
<b>Total</b>	<b>116</b>	<b>41</b>	<b>1,447</b>	<b>2,093</b>	<b>44</b>	<b>3,741</b>

<sup>1</sup> As data are not provided specifically by "Health Field", this is STC's best estimate.

<sup>2</sup> Includes teaching hospitals.

## Gross domestic expenditures on R&D (GERD) in the health field<sup>1</sup>, 2001<sup>r</sup>

Funding sector	Performing sector					Total
	Federal government	Provincial governments	Business enterprise	Higher education <sup>2</sup>	Private non-profit	
in millions of dollars						
Federal government	134	0	9	489	6	<b>638</b>
Provincial governments	0	41	4	198	16	<b>259</b>
Business enterprise	0	0	1,036	236	9	<b>1,281</b>
Higher education <sup>2</sup>	0	0	0	1,117	0	<b>1,117</b>
Private non-profit	0	0	0	297	24	<b>321</b>
Foreign	0	0	455	24	1	<b>480</b>
<b>Total</b>	<b>134</b>	<b>41</b>	<b>1,504</b>	<b>2,361</b>	<b>56</b>	<b>4,096</b>

<sup>1</sup> As data are not provided specifically by "Health Field", this is STC's best estimate.

<sup>2</sup> Includes teaching hospitals.

## Gross domestic expenditures on R&D (GERD) in the health field<sup>1</sup>, 2002<sup>P</sup>

Funding sector	Performing sector					Total
	Federal government	Provincial governments	Business enterprise	Higher education <sup>2</sup>	Private non-profit	
	in millions of dollars					
Federal government	140	0	9	537	6	<b>692</b>
Provincial governments	0	42	5	218	16	<b>281</b>
Business enterprise	0	0	1,085	260	9	<b>1,354</b>
Higher education <sup>2</sup>	0	0	0	1,228	0	<b>1,228</b>
Private non-profit	0	0	0	327	25	<b>352</b>
Foreign	0	0	476	26	1	<b>503</b>
<b>Total</b>	<b>140</b>	<b>42</b>	<b>1,575</b>	<b>2,596</b>	<b>57</b>	<b>4,410</b>

<sup>1</sup> As data are not provided specifically by "Health Field", this is STC's best estimate.

<sup>2</sup> Includes teaching hospitals.

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