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Estimates of Total Expenditures on Research and Development in the Health Fields in Canada, 1988 to 2001^p

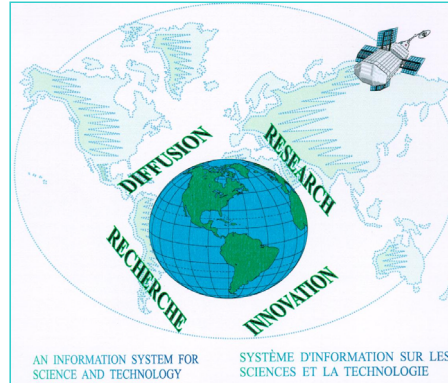


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Symbols

The following symbols are used in this publication:

r revised figures
p preliminary figures

AUCC Association of Universities and Colleges of Canada
CAUBO Canadian Association of Business Officers
CIHR Canadian Institutes of Health Research
GERD Gross Expenditures on Research and Development
HERD Higher Education Research and Development
NSE Natural Sciences and Engineering
NSERC Natural Science and Engineering Research Council
OECD Organization for Economic Co-operation and Development
R&D Research and Development
S&T Science and Technology
SIC Standard Industrial Classification
SIEID Science, Innovation and Electronic Information Division
SSH Social Sciences and Humanities
SSHRC Social Sciences and Humanities Research Council

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 expenditures 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 made abroad for R&D".¹ 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 third time Science, Innovation and Electronic Information Division (SIEID) 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.

In 1999, SIEID created a Working Group to provide recommendations to estimation methods used to determine Higher Education R&D Expenditures (HERD) and health GERD. A framework² was produced in April 2000 and SIEID developed a three-year Operational Plan to see to the implementation of as many recommendations as possible, with financial and consultation help from a partnership of interested data users.³

This Working Paper, which incorporates the new method for calculating health GERD, is part of the initiative to improve estimates in an area that also includes estimates of higher education R&D expenditures, the number of personnel engaged in higher education R&D, and U.S. and international comparisons.

The first series of Health R&D expenditures (ST-99-04), included estimates from 1970 to 1999. The new methodology, (affecting the business enterprise and higher education sector's), has been applied to estimates back as far as 1988.

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.

¹ **The measurement of Scientific and Technical Activities - Proposed Standard Practice for Surveys of Research and Experimental Development**, OECD, Paris, 1993, p. 101.

² Statistics Canada 1999. Review of HERD and Health GERD - Report to Statistics Canada, Mireille Brochu.

³ CIHR, NSERC, SSHRC, Industry Canada, the Association of Universities and Colleges of Canada (AUCC), and the Canadian Association of Business Officers (CAUBO).

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 breeding of laboratory animals for scientific purposes) as well as research relating to epidemiology, prevention of industrial diseases and drug addiction.

Business Enterprises:

R&D performed in the "pharmaceutical and medicines" industry (SIC 3741), "drugs, wholesale" (SIC 5231), "health and social services" industry (SIC 86**), and selected companies in other SIC's (mostly SIC 7759, "other scientific and technical services").

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 2001^P, 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 medicines industry; drugs, wholesale industry; health and social service industries ; and selected companies in other industries (mostly other scientific and technical services), are used for estimating health field R&D in the business enterprise sector (Catalogue No. 88-202-XIB).

The higher education sector: Health R&D statistics are derived from Statistics Canada's revised higher education R&D estimates (STC Catalogue 88-001 Vol. 25, No. 7) which identify R&D performed in the health field. The revised estimates assumes that the total R&D expenditures are equal to: 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. See Volume 25, No. 10 of this publication for further information.

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 Field¹, 1988^r

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

¹ As data are not provided specifically by "Health Field", this is STC's best estimate

² Includes teaching hospitals.

Gross Domestic Expenditures on R&D (GERD) in the Health Field¹, 1989^r

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

¹ As data are not provided specifically by "Health Field", this is STC's best estimate

² Includes teaching hospitals.

Gross Domestic Expenditures on R&D (GERD) in the Health Field¹, 1990^r

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

¹ As data are not provided specifically by "Health Field", this is STC's best estimate

² Includes teaching hospitals.

Gross Domestic Expenditures on R&D (GERD) in the Health Field¹, 1991^r

Funding sector	Performing sector					Total
	Federal government	Provincial governments	Business enterprise	Higher education ²	Private non-profit	
	in millions of dollars					
Federal government	55	0	9	236	22	322
Provincial governments	0	29	18	87	13	147
Business enterprise	0	0	269	87	11	367
Higher education ²	0	0	0	620	0	620
Private non-profit	0	0	0	126	47	173
Foreign	0	0	28	4	8	40
Total	55	29	324	1,160	101	1,669

¹ As data are not provided specifically by "Health Field", this is STC's best estimate

² Includes teaching hospitals.

Gross Domestic Expenditures on R&D (GERD) in the Health Field¹, 1992^r

Funding sector	Performing sector					Total
	Federal government	Provincial governments	Business enterprise	Higher education ²	Private non-profit	
in millions of dollars						
Federal government	56	0	10	243	20	329
Provincial governments	0	33	17	88	14	152
Business enterprise	0	0	344	107	24	475
Higher education ²	0	0	0	689	0	689
Private non-profit	0	0	0	113	49	162
Foreign	0	0	52	8	7	67
Total	56	33	423	1,248	114	1,874

¹ As data are not provided specifically by "Health Field", this is STC's best estimate

² Includes teaching hospitals.

Gross Domestic Expenditures on R&D (GERD) in the Health Field¹, 1993^r

Funding sector	Performing sector					Total
	Federal government	Provincial governments	Business enterprise	Higher education ²	Private non-profit	
in millions of dollars						
Federal government	53	0	7	282	22	364
Provincial governments	0	29	9	94	16	148
Business enterprise	0	0	403	117	25	545
Higher education ²	0	0	0	687	0	687
Private non-profit	0	0	0	153	50	203
Foreign	0	0	71	8	7	86
Total	53	29	490	1,341	120	2,033

¹ As data are not provided specifically by "Health Field", this is STC's best estimate

² Includes teaching hospitals.

Gross Domestic Expenditures on R&D (GERD) in the Health Field¹, 1994^r

Funding sector	Performing sector					Total
	Federal government	Provincial governments	Business enterprise	Higher education ²	Private non-profit	
	in millions of dollars					
Federal government	57	0	6	283	22	368
Provincial governments	0	31	8	94	19	152
Business enterprise	0	0	460	109	25	594
Higher education ²	0	0	0	689	0	689
Private non-profit	0	0	0	166	65	231
Foreign	0	0	87	9	8	104
Total	57	31	561	1,350	139	2,138

¹ As data are not provided specifically by "Health Field", this is STC's best estimate

² Includes teaching hospitals.

Gross Domestic Expenditures on R&D (GERD) in the Health Field¹, 1995^r

Funding sector	Performing sector					Total
	Federal government	Provincial governments	Business enterprise	Higher education ²	Private non-profit	
	in millions of dollars					
Federal government	63	0	9	294	22	388
Provincial governments	0	33	9	97	20	159
Business enterprise	0	0	547	105	25	677
Higher education ²	0	0	0	762	0	762
Private non-profit	0	0	0	169	65	234
Foreign	0	0	156	10	8	174
Total	63	33	721	1,437	140	2,394

¹ As data are not provided specifically by "Health Field", this is STC's best estimate

² Includes teaching hospitals.

Gross Domestic Expenditures on R&D (GERD) in the Health Field¹, 1996^r

Funding sector	Performing sector					Total
	Federal government	Provincial governments	Business enterprise	Higher education ²	Private non-profit	
in millions of dollars						
Federal government	76	0	10	255	23	364
Provincial governments	0	32	7	89	21	149
Business enterprise	0	0	614	118	18	750
Higher education ²	0	0	0	776	0	776
Private non-profit	0	0	0	200	68	268
Foreign	0	0	241	14	11	266
Total	76	32	872	1,452	141	2,573

¹ As data are not provided specifically by "Health Field", this is STC's best estimate

² Includes teaching hospitals.

Gross Domestic Expenditures on R&D (GERD) in the Health Field¹, 1997^r

Funding sector	Performing sector					Total
	Federal government	Provincial governments	Business enterprise	Higher education ²	Private non-profit	
in millions of dollars						
Federal government	78	0	9	261	25	373
Provincial governments	0	32	7	111	22	172
Business enterprise	0	0	680	134	21	835
Higher education ²	0	0	0	791	0	791
Private non-profit	0	0	0	208	79	287
Foreign	0	0	260	16	10	286
Total	78	32	956	1,521	157	2,744

¹ As data are not provided specifically by "Health Field", this is STC's best estimate

² Includes teaching hospitals.

Gross Domestic Expenditures on R&D (GERD) in the Health Field¹, 1998^r

Funding sector	Performing sector					Total
	Federal government	Provincial governments	Business enterprise	Higher education ²	Private non-profit	
in millions of dollars						
Federal government	84	0	10	275	28	397
Provincial governments	0	36	9	111	23	179
Business enterprise	0	0	759	145	25	929
Higher education ²	0	0	0	874	0	874
Private non-profit	0	0	0	213	82	295
Foreign	0	0	309	20	11	340
Total	84	36	1,087	1,638	169	3,014

¹ As data are not provided specifically by "Health Field", this is STC's best estimate

² Includes teaching hospitals.

Gross Domestic Expenditures on R&D (GERD) in the Health Field¹, 1999^r

Funding sector	Performing sector					Total
	Federal government	Provincial governments	Business enterprise	Higher education ²	Private non-profit	
in millions of dollars						
Federal government	103	0	7	362	26	498
Provincial governments	0	31	7	144	19	201
Business enterprise	0	0	769	167	19	955
Higher education ²	0	0	0	871	0	871
Private non-profit	0	0	0	219	85	304
Foreign	0	0	401	22	11	434
Total	103	31	1,184	1,785	160	3,263

¹ As data are not provided specifically by "Health Field", this is STC's best estimate

² Includes teaching hospitals.

Gross Domestic Expenditures on R&D (GERD) in the Health Field¹, 2000^P

Funding sector	Performing sector					Total
	Federal government	Provincial governments	Business enterprise	Higher education ²	Private non-profit	
in millions of dollars						
Federal government	124	0	8	446	28	606
Provincial governments	0	39	7	177	26	249
Business enterprise	0	0	828	206	25	1,059
Higher education ²	0	0	0	1,072	0	1,072
Private non-profit	0	0	0	269	84	353
Foreign	0	0	432	27	13	472
Total	124	39	1,275	2,197	176	3,811

¹ As data are not provided specifically by "Health Field", this is STC's best estimate

² Includes teaching hospitals.

Gross Domestic Expenditures on R&D (GERD) in the Health Field¹, 2001^P

Funding sector	Performing sector					Total
	Federal government	Provincial governments	Business enterprise	Higher education ²	Private non-profit	
in millions of dollars						
Federal government	124	0	8	513	29	674
Provincial governments	0	40	8	204	27	279
Business enterprise	0	0	887	237	25	1,149
Higher education ²	0	0	0	1,233	0	1,233
Private non-profit	0	0	0	309	86	395
Foreign	0	0	463	31	13	507
Total	124	40	1,366	2,527	180	4,237

¹ As data are not provided specifically by "Health Field", this is STC's best estimate

² Includes teaching hospitals.

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