CANCER RESEARCH INVESTMENT IN CANADA, 2005–2009

THE CANADIAN CANCER RESEARCH ALLIANCE'S SURVEY OF GOVERNMENT AND VOLUNTARY SECTOR INVESTMENT IN CANCER RESEARCH IN 2009

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Canadian Cancer Research Alliance • Alliance canadienne pour la recherche sur le cancer

CANADIAN PARTNERSHIP AGAINST CANCER
PARTENARIAT CANADIEN CONTRE LE CANCER

JUNE 2012

For additional copies of this publication, please contact:

Canadian Cancer Research Alliance (CCRA)
1 University Avenue, Suite 300
Toronto, Ontario M5J 2P1 CANADA
Tel.: (416) 915-9222, ext. 5739
Fax: (416) 915-9224
Email: info@ccra-acrc.ca

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Kim Badovinac, who managed this project, prepared this report with the invaluable advice and expertise provided by Drs. Mario Chevrette (Cancer Research Society), Stuart Edmonds (Prostate Cancer Canada), Elizabeth Eisenhauer (Canadian Partnership Against Cancer/Canadian Cancer Research Alliance), Jim Hudson (Consultant), Nancy Kreiger (Cancer Care Ontario), and Christine Williams (Canadian Cancer Society). This report was designed by Unified Marketing Communications of Toronto.

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Elizabeth A. Eisenhauer, MD, FRCP, is the Research Advisory Group Chair for the Canadian Partnership Against Cancer, Director of the Investigational New Drug Program at the NCIC Clinical Trials Groups, and Senior Scientist and Professor at Queen's University in Kingston Ontario.

Mario Chevrette, PhD, is the Scientific Director of the Cancer Research Society, and Associate Professor, Department of Surgery and Associate Member of the Department of Medicine, Division of Experimental Medicine at McGill University in Montréal, Quebec.

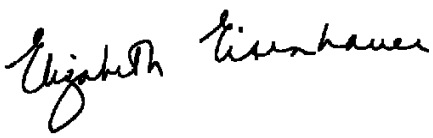
The CCRA annual survey of investment in cancer research provides valuable insights into the nature of cancer research funding in Canada. This report updates our series with 2009 data and also examines the trends in cancer research investment that have occurred since our inaugural report of 2005 data was published in 2007. Over the past five years, the cancer research investment of the 39 contributing organizations has grown from $372.2M to $545.5M, reflecting new federal investments in trainee research and infrastructure, significant strategic investment from the governments of Ontario and Alberta as well as growth among other organizations. There were more cancer research projects in 2009 and more researchers conducting research. Anecdotally, evidence from some funders shows increased application pressure for available research funding over the period. Our examination of the trends also revealed a greater than proportional increase in investment in prevention research and research on lung and pancreatic cancers, all gap areas identified in our 2005 survey.

The year has been busy with ongoing implementation of the strategic plan. Our first Canadian Cancer Research Conference was held in November 2011, enabled by 18 supporters. The conference was attended by nearly 1,000 participants and our call for abstracts resulted in nearly 600 submissions. We received ringing endorsements from the research community about the breadth and calibre of the scientific program and participants expressed a need for ongoing meetings. In fact, we will be gearing up in the next few months to begin planning our next conference scheduled for November 2013.

Over the past 18 months, we have been involved in a major initiative to enhance the efficiency and effectiveness of academic centre-driven Canadian cancer clinical trials. There is evidence that institutions with active cooperative group clinical trials programs have better patient outcomes for all patients whether or not they are enrolled in clinical trials. These data suggest that a vigorous clinical trials program is vital to accelerating the uptake of new knowledge on treatments and standards of care throughout a health care organization, with the ultimate beneficiaries being the patients.

A report summarizing the results of an online survey of cancer researchers on human resources research needs and trainee needs will also soon be released. This information will help our members to better understand how they can capitalize on existing investments in infrastructure and training to ensure that essential cancer research and key research centres can be sustainably supported.

In closing, it has been a busy year and we would like to thank the CCRA members and other organizations for their ongoing commitment to the pan-Canadian cancer research strategy and the collaborative process, a key ingredient to successfully accelerating discovery and maximizing impact on cancer control in Canada.



Elizabeth A. Eisenhauer, MD, FRCP
Co-Chair, CCRA

Mario Chevrette, PhD
Co-Chair, CCRA

1. INTRODUCTION

1.1 WHAT IS THE CANADIAN CANCER RESEARCH SURVEY?

The Canadian Cancer Research Survey (CCRS) was the first collaborative activity undertaken by the Canadian Cancer Research Alliance (CCRA). The project commenced in the fall of 2005 with the hiring of a project manager who was tasked with compiling information for the member organizations on the nature and quantity of cancer research funding in Canada. The initial activities involved the creation of a relational database, development and adoption of classification systems for data reporting, and development of reporting conventions and data validation processes.

The first report published in the fall of 2007 captured funding data for 2005 from 19 organizations/programs. Since that time, four additional annual investment reports and four reports on investment in specific areas of research of interest to the research funding community have been released.

This report is the fifth annual report and the first time we have extensively described trends in cancer research investment. It covers the five-year period, 2005 to 2009.

1.2 WHAT'S NEW IN THIS REPORT?

This report varies from others released in the series in the following ways:

- we have modified the way that we are attributing investment for all years covered in the CCRS (see Methodology for details)
- we are no longer reporting the multi-funded initiatives as separate entities given that these initiatives have all ceased operation
- we undertook an assessment of the data quality of our cancer site coding, with an aim to improve the overall consistency of our coding over the five years of data (results are described in the next chapter)
- there are two new contributors: PROCURE and the Newfoundland and Labrador Centre for Applied Health Research

The reader is urged to peruse the Methodology chapter, which details the reporting conventions used in the main section of the report. Analyses are descriptive in nature and, by design, the report contains many tables and figures rather than extensive narrative. Alphabetical order has been used when reporting data by organization and cancer site. Provincial breakdowns are ordered from west to east coast. Appendix A provides a list of important abbreviations.

1.3 REPORT SCOPE AND LIMITATIONS

While all major cancer research funders from the governmental and voluntary sectors are included (i.e., these are, for the most part, funders that offer open competitions and support researchers at more than one organization), this report does not include the cancer research investment of the BC Cancer Foundation, institution-specific foundations (e.g., hospital foundations), federal and provincial government programs for which health research is only a small component of their funding, or industry sponsored R&D. In addition, we have not included funding that researchers working in Canadian institutions receive from organizations outside Canada.

Table 1.1.1 lists estimates of the amounts of research funding captured by these funding sources. According to these approximations, the CCRS captures between 40 to 60% of the total (all sources) annual investment in cancer research funding in Canada.

TABLE 1.1.1

ESTIMATED CANCER RESEARCH INVESTMENT FROM SOURCES NOT CAPTURED IN THE CANADIAN CANCER RESEARCH SURVEY, 2005 TO 2009

Funder	Estimated investment ($M)	Quality of Estimate	Data Source and Assumptions
BC Cancer Foundation	Less than 80	Fair	$79.9M reported in annual reports for core research support, clinical and other support, and primary prevention for fiscal years 2005/06 to 2009/10 (includes more than research support).
Hospital foundations	~300	Fair	Princess Margaret Hospital Foundation, the largest hospital foundation in Canada, reported $208.4M for fiscal years 2005/06 to 2009/10 for research conducted at the Princess Margaret Hospital and the Ontario Cancer Institute. Given a lack of information about cancer-specific research funding from other hospital foundations, it was estimated to total no more than $80M.
Other federal agencies	~5	Poor	Programs include the Western Diversification Program, Atlantic Innovation Fund, and the International Science and Technology Partnerships Program through the Foreign Affairs and International Trade Canada. Some support has been provided to cancer research organizations.
Other provincial agencies	~10	Poor	Some leveraged funding for programs such as the Ontario Centres of Excellence program, the Quebec indirect costs programs, etc. Amounts unknown.
Industry	1,270.4	Poor	There is no data available. This estimate represents 20% of the total $6,352M R&D expenditures by all patentees for years 2005 to 2009 as reported by the Patented Medicines Prices Review Board in its 2010 annual report.
Funders outside Canada	105.1	Good	Based on a scan of 14 funding organizations in the U.S. and U.K. Data come from the International Cancer Research Partnership (ICRP) and from publicly available information from funding organizations that are not part of the ICRP.
TOTAL	**Less than 1,770.5**		

2. METHODOLOGY

This chapter provides a very detailed account of how data are captured and reported within the CCRS. This technical information may not be of interest to the general reader so the list below highlights the features of the CCRS that are critical to understanding the presented analyses.

- There are 39 organizations included in the CCRS (see Table 3.1.1 for a listing) and data from each organization covers the entire 2005 to 2009 period.
- Year refers to a calendar period (January 1 to December 31).
- The amount a research project is funded is pro-rated over its duration.
- For a project where the research deals with more than cancer, the portion of the research focused on cancer is estimated and the project budget is adjusted to reflect the cancer portion.
- Projects are classified in terms of area of science and cancer site on the basis of internationally used classifications. Projects are also grouped by type of funding mechanism.
- Investment shown for a funder does not include leveraged or partnered funding (this is a change from previous reports).
- Analyses by geographic region are based on the institutional affiliation of the nominated principal investigator.
- Investment figures are not adjusted for inflation unless noted in the specific table/figure.

2.1 PARTICIPATING ORGANIZATIONS

The CCRS is composed of peer-reviewed cancer research projects funded by 39 organizations/programs within the federal government, provincial government, and voluntary sectors. It includes organizations that fund only cancer research (e.g., Canadian Breast Cancer Foundation) and organizations that fund all types of health research (e.g., Alberta Innovates – Health Solutions), and general research/technology (e.g., Canada Foundation for Innovation (CFI)). Current names are used for organizations that have undergone recent name changes and will vary from previous reports. These changes are noted in the footnotes accompanying Table 3.1.1. This report focuses on research projects with start dates before December 31, 2009 and end dates after January 1, 2005. Appendix B lists all CCRS participating organizations, as well as specific issues relevant to the quality of the data provided.

In this report, Health Canada/Public Health Agency of Canada (PHAC) is shown as a distinct funding organization and its investment represents monies that Health Canada/PHAC has provided to funding programs of the Canadian Breast Cancer Research Alliance, Canadian Tobacco Control Research Initiative, and Canadian Institutes of Health Research (CIHR). It does not include monies from its own non-research based funding programs.[1] Although Health Canada funds the Canadian Partnership Against Cancer, the Partnership is shown as a separate organization in this report. A breakdown of the Health Canada/PHAC investment for 2009 is shown in Table 2.1.1.

Investment shown for the Networks of Centres of Excellence (NCE) refers to distinct cancer-relevant projects funded by three centres (i.e., Canadian Institute for Photonic Innovations (CIPI), Mathematics of Information Technology & Complex Systems (MITACS), and the Stem Cell Network (SCN)) as well as the investment in the Centres of Excellence for Commercialization and Research (CECR). Table 2.1.2 provides a summary of the CECR investment captured in this report for 2009. Of note, the NCE investment does not include the funds provided for network management and network activities by the CIHR, Natural Sciences and Engineering Research Council (NSERC), and Social Sciences and Humanities Research Council (SSHRC) in support of the NCE initiative.

Also of note, new guidelines for federal granting agencies regarding subject matter eligibility for health-related research came into effect in 2009. Social science or humanities research that is primarily intended to improve and/or increase knowledge of health, health care, and health-care systems is no longer eligible for support from SSHRC. Although cancer research investment is shown for SSHRC for the period 2005 to 2009, it is expected to drop and eventually disappear over the next few years.

1. PHAC investment for the 2005–2009 period for its various grants/contributions, including the Canadian Breast Cancer Initiative and the Healthy Living and Chronic Disease Cancer Community-Based Funding Program, is estimated at $17.4M.

TABLE 2.1.1

2009 CANCER RESEARCH INVESTMENT BY ORGANIZATION/PROGRAM WITH MONIES PROVIDED BY HEALTH CANADA

SECTOR/ORGANIZATION	PROGRAM	2009 Investment	
		$	%
Multi-funded initiatives	Canadian Breast Cancer Research Alliance	2,824,918	18.9
	Canadian Tobacco Control Research Initiative	83,398	0.6
Federal agencies	Canadian Institutes of Health Research	139,425	0.9
Canadian Partnership Against Cancer [1]	Canadian Partnership for Tomorrow Project (CPTP)	9,718,756	65.1
	Terry Fox Research Institute (TFRI) Translational Cancer Research Pilot Project	2,163,407	14.5
TOTAL		**14,929,904**	**100**

[1] The Partnership is an independent organization funded by Health Canada.

TABLE 2.1.2

2009 CANCER RESEARCH INVESTMENT IN CENTRES OF EXCELLENCE FOR COMMERCIALIZATION AND RESEARCH (CECR)

CENTRE	Weighting	2009 Investment [1]					
		Canadian Institutes of Health Research	Natural Sciences and Engineering Research Council	Social Sciences and Humanities Research Council	Cancer Care Ontario	Ontario Institute for Cancer Research	TOTAL
Advanced Applied Physics Solutions, Inc. (AAPS), Vancouver	10	29,700	210,000	59,412			299,112
Centre for Drug Research and Development (CDRD), Vancouver	33	588,192	251,790	147,086			987,068
Centre for Probe Development and Commercialization (CPDC), Hamilton	100	1,690,000	1,004,000	297,115	116,667	800,000	3,907,782
Institute for Research in Immunology and Cancer (IRIC)/CECR in Therapeutics Discovery (IRICoR), Montreal	100	1,937,600	567,200	486,315			2,991,115
The Prostate Centre's Translational Research Initiative for Accelerated Discovery and Development (PC-TRIADD), Vancouver	100	2,080,000	20,000	711,115			2,811,115
TOTAL		**6,325,492**	**2,052,990**	**1,701,042**	**116,667**	**800,000**	**10,996,191**

[1] Investment was prorated over a five-year timeframe and, where applicable, adjusted by the cancer relevance weighting. Only the investment shown in this table was used in this report. Other leveraged funding is not captured.

2.2 PROJECT CLASSIFICATION

All research projects were coded in terms of type of research and cancer site (see sidebar). The Common Scientific Outline (CSO) was the typology used for coding the type of research, and final CSO coding for each project was determined after two coders independently classified the projects and then met to discuss discrepancies and determine final agreed-upon codes. Observed agreement of the blind-coded classifications of the two coders in terms of the seven CSO categories was 85.2%. The Cohen's kappa coefficient (unweighted) was 0.81 (95% confidence intervals 0.81-0.82), which is in the "almost perfect" agreement category according to Landis and Koch.[2]

Kite diagrams are used to illustrate the distribution of the CSO across its seven categories. A kite diagram is a type of area chart in which the y-axis is split into two equal parts ranging from 0 to 50%, with the 0 origin located in the middle of the graph. The kite diagram is a succinct visual for detecting differences/similarities across multiple organizations.

Cancer site classification was completed by one coder. In addition to the project descriptions, other sources of information, when available from participating organizations (e.g., site checklists), were used to make the site determinations. When a project was focused on a specific risk factor such as smoking and no mention was made of cancer sites in the project description/additional information, predetermined site allocations based on expert input were used (e.g., for projects focused on smoking, the site allocations were lung 50%, esophagus 15%, larynx 15%, pharynx 15%, and all other sites 5%).

Projects were also grouped in terms of type of funding mechanism (see sidebar on next page for descriptions).

Within the appendices, investment data for all five years is provided for codes of the CSO (Appendix C) and cancer sites (Appendix D). These updated investment figures will help to bridge the analyses presented in this report with previously published reports. As with our previous reports, the data presented herein is subject to change based on future data submissions or refinements.

PROJECT CLASSIFICATION

All projects within the CCRA database were classified according to type of research and type of cancer. The classification was determined on the basis of the available project summary. The Common Scientific Outline (CSO), a classification system specific to cancer research, was used as the tool to classify research type. The CSO is the principal classification framework used by the International Cancer Research Partnership (ICRP). The 38 CSO codes are organized into seven broad categories of scientific interest. Each project within the CCRA database was assigned a relevant CSO code. Where more than one CSO code was assigned to a given project, the project budget was distributed equally among the codes. For more information about the CSO, please refer to https://www.icrpartnership.org/CSO.cfm.

Projects were also classified according to cancer site using the International Statistical Classification of Diseases and Related Health Problems, 10th Revision, Version for 2010 (ICD-10). The ICD-10 is an international standard diagnostic classification used for general studies of the distribution and frequency of human disease and for health management purposes. It is also used in the national reporting of new cancer cases. Similar to the CSO coding, some projects were assigned more than one cancer site. In these cases, the project budget was allocated accordingly to each code so that it summed to 100% of the total. An electronic version of the ICD-10 is available from the World Health Organization. Please refer to http://apps.who.int/classifications/icd10/browse/2010/en/ for more information.

2. J.R. Landis and G.G. Koch, "The measurement of observer agreement for categorical data," *Biometrics* 33, 1977:159–174.

2.3 REPORTING CONVENTIONS

The term "cancer research investment" represents the direct funding of cancer research that received some form of peer review and that was administered by organizations participating in the survey. (There is also, however, an estimate of the cancer-relevant portion of the federal government's Indirect Costs Program in section 3.4.) Within the context of this report, "peer review" is defined as the process of subjecting a research proposal to the scrutiny of others who are experts in the same or similar fields. These experts conduct an impartial review (i.e., they do not have any competing professional or personal interests). The formats for peer review vary among organizations and funding mechanisms, and range from formalized reviews to more ad hoc arrangements to the use of in-house expertise as is commonly used for related support grants.

All projects conducted within calendar years 2005 to 2009 are included. Given that many organizations have different grant cycles and fiscal years, the selection of calendar year is intended to standardize data collection. Unless additional data was provided by the funding organization, annual investment was calculated on a prorated basis and assumes that the project dollars were paid out in equal monthly instalments based on project start and end dates. Investment figures are not adjusted for inflation unless noted in the specific table/figure. That is, we are reporting in current dollars unless noted that we are reporting in "constant dollars," where dollars were adjusted to 2009 values.

In this report, sector breakdowns have been used to denote the sectors of the organizations

DEFINITIONS OF FUNDING MECHANISMS

Operating grants: competitive grants that support all the direct costs involved in conducting specific research projects performed by identified researchers. Operating grants typically cover salaries for laboratory staff and research assistants/associates/trainees, costs of research equipment and supplies, and other specific research-related expenses. Multi-component projects (program projects), feasibility grants, proof-of-principle grants, regional development grants, innovation grants, and knowledge translation grants are all included in this category.

Equipment/infrastructure grants: competitive grants that cover, in part or in full, the costs of construction or major remodelling of new research facilities, and/or the purchase, housing, and installation of equipment, scientific collections, computer software, information databases, and communication linkages used primarily for conducting research. It includes funding for costs associated with cohort establishment.

Career awards: competitive awards that provide protected time for research on either a long- or short-term basis to outstanding researchers who have demonstrated high levels of productivity and research accomplishments. These awards are given to only a small percentage of all researchers. (They may also be called salary awards.) Research chairs and establishment grants, grants designed to facilitate the recruitment of outstanding researchers, are also included under this funding mechanism.

Trainee awards: competitive awards that recognize outstanding trainees and support them during their undergraduate, graduate, or post-graduate training. Trainees from Canada who are studying at institutions outside Canada may also be eligible for some types of trainee awards. Block training grants given to institutions that in turn distribute the monies to trainees through a competitive process are also included under this funding mechanism. These awards are in addition to trainee salaries covered in operating grants.

Related support grants: competitive grants that support travel, workshops/symposia, and researcher time for proposal development/letters of intent. These grants involve small sums of money.

that administered and funded the research projects, a departure from our previous reports where investments were allocated to the funder that administered the funding program. This means that the investment for projects funded by two or more organizations will be reflected in the investment amounts of the organizations that provided the funding. For example, the investments in CFI projects are shown under CFI (40%) within the federal government sector, under the provincial government sector (40%), and under "Other" (20%).[3] Sector allocations for Genome Canada for 2009 are summarized in Table 2.3.1.

Likewise, in previous reports we reported on three multi-funded initiatives separately (i.e., Canadian Breast Cancer Research Alliance, Canadian Prostate Cancer Research Initiative, and Canadian Tobacco Control Research Initiative). These initiatives were funded entirely by partner organizations from both the federal government and voluntary sectors. All of these initiatives have ceased operation so the CCRS database schema was modified so that the contributions made to the initiatives by the individual funders could be combined with their other investments.

TABLE 2.3.1

2009 CANCER RESEARCH INVESTMENT BY FUNDING SOURCE FOR GENOME CANADA

SECTOR	FUNDING SOURCE	2009 Investment	
		$	%
Federal government	Genome Canada	8,278,435	50.7
	Canada Foundation for Innovation	297,357	1.8
Provincial government	Provincial government	1,811,768	11.1
Other	Private industry	2,883,974	17.7
	Institutional	1,298,108	8.0
	Foreign	1,749,491	10.7
TOTAL		**16,319,134**	**100**

3. CFI does not provide the details of the partner investment. In the database, the estimated partner contributions were calculated on the basis of the CFI maximum contribution.

The institutional affiliation of the nominated principal investigator (PI) or project leader was used for analyses based on geography (province). There is only one nominated PI per project. Components of multi-component projects are considered individual projects if the funding organization provided details (i.e., description, researchers, budget, etc.) on the component parts. The Canadian Cancer Society, National Research Council Canada, Ontario Institute for Cancer Research, and The Terry Fox Foundation provided this level of detail. For clinical trials supported by the Canadian Cancer Society (i.e., NCIC Clinical Trials Group), each site involved in the trial was treated as a separate project with its own PI and budget (based on per case and site administration funding).

Project budgets have been weighted in terms of the extent to which they were focused on cancer. Budgets for projects determined to have the study of cancer as their primary focus were weighted at 100%. This included all projects funded by organizations that fund only cancer research, as well as research funded by other organizations where the research was focused on cancer. Budgets for all other research projects that were not entirely focused on cancer were weighted on the basis of the available project descriptions (see Table 2.3.2 for some examples of how weightings were applied). Weightings (i.e., the percentage of funding of a particular project that was assessed as being focused on cancer research) ranged from 5% to 100% (see Table 2.3.3). Of note, six of the CFI "Research Hospital Fund – Large Scale Institutional Endeavours" were included in investments shown in this report, with weightings ranging from 10% to 50%.[4]

In this report, when the term "number of projects" is specified, it refers to a count of projects without the weightings applied. When the term "project equivalents" is used, it refers to a count of projects with the weightings applied.

All projects are coded to cancer sites using the ICD-10 in accordance with the level of detail provided in the project description. ICD-10 codes are rolled up to 24 cancer sites. Collectively, these cancer sites represent ~90% of all new cancer cases and deaths per year.

4. Includes: Newfoundland and Labrador Centre for Interdisciplinary Research in Human Genetics (cancer weighting 10%; 2009 weighted amount $561,567); Building the UHN Advanced Therapeutics Research Platform (cancer weighting 20%; 2009 weighted amount $9,225,597); Translational Research and Intervention Across the Lifespan (cancer weighting 20%; 2009 weighted amount $9,998,834); Centre for Image-Guided Therapeutics (cancer weighting 25%; 2009 weighted amount $8,000,000); The SickKids Child Health Research Institute (cancer weighting 33%; 2009 weighted amount $15,034,664); Translation of Innovation into Medical Excellence (TIMEx) (cancer weighting 50%; 2009 weighted amount $6,147,559).

TABLE 2.3.2

EXAMPLES OF THE APPLICATION OF CANCER WEIGHTINGS TO RESEARCH PROJECTS

ISSUE	EXAMPLE	APPROACH
Project is not entirely focused on cancer	Quality of end-of-life care: The perspectives of bereaved family members of lung cancer and COPD	Budget was weighted at 50% as the research was looking at cancer and chronic obstructive pulmonary disease (COPD).
Project spans more than one category of the CSO	Molecular and genomic characterization of breast cancer according to metastatic site	Budget was allocated to CSO codes 1.4 - Cancer progression and metastasis and 4.1 - Technology development and/or marker discovery.
Project involves more than one cancer site	Biomarkers and imaging studies of the tumour microenvironment: Treatment response and new therapeutic targets in cervix and prostate cancer	Budget was allocated 50-50 to two cancer sites (i.e., cervix and prostate).

TABLE 2.3.3

DISTRIBUTION OF WEIGHTINGS APPLIED TO PROJECTS IN THE SURVEY DATABASE, 2005–2009

	Projects	
Cancer weight (%)	Number	%
100	8,776	80.2
80	73	Less than 1
75	21	Less than 1
67	4	Less than 1
50	505	4.6
40	3	Less than 1
33	1,029	9.4
25	67	Less than 1
20	327	3.0
17	1	Less than 1
10	138	1.3
5	1	Less than 1
TOTAL	**10,945**	**100**

2.4 DATA QUALITY

A review of site coding was undertaken prior to the preparation of this report in an effort to enhance the consistency of the coding over the five years. Key concepts in project titles and abstracts were annotated using an automated system, which incorporated multiple tools including a virtual appliance of the U.S. National Center for Biomedical Ontology BioPortal.[5] Annotated cancer sites were mapped to the corresponding cancer sites reported in the CCRS analysis (24 sites). Site coding completed as part of the CCRS was then compared to the sites generated by the automated system.

Out of 10,945 projects, 3,755 non-matches (34.3%) were identified. Visual inspection reduced this to a list of 1,206 projects, all of which were subsequently reviewed to determine if the site coding needed to be adjusted.

Coding was modified for 455 projects (4.2%) projects in the database. For most projects (55.6%), the change involved additions or deletions to site codes already attributed to the project. See Table 2.4.1 for details.

As a consequence of this recoding and other changes made to the data, figures presented in this report will vary from those previously published.

TABLE 2.4.1

SITE CODING CHANGES MADE TO THE SURVEY DATABASE TO IMPROVE DATA QUALITY

Type of change	Projects	
	Number	%
No change	10,490	95.8
Partial change (original coding and new coding overlapped)	253	2.3
Complete change - original was not site specific; new was site specific (n=149) - original was site specific; new was not site specific (n=19) - there was a complete mismatch on site coding (n=34)	202	1.9
TOTAL	**10,945**	**100**

5. Natalya F. Noy et al. (2009). BioPortal: ontologies and integrated data resources at the click of a mouse. *Nucleic Acids Research*, 37 (Suppl 2):W170–3.

3. 2009 Investment and Trends in Investment, 2005–2009

This chapter describes the 2009 investment as well as changes in amount and distribution of the cancer research investment from 2005 to 2009. We examine the investment by funding sector, areas of research, cancer sites, and funding mechanism.

3.1 FUNDING SECTOR

Overall, cancer research investment as captured in the CCRS rose from $372.2M in 2005 to $545.5M in 2009, representing an increase of 46.6% (Figure 3.1.1A). The annual percent increase in research investment was largest for years 2008 to 2009 at 15.8%. After correcting for inflation by adjusting to 2009 dollars, the overall increase in investment from 2005 to 2009 was 35.5%. Over the five-year period, the number of projects, nominated PIs, and trainees rose. For some funding organizations, the maximum amounts awarded for direct support and trainee awards were increased during the 2005 to 2009 period. The percent increase in investment in cancer research exceeded that found for overall health expenditures and overall R&D expenditures in the higher education sector for the same time period.

Research investment grew for all sectors from 2005 to 2009 (see Figure 3.1.1B), with the highest average rate of change being for the provincial government sector. Alberta and Ontario were key drivers of this growth. Within the federal government sector, the CECR program, The Partnership's research investment, and CFI funding contributed substantially to the increased investments for years 2008 and 2009.

Programs/agencies funded by the federal government represented 46.1% of the $545.5M total 2009 cancer research investment (Table 3.1.1). This does not include an estimated $20.7M in cancer-attributable indirect costs based on information provided by the federal government's Indirect Costs Program, which is detailed in section 3.4. CIHR was the single largest investor in cancer research, representing 24.2% of the total investment. The Ontario Institute for Cancer Research represented 32.6% of the $158.5M provincial government investment and 9.5% of the $545.5M total. Investment by the Canadian Cancer Society represented 46.0% of the total voluntary sector investment and 8.1% of the overall investment.

Table 3.1.2 presents all five years of data for all organizations/programs. The tremendous growth in investment by the Ontario Ministry of Economic Development and Innovation (MEDI) reflects the initiation and ramp up of its research funding programs. Among the federal government and charitable sectors, organizations that accounted for smaller proportions of the overall cancer research investment tended to have the highest proportionate growth in investment from 2005 to 2009.

Research investment for years 2005 and 2009 by province of nominated PI is summarized in Figure 3.1.2. Per capita investment was highest in Ontario, Quebec, and B.C. although the highest percent increases in per capita investment from 2005 to 2009 were found for the four provinces of Atlantic Canada (especially New Brunswick). Only Saskatchewan had a decreased per capita investment over the period.

Figure 3.1.3 shows the investment by funding sector for each province over the five years covered in the CCRS. Provinces characterized by an increasing proportion of federal government investment were B.C., Quebec, and Nova Scotia. Alberta, New Brunswick, and Newfoundland and Labrador had the highest proportionate increases in provincial government funding. Saskatchewan had a decreased proportion of provincial funding and an increased proportion of voluntary sector investment in 2009 while Manitoba had a decreased proportion of federal government funding and an increased proportion of voluntary sector investment in 2008 and 2009. Ontario had a slightly decreased proportion of investment from the federal government and voluntary sectors with a concomitant increase in the proportion of provincial government funding. P.E.I. had an increased proportion of funding from the voluntary sector over the time period.

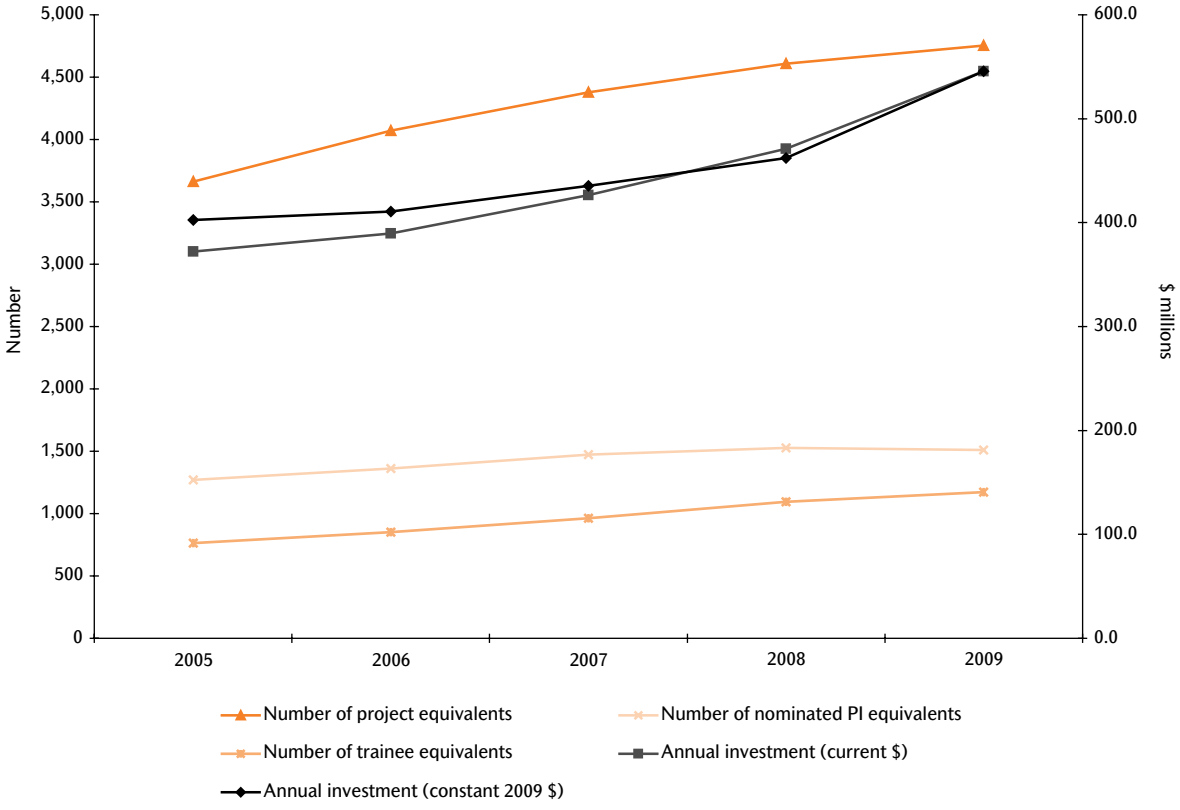
The provincial government investment adjusted by estimates of provincial GDP is presented in Figure 3.1.4. This shows that the highest percent change from 2005 to 2009 was in New Brunswick. Percent decreases were found for Saskatchewan, P.E.I., B.C., Quebec, and to a lesser extent, Manitoba. Alberta and Ontario had the highest investment rates in 2009 and both exceeded $120 per million GDP.

TREND SUMMARY

- There was an increase in cancer research funding over the five-year period in part accounted for by inflation and higher project funding as well as an increased number of research projects and researchers/trainees.
- The federal government continued to be the chief funder of cancer research, with CIHR as the leading funding agency. Some of the federal organizations representing smaller overall proportions of the cancer research investment, however, were among those with the highest percentage growth in investment over the five-year period (i.e., National Research Council, NSERC, and SSHRC).
- Strategic investment by the governments of Ontario and Alberta helped propel the growth in provincial government investment in cancer research over this period. Combined, the Ontario Institute for Cancer Research and the Ontario Ministry of Economic Development and Innovation went from representing less than 5% of the overall cancer research investment in 2005 to over 11% in 2009. Cancer research investment from provincial sources in Alberta represented less than 3% of the investment in 2005 to over 5% of the investment in 2009.
- In terms of other provincial trends over the five years, there was an infusion of research investment in Atlantic Canada from organizations within the federal government and voluntary sectors. Research investment in Saskatchewan, however, took a downturn.
- While the percentage growth in investment from 2005 to 2009 for the voluntary sector was lower than the government sectors, some of the smaller charities contributing data to the CCRS had substantial proportionate gains in their investment amounts. The 2009 research investments made by the Brain Tumour Foundation of Canada, C17 Research Network, Canadian Association of Radiation Oncology, Ovarian Cancer Canada, and The Leukemia & Lymphoma Society of Canada, for example, were more than double what they were in 2005.

FIGURE 3.1.1A

TREND IN CANCER RESEARCH INVESTMENT, 2005 AND 2009



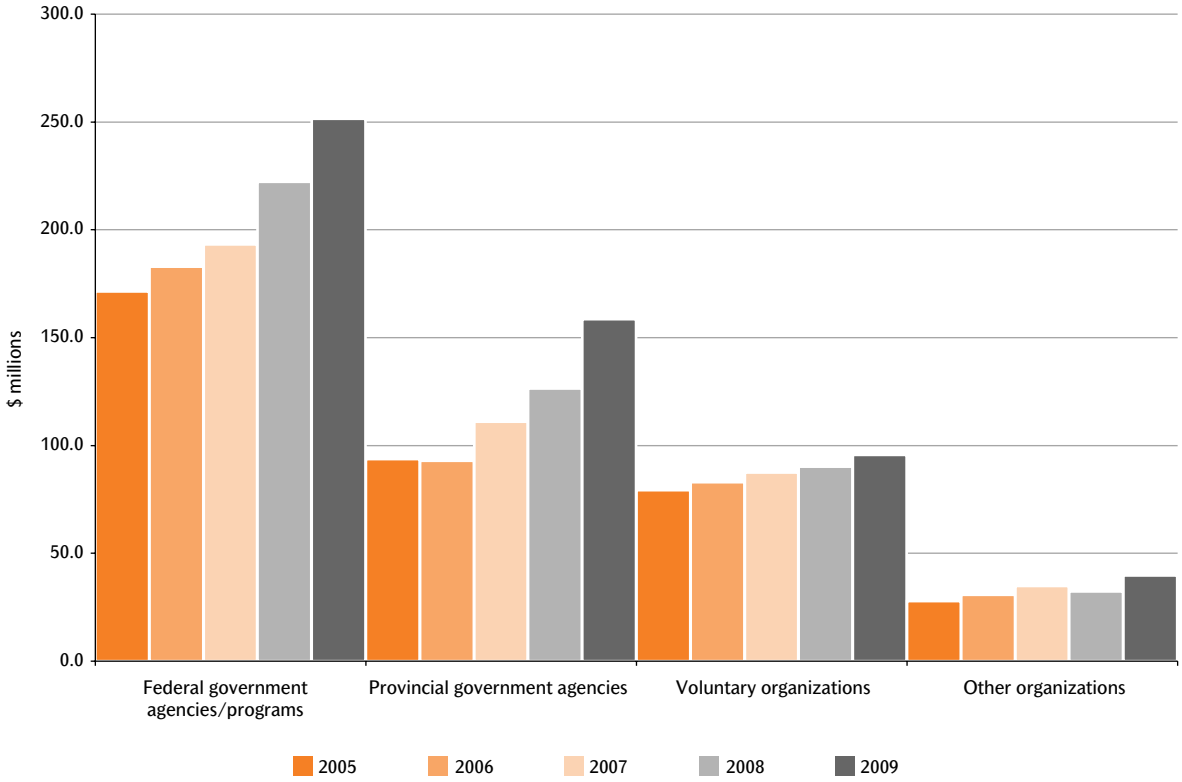
	Annual investment (current $)	Annual investment (constant 2009 $) [1]	Number of projects equivalents [2]	Number of nominated PI equivalents [2]	Number of trainees equivalents [2]
Percent change from 2005 to 2009	46.6	35.5	29.9	18.9	53.5

	millions of current dollars [3]					Percent change from 2005 to 2009
	2005	**2006**	**2007**	**2008**	**2009**	
Cancer research investment	372.2	389.6	426.5	471.1	545.5	46.6
Total health expenditures [4]	140,542.2	150,801.6	160,322.8	171,776.8	182,100.1	29.6
Estimates of R&D expenditures in the higher education sector [5]	9,518.2	9,624.8	10,187.3	10,926.4	11,013.0	15.7

[1] Constant dollars represent current dollars adjusted to 2009 values using the gross domestic product (GDP) at market prices provided in CANSIM Table 384-0036, Implicit price indexes, gross domestic product (GDP), provincial economic accounts, CANSIM (database).
[2] Numbers of projects, nominated PIs, and trainees are weighted by cancer relevance.
[3] Current dollars are unadjusted for inflation.
[4] Source: Canadian Institute for Health Information (2011). *National Health Expenditure Trends, 1975 to 2011*. Ottawa: CIHI.
[5] Source: Ministry of Industry (2011). Estimates of research and development expenditures in the higher education sector, 2009/2010. *Science Statistics*, October 2011, vol. 35, no. 3. Catalogue no. 88-001-X.

FIGURE 3.1.1B

CANCER RESEARCH INVESTMENT BY FUNDING SECTOR, 2005 TO 2009



	Federal government agencies/ programs	Provincial government agencies	Voluntary organizations	Other organizations
Percent change from 2005 to 2009	46.7	69.3	20.6	42.8

TABLE 3.1.1

2009 CANCER RESEARCH INVESTMENT BY PARTICIPATING ORGANIZATIONS/PROGRAMS

Sector [1]	Organization Type	Organization	2009 Investment $	2009 Investment %
GOVERNMENT $409,992,737 75.2%	Federal [2] $251,468,033 46.1%	Canada Foundation for Innovation	49,908,288	9.1
		Canada Research Chairs Program	21,474,250	3.9
		Canadian Institutes of Health Research	132,035,591	24.2
		Canadian Partnership Against Cancer	11,882,163	2.2
		Genome Canada	8,278,435	1.5
		Health Canada/Public Health Agency of Canada	3,047,741	0.6
		National Research Council	8,920,547	1.6
		Natural Sciences and Engineering Research Council	12,817,664	2.3
		Networks of Centres of Excellence [3]	560,854	0.1
		Social Sciences and Humanities Research Council	2,542,500	0.5
	Provincial Cancer Agency $27,735,882 5.1%	Alberta Cancer [4]	19,548,722	3.6
		CancerCare Manitoba	974,130	0.2
		Cancer Care Ontario	6,642,733	1.2
		Cancer Care Nova Scotia	229,813	0.0
		Saskatchewan Cancer Agency	340,485	0.1
	Provincial Health Research Organization $85,757,867 15.7%	Alberta Innovates – Health Solutions	6,088,194	1.1
		Fonds de recherche du Québec – Santé [5]	11,467,332	2.1
		Manitoba Health Research Council	1,023,303	0.2
		Medical Research Fund of New Brunswick	17,441	0.0
		Michael Smith Foundation for Health Research	5,634,507	1.0
		Newfoundland and Labrador Centre for Applied Health Research	31,208	0.0
		Nova Scotia Health Research Foundation	651,302	0.1
		Ontario Institute for Cancer Research	51,643,802	9.5
		Ontario Ministry of Economic Development and Innovation	8,804,697	1.6
		Saskatchewan Health Research Foundation	396,082	0.1
	Other provincial government agency		45,030,955	8.3
VOLUNTARY $95,722,684 17.5%		Brain Tumour Foundation of Canada	253,281	0.0
		C^{17} Research Network	467,694	0.1
		Canadian Association of Radiation Oncology	410,508	0.1
		Canadian Breast Cancer Foundation	13,819,706	2.5
		Canadian Cancer Society	44,068,692	8.1
		Canary Foundation of Canada	183,375	0.0
		Cancer Research Society	5,187,445	1.0
		Fondation du cancer du sein du Québec / Quebec Breast Cancer Foundation	1,215,443	0.2
		Ovarian Cancer Canada	469,158	0.1
		PROCURE	505,503	0.1
		Prostate Cancer Canada	1,312,198	0.2
		The Kidney Foundation of Canada	190,000	0.0
		The Leukemia & Lymphoma Society of Canada	1,783,912	0.3
		The Terry Fox Foundation [6]	24,245,158	4.4
		Other charitable organizations	1,610,611	0.3
OTHER		Other partnered/leveraged funding [7]	39,769,780	7.3
TOTAL			**545,485,200**	**100**

[1] Refers to the sector that funded the research regardless of the administering program.
[2] This figure does not include the cancer-relevant estimate for the federal Indirect Costs Program ($20.7M), which is discussed in section 3.4.
[3] NCE figure does not include funding from CIHR, NSERC or SSHRC for network management and activities but does reflect investment in cancer-relevant projects supported by specific networks (CIPI, MITACS, and SCN). CIHR, NSERC and SSHRC contributions to five Centres of Excellence for Commercialization and Research (CECR) are also included in the total shown.
[4] Alberta Cancer represents an amalgamation of different funding sources over the 2005 to 2009 period, including Alberta Cancer Board, Alberta Cancer Foundation, Alberta Health Services, Alberta Heritage Foundation for Medical Research, and Alberta Innovates – Health Solutions. For the sake of simplicity, these are grouped under Provincial Cancer Agency.
[5] In 2011, the Fonds de la recherche en santé du Québec became the Fonds de recherche du Québec – Santé (FRQS).
[6] Investment shown for The Terry Fox Foundation includes the projects supported by The Terry Fox Research Institute.
[7] Breakdown is as follows: other institutions (e.g., hospitals) $2,769,601; industry $18,143,461; foreign sources $1,749,491; and other/unknown $17,107,227.

TABLE 3.1.2

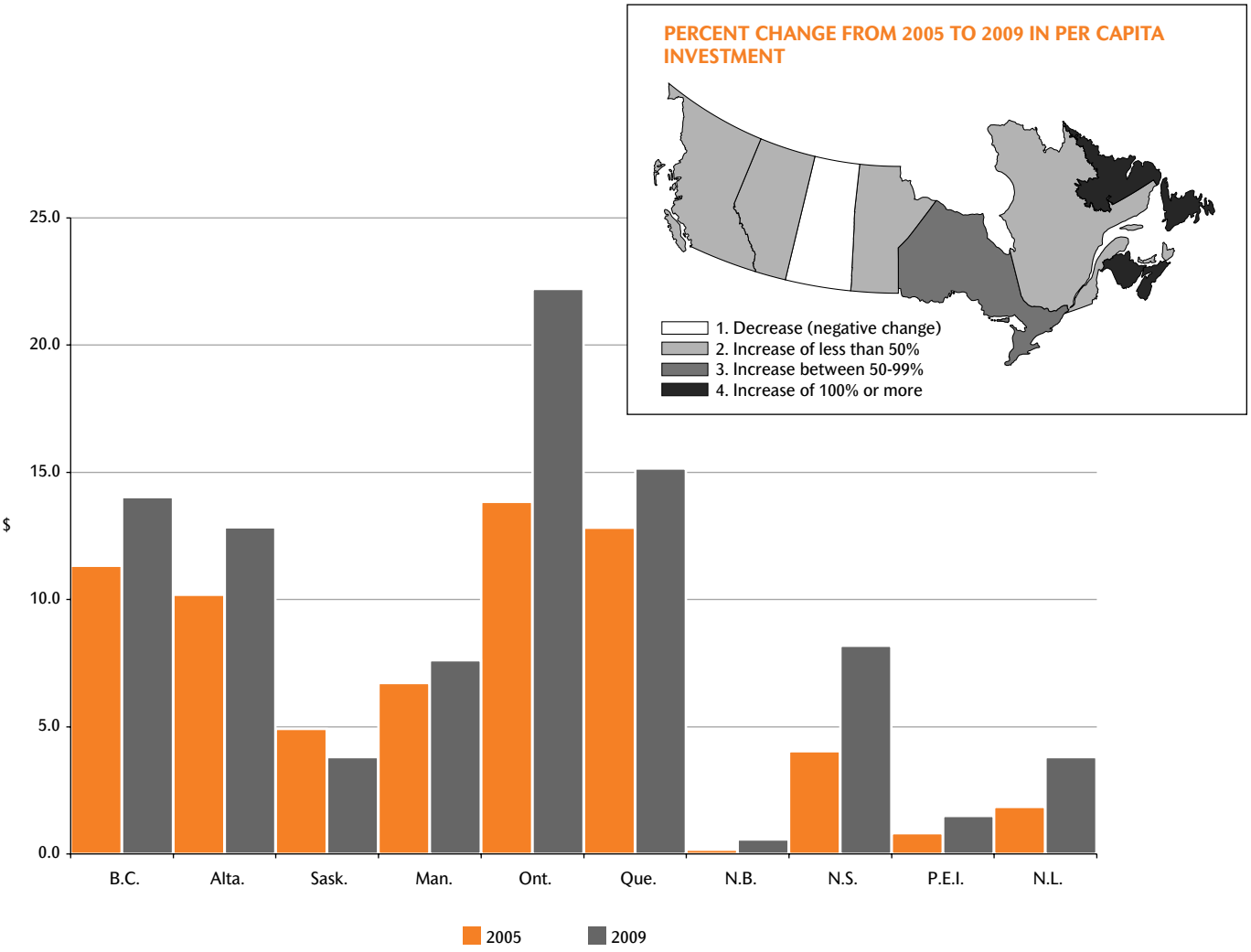
CANCER RESEARCH INVESTMENT BY PARTICIPATING ORGANIZATIONS/PROGRAMS, 2005 TO 2009

ORGANIZATION [1]	$					Percent change from 2005 to 2009
	2005	2006	2007	2008	2009	
FEDERAL GOVERNMENT [2]	**171,367,592**	**182,925,272**	**193,253,105**	**222,192,734**	**251,468,033**	**46.7**
Canada Foundation for Innovation	39,591,764	34,278,990	34,304,062	36,790,455	49,908,288	26.1
Canada Research Chairs Program	16,924,306	19,286,749	20,851,083	21,740,667	21,474,250	26.9
Canadian Institutes of Health Research	95,556,993	105,849,556	112,226,158	121,536,438	132,035,591	38.2
Canadian Partnership Against Cancer	-	-	-	9,934,074	11,882,163	-
Genome Canada	8,000,889	10,149,495	11,549,481	8,625,276	8,278,435	3.5
Health Canada/Public Health Agency of Canada	4,178,803	3,878,019	3,322,132	2,852,687	3,047,741	-27.1
National Research Council	2,342,650	3,288,251	3,416,418	7,341,680	8,920,547	280.8
Natural Sciences and Engineering Research Council	4,122,353	5,241,540	6,416,507	9,937,637	12,817,664	210.9
Networks of Centres of Excellence [3]	271,296	392,289	397,659	1,177,873	560,854	106.7
Social Sciences and Humanities Research Council	373,794	555,578	765,162	2,254,867	2,542,500	580.2
Other Federal agency	4,744	4,806	4,444	1,081	-	-
PROVINCIAL GOVERNMENT	**93,630,425**	**92,914,253**	**110,943,841**	**126,345,919**	**158,524,704**	**69.3**
PROVINCIAL CANCER AGENCY	14,193,871	20,366,658	25,621,668	29,920,480	27,735,882	95.4
Alberta Cancer [4]	6,517,923	9,717,681	14,743,615	21,399,402	19,548,722	199.9
CancerCare Manitoba	1,044,361	1,235,258	1,208,115	955,520	974,130	-6.7
Cancer Care Nova Scotia	296,250	301,250	322,500	336,250	229,813	-22.4
Cancer Care Ontario	6,044,850	8,850,336	9,022,779	6,821,871	6,642,733	9.9
Saskatchewan Cancer Agency	290,488	262,134	324,659	407,438	340,485	17.2
PROVINCIAL HEALTH RESEARCH ORGANIZATION	36,406,074	36,999,633	48,467,949	60,412,204	85,757,867	135.6
Alberta Innovates - Health Solutions	4,882,084	6,032,419	6,082,698	6,025,058	6,088,194	24.7
Fonds de recherche du Québec - Santé [5]	9,680,037	9,960,619	10,080,408	10,100,882	11,467,332	18.5
Manitoba Health Research Council	508,703	510,760	450,587	842,267	1,023,303	101.2
Medical Research Fund of New Brunswick	-	45,000	15,000	52,322	17,441	-
Michael Smith Foundation for Health Research	5,286,127	5,959,421	7,365,459	8,485,447	5,634,507	6.6
Newfoundland and Labrador Centre for Applied Health Research	-	-	6,000	18,000	31,208	-
Nova Scotia Health Research Foundation	285,695	399,982	450,965	577,073	651,302	128.0
Ontario Institute for Cancer Research	15,380,959	13,301,351	20,836,496	28,444,117	51,643,802	235.8
Ontario Ministry of Economic Development and Innovation	42,000	416,202	2,746,792	5,356,753	8,804,697	20,863.6
Saskatchewan Health Research Foundation	340,469	373,879	433,544	510,286	396,082	16.3
OTHER PROVINCIAL AGENCY	43,030,479	35,547,962	36,854,224	36,013,235	45,030,955	4.6
VOLUNTARY ORGANIZATION	**79,353,929**	**82,989,147**	**87,416,656**	**90,162,660**	**95,722,684**	**20.6**
Brain Tumour Foundation of Canada	83,333	157,334	145,999	370,044	253,281	203.9
C^{17} Research Network	23,750	59,300	185,731	325,860	467,694	1,869.2
Canadian Association of Radiation Oncology	186,307	187,417	261,700	182,376	410,508	120.3
Canadian Breast Cancer Foundation	7,229,640	7,602,413	8,736,367	11,637,839	13,819,706	91.2
Canadian Cancer Society	43,716,915	44,331,254	45,843,323	45,125,203	44,068,692	0.8
Canary Foundation of Canada	-	231,500	1,452,500	503,375	183,375	-
Cancer Research Society	5,727,890	6,035,123	6,657,384	6,423,874	5,187,445	-9.4
Fondation du cancer du sein du Québec / Quebec Breast Cancer Foundation	1,066,667	1,066,667	533,333	19,917	1,215,443	13.9
Ovarian Cancer Canada	143,000	89,000	147,646	286,491	469,158	228.1
PROCURE	-	140,000	270,500	495,092	505,503	-
Prostate Cancer Canada	901,647	1,183,059	992,468	896,408	1,312,198	45.5
The Kidney Foundation of Canada	273,906	151,953	105,000	147,500	190,000	-30.6
The Leukemia & Lymphoma Society of Canada	547,000	924,250	1,133,943	1,450,975	1,783,912	226.1
The Terry Fox Foundation [6]	17,588,804	19,055,919	19,345,397	20,732,971	24,245,158	37.8
Other charitable organization	1,865,070	1,773,958	1,605,365	1,564,738	1,610,611	-13.6
OTHER [7]	**27,850,863**	**30,803,744**	**34,890,570**	**32,408,585**	**39,769,780**	**42.8**
TOTAL	**372,202,809**	**389,632,416**	**426,504,173**	**471,109,898**	**545,485,200**	**46.6**

[1] Organizations are listed alphabetically under the relevant funding sector (sector totals are shown in boldfaced, upper case letters).
[2] This figure does not include the cancer-relevant estimate for the federal Indirect Costs Program ($20.7M), which is discussed in section 3.4.
[3] NCE figure does not include funding from CIHR, NSERC or SSHRC for network management and activities but does reflect investment in cancer-relevant projects supported by specific networks (CIPI, MITACS, and SCN). CIHR, NSERC and SSHRC contributions to five Centres of Excellence for Commercialization and Research (CECR) are also included in the total shown.
[4] Alberta Cancer represents an amalgamation of different funding sources over the 2005 to 2009 period, including Alberta Cancer Board, Alberta Cancer Foundation, Alberta Health Services, Alberta Heritage Foundation for Medical Research, and Alberta Innovates – Health Solutions. For the sake of simplicity, these are grouped under Provincial Cancer Agency.
[5] In 2011, the Fonds de la recherche en santé du Québec became the Fonds de recherche du Québec – Santé (FRQS).
[6] Investment shown for The Terry Fox Foundation includes the projects supported by The Terry Fox Research Institute.
[7] Other partnered/leveraged funding.

FIGURE 3.1.2

PER CAPITA CANCER RESEARCH INVESTMENT BY PROVINCE OF NOMINATED PI, 2005 AND 2009 [1, 2]

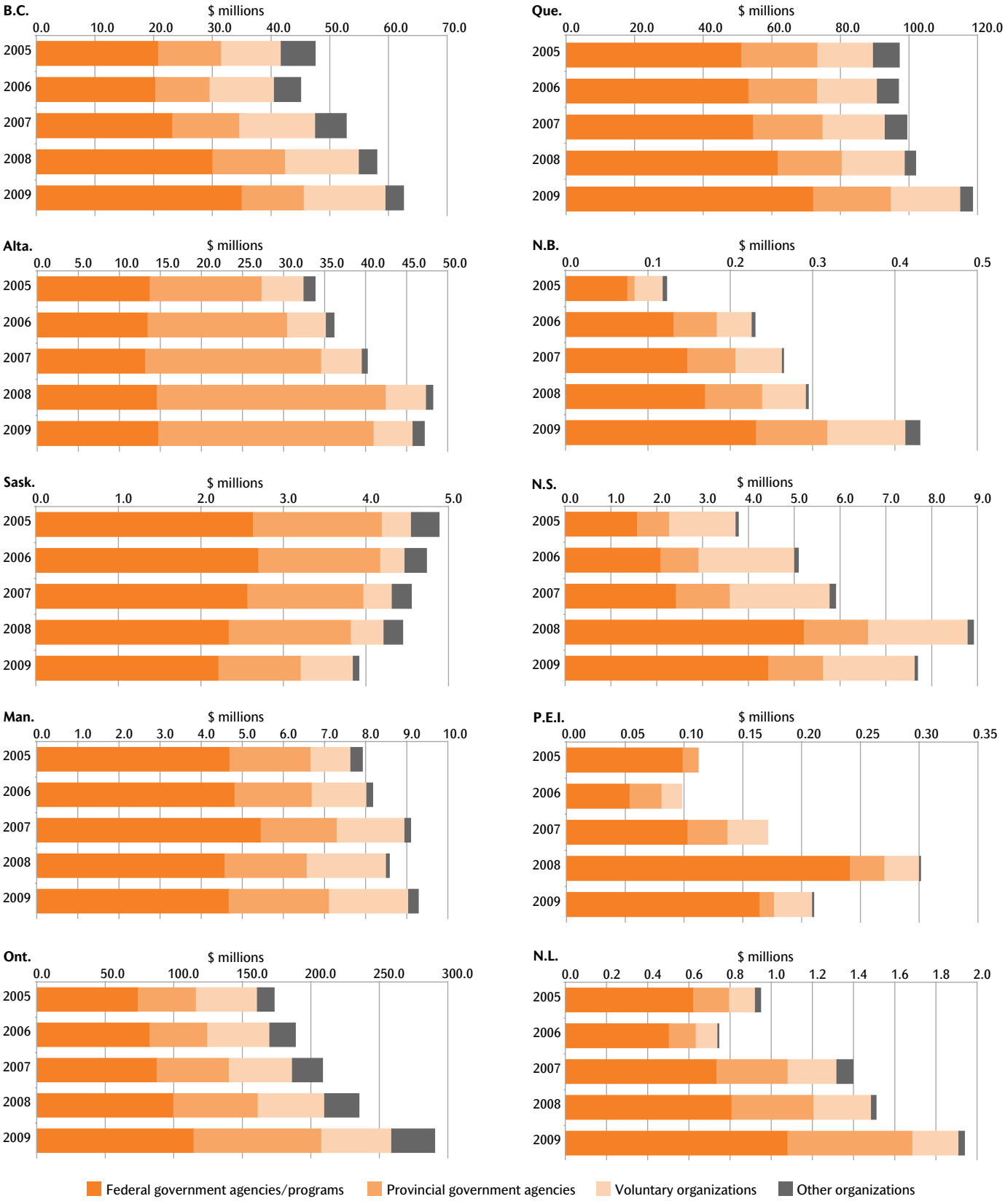


	B.C.	Alta.	Sask.	Man.	Ont.	Que.	N.B.	N.S.	P.E.I.	N.L.
2005 cancer research investment ($M)	47.5	33.9	4.9	7.9	173.3	97.2	0.1	3.8	0.1	1.0
2009 cancer research investment ($M)	62.6	47.2	3.9	9.3	290.4	118.6	0.4	7.7	0.2	1.9
2005 per capita investment ($)	11.33	10.19	4.92	6.72	13.84	12.82	0.16	4.03	0.81	1.84
2009 per capita investment ($)	14.03	12.85	3.80	7.61	22.22	15.15	0.57	8.18	1.49	3.81
Percent change in per capita investment from 2005 to 2009	23.9	26.0	-22.7	13.2	60.6	18.2	249.0	103.0	83.4	106.6

[1] Excludes trainee awardees studying outside Canada and a single grant to a PI located in the territories.
[2] Provincial population figures based on July 1 estimates from Statistics Canada, CANSIM, table 051-0001 were used in the per capita investment calculation.

FIGURE 3.1.3

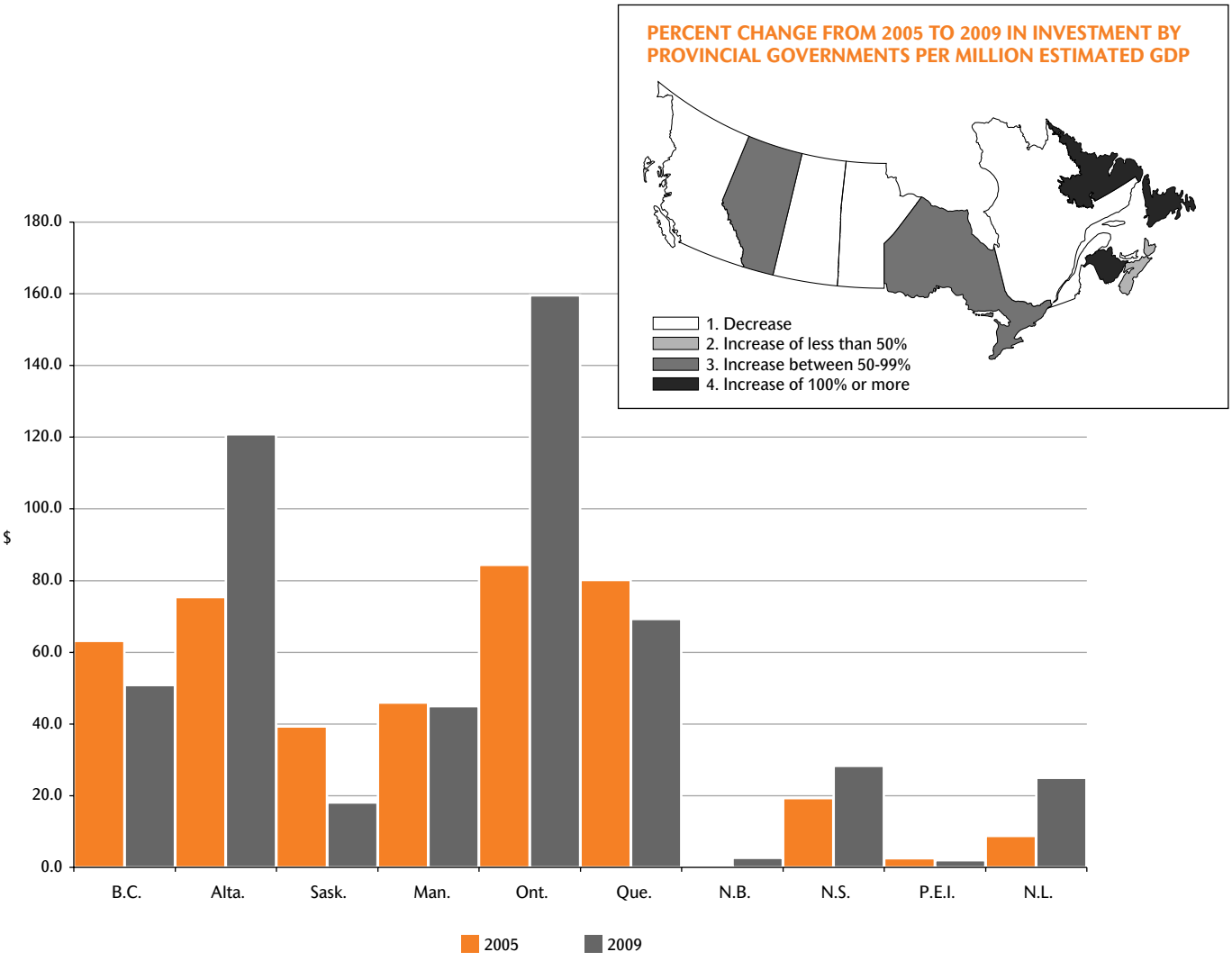
CANCER RESEARCH INVESTMENT BY FUNDING SECTOR FOR EACH PROVINCE, 2005 TO 2009 [1]



[1] Axis scale ($ millions) varies from province to province.

FIGURE 3.1.4

CANCER RESEARCH INVESTMENT BY PROVINCIAL GOVERNMENTS PER MILLION ESTIMATED GDP, 2005 AND 2009 [1, 2]



	B.C.	Alta.	Sask.	Man.	Ont.	Que.	N.B.	N.S.	P.E.I.	N.L.
2005 research investment per million GDP ($)	63.21	75.43	39.34	46.00	84.40	80.13	0.33	19.36	2.60	8.77
2009 research investment per million GDP ($)	50.81	120.87	18.14	44.97	159.57	69.25	2.63	28.33	2.04	25.02
Percent change from 2005 to 2009	-19.6	60.3	-53.9	-2.2	89.1	-13.6	705.8	46.3	-21.5	185.2

[1] Excludes trainee awardees studying outside Canada and a single grant to a PI located in the territories.
[2] Provincial GDP (expenditure-based, provincial economic accounts) estimates from Statistics Canada, CANSIM, table 384-0002.

3.2 TYPES OF RESEARCH

Figure 3.2.1 compares the CSO distribution of the 2005 and 2009 investment. There were percent increases for all areas except Scientific model systems (which represented less than 1% of the investment). The highest percent increase was found for Prevention[6] (referring largely to prevention intervention research), but all areas, with the exception of Biology and Scientific model systems, had percent increases above the overall increase of 46.6%. Over 60% of the 2009 investment was in the areas of Biology (39.2%) and Treatment (28.2%).

Individual kite diagrams are presented for each of the 39 organizations/programs in Figure 3.2.2, which compare the 2005 and 2009 investment distributions. For many organizations, the distributions have changed rather markedly.

A detailed breakdown of the investment by the 38 CSO codes is provided in Table 3.2.1. (For a comparison of the five years of data, please refer to Appendix C.) Areas where the investment more than doubled from 2005 to 2009 were: 2.4 – Resources and infrastructure (Etiology); 3.2 Nutritional science in cancer prevention; 3.3 – Vaccines (Prevention); 3.6 – Resources and infrastructure (Prevention); 4.3 – Technology and/or marker testing in a clinical setting; 5.1 – Localized therapies – clinical applications; 5.3 – Systemic therapies – discovery and development; 6.4 – Cost analyses and health care delivery; 6.9 – Resources and infrastructure (Cancer control, survivorship & outcomes).

Figure 3.2.3 shows kite diagrams of the CSO distribution for the 2005 and 2009 investments by province of nominated PI. Seven provinces had a contraction in proportionate investment in Biology. Both Manitoba and Quebec had over 40% of their investment in Biology in 2009. In Ontario, there was increased investment in Early detection, diagnosis & prognosis as well as Treatment (Ontario had the highest proportionate investment in Treatment in 2009). Manitoba had the highest percent investment in Cancer control, survivorship & outcomes in 2009. Newfoundland and Labrador and Nova Scotia had proportionately more research investment than other provinces in the Etiology category in 2009, with the investment in Etiology more than doubling in these two provinces over the five-year period. Provincial differences in the investment distribution by CSO likely reflect different strategic priorities by provincial governments as well as differences in resident research capacity/strengths.

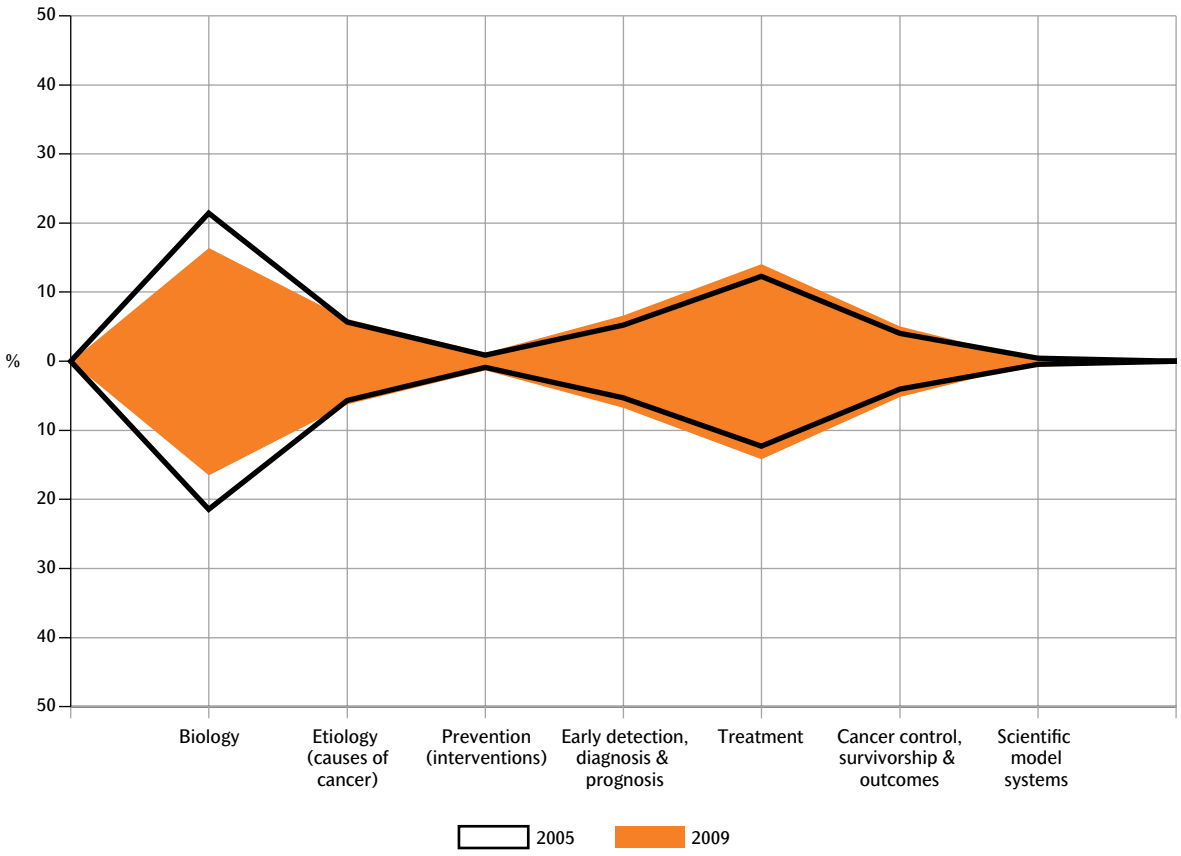
6. CCRA intends to release an update of its report, *Investment in Cancer Risk & Prevention Research, 2005–2007*, within the next 10 months. This new report will show trends in investment in cancer risk and prevention research for the 2005 to 2010 period.

TREND SUMMARY

- Although investment in Biology remained the highest of the CSO categories, investment in Biology grew only 12% over the five-year period in sharp contrast to the overall increase of 47%. CIHR assumed a greater proportion of the Biology research in 2009 (35%) than it did in 2005 (30%).
- Despite the doubling of investment in Prevention research from 2005 to 2009 – an area identified as a significant gap in our data report for 2005 – Prevention research represented only 2.5% of the overall research investment in 2009, which is below the 3.2% reported by our U.K. counterparts, the National Cancer Research Institute.
- Research supported by the National Research Council, Ontario Institute for Cancer Research, and Alberta Cancer helped to augment the investment in 6.4 – Cost analyses and health care delivery (the health services research subcode), which in turn helped boost the overall investment in the Cancer control, survivorship & outcomes category.
- Other targeted programs raised the level of investment in other specific areas of research within the Etiology, Early detection, diagnosis & prognosis, and Treatment categories of the CSO.

FIGURE 3.2.1

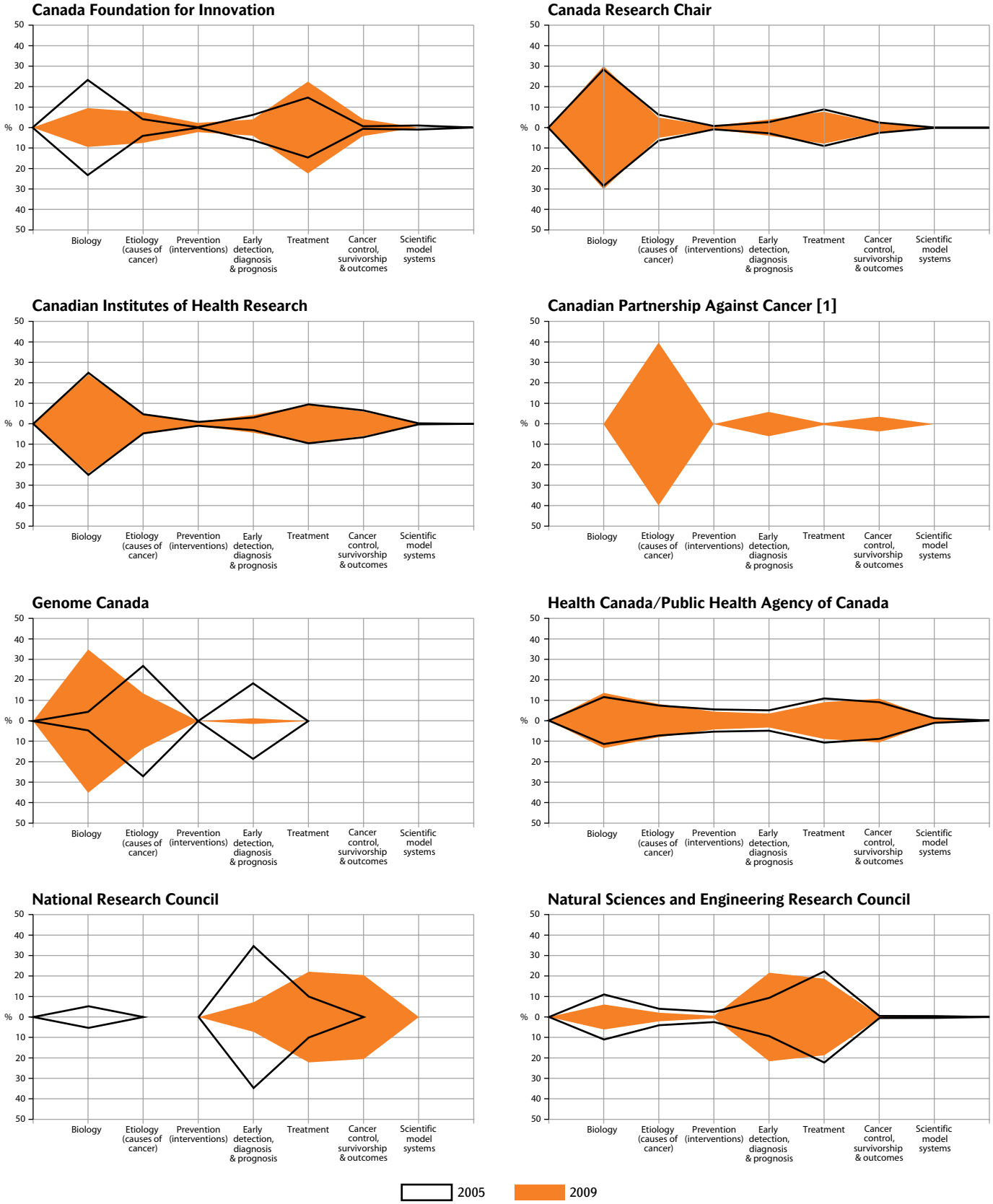
DISTRIBUTION OF CANCER RESEARCH INVESTMENT BY CSO CATEGORY, 2005 AND 2009



	Biology	Etiology (causes of cancer)	Prevention (interventions)	Early detection, diagnosis & prognosis	Treatment	Cancer control, survivorship & outcomes	Scientific model systems
Proportion of investment in 2005 (%)	42.9	11.4	1.7	10.5	24.5	8.1	0.9
Proportion of investment in 2009 (%)	32.9	12.4	2.5	13.4	28.2	10.2	0.3
2005 investment ($M)	159.7	42.3	6.4	39.2	91.3	30.1	3.2
2009 investment ($M)	179.7	67.6	13.7	73.0	153.9	55.9	1.7
Percent change in investment from 2005 to 2009	12.5	59.9	115.5	86.2	68.5	85.6	-47.4

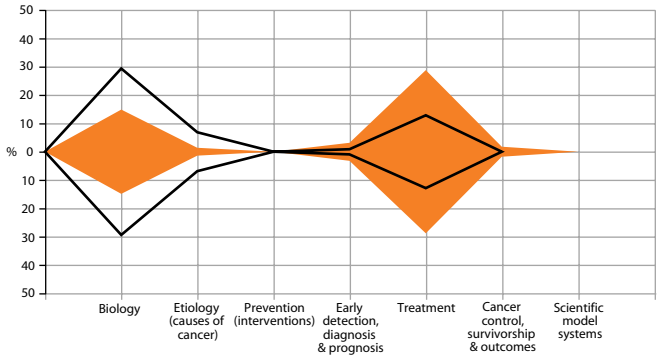
FIGURE 3.2.2

DISTRIBUTION OF CANCER RESEARCH INVESTMENT FOR PARTICIPATING ORGANIZATIONS BY CSO CATEGORY, 2005 AND 2009

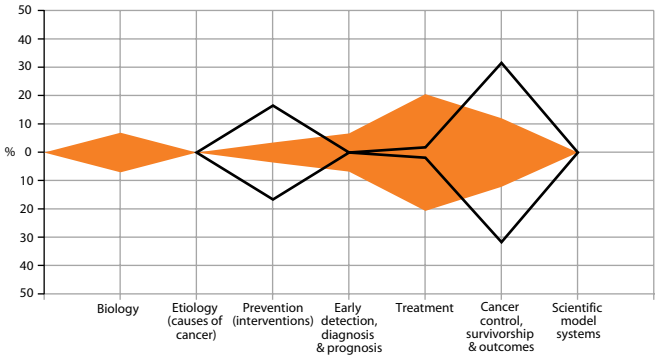


[1] There was no investment for this organization in 2005.

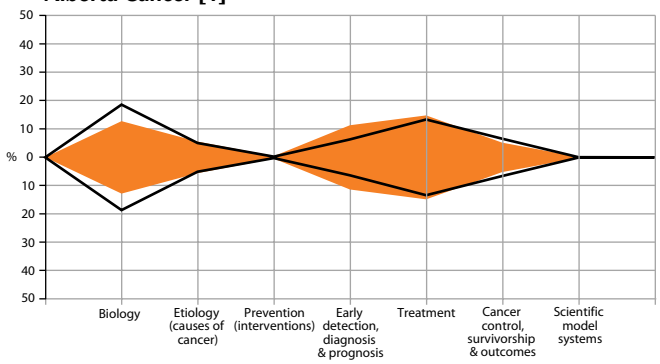
Networks of Centres of Excellence



Social Sciences and Humanities Research Council



Alberta Cancer [1]



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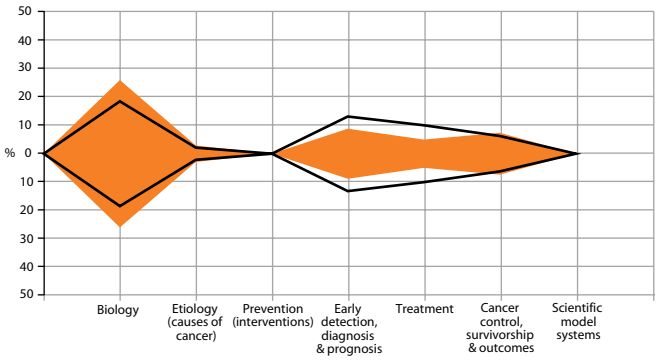
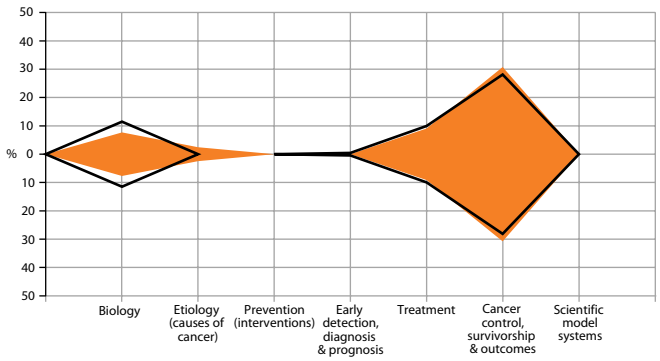
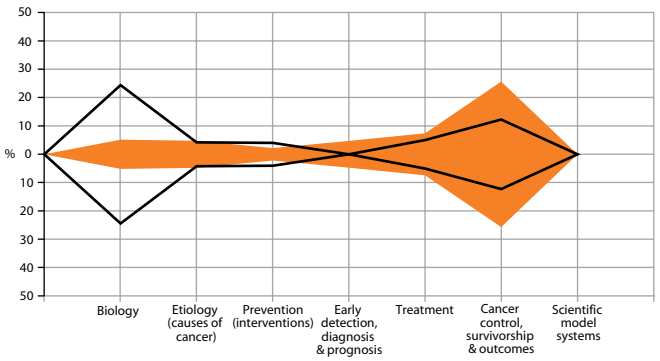


Cancer Care Nova Scotia



Cancer Care Ontario



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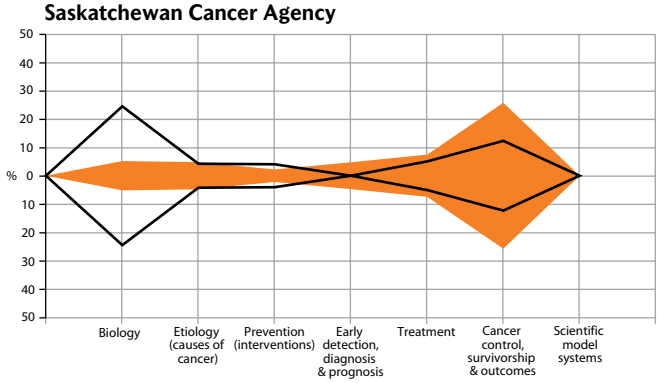
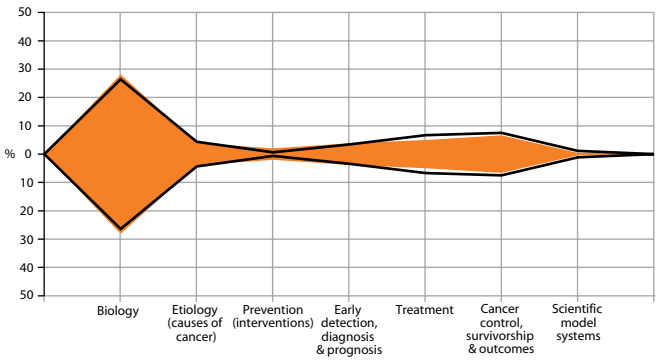


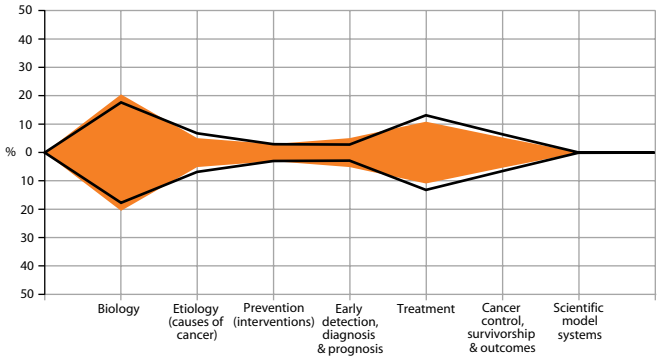
Alberta Innovates – Health Solutions



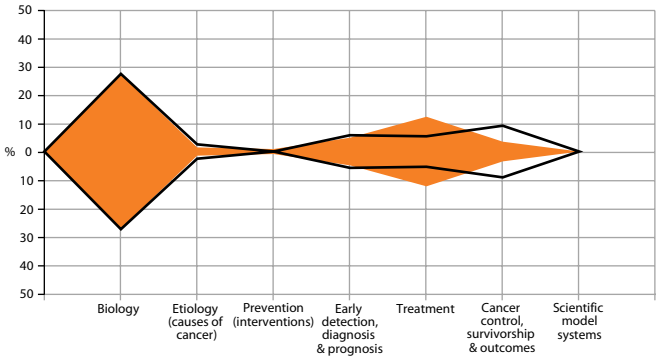
2005 2009

[1] Alberta Cancer represents an amalgamation of different funding sources over the 2005 to 2009 period, including Alberta Cancer Board, Alberta Cancer Foundation, Alberta Health Services, Alberta Heritage Foundation for Medical Research, and AIHS. For the sake of simplicity, these are grouped with other provincial cancer agencies.

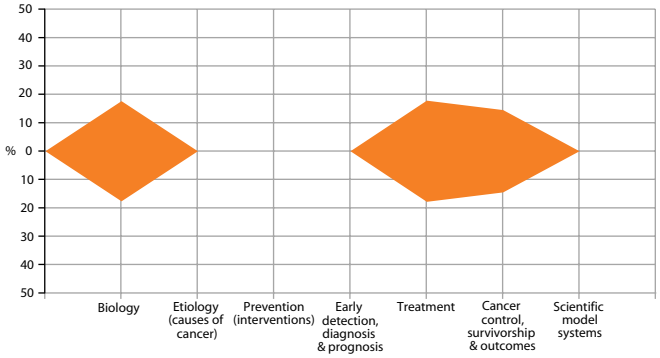
Fonds de recherche du Québec – Santé



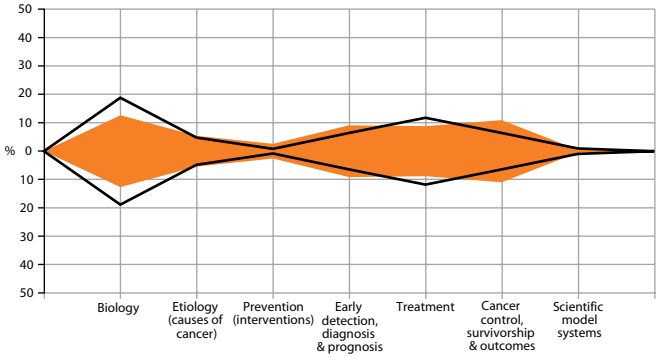
Manitoba Health Research Council



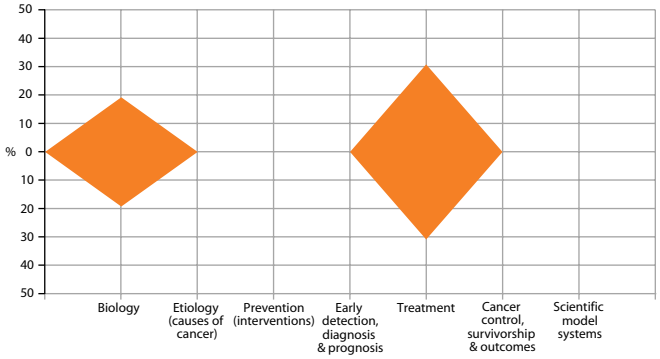
Medical Research Fund of New Brunswick [1]



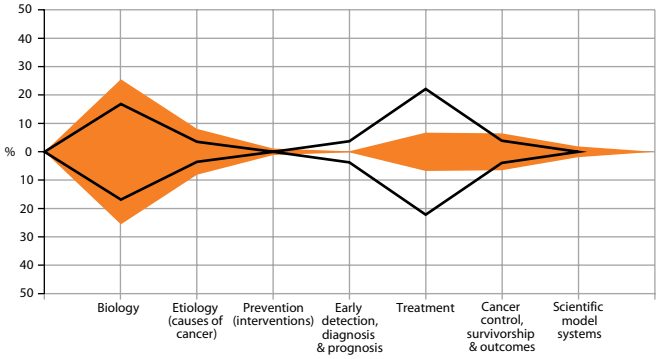
Michael Smith Foundation for Health Research



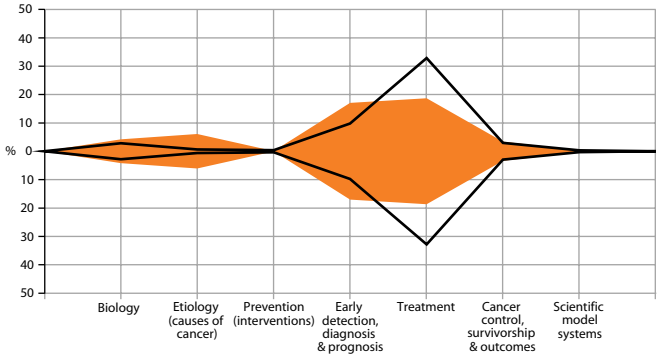
Newfoundland and Labrador Centre for Applied Health Research [1]



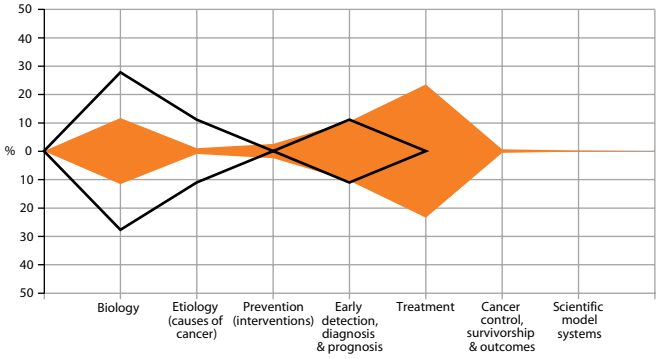
Nova Scotia Health Research Foundation



Ontario Institute for Cancer Research



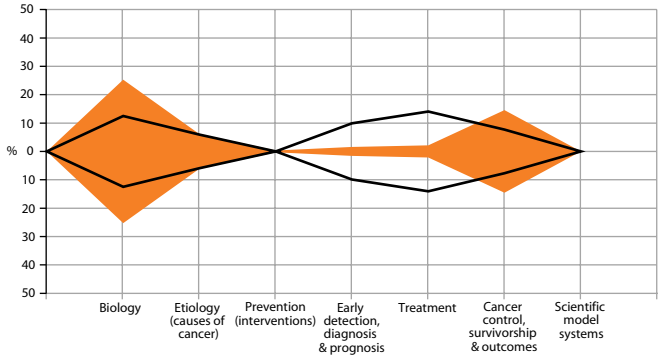
Ontario Ministry of Economic Development and Innovation



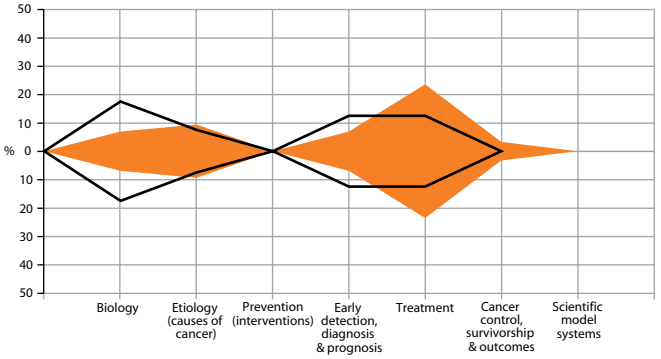
2005 2009

[1] There was no investment for this organization in 2005.

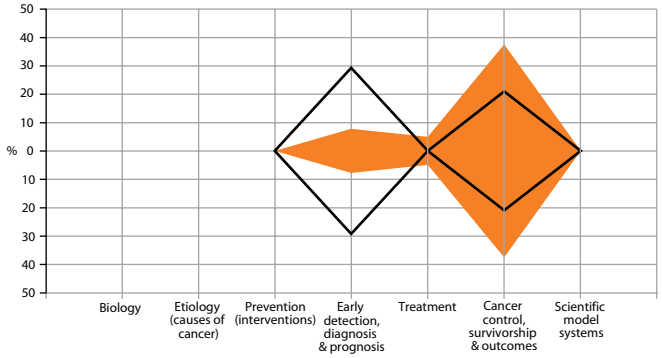
Saskatchewan Health Research Foundation



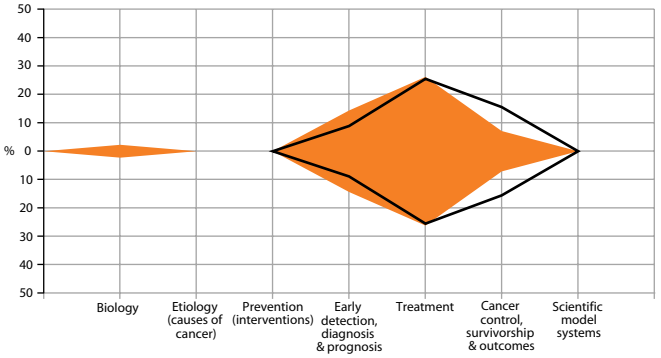
Brain Tumour Foundation of Canada



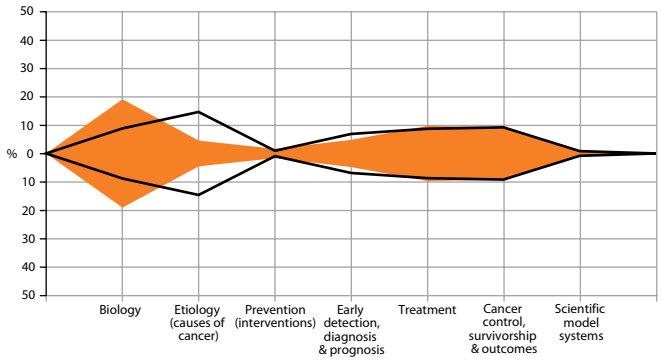
C[17] Research Network



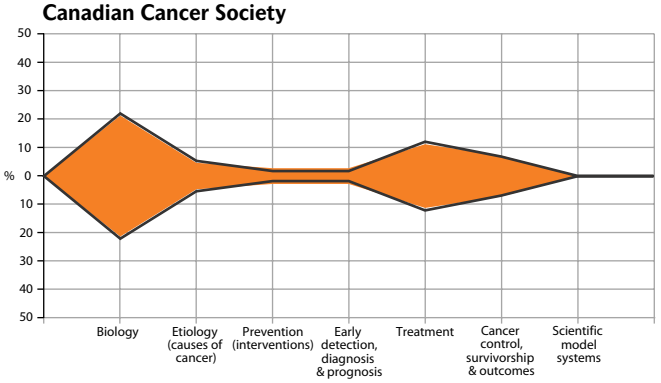
Canadian Association of Radiation Oncology



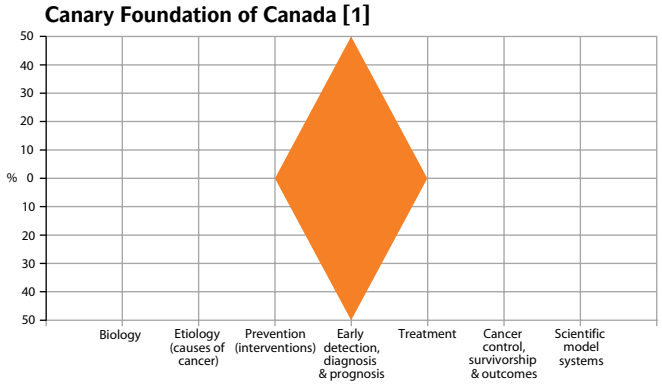
Canadian Breast Cancer Foundation



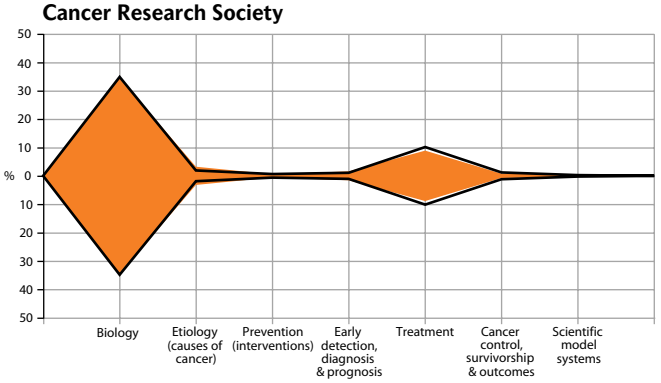
Canadian Cancer Society



Canary Foundation of Canada [1]



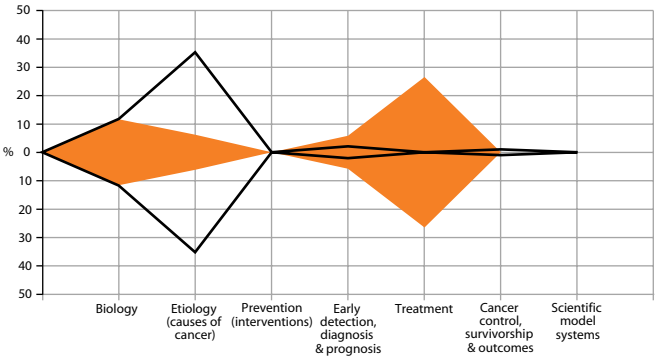
Cancer Research Society



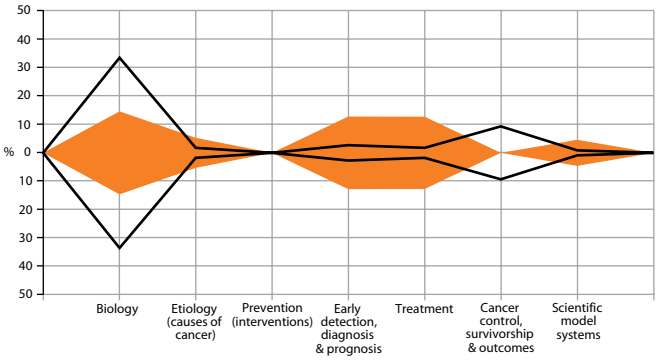
2005 2009

[1] There was no investment for this organization in 2005.

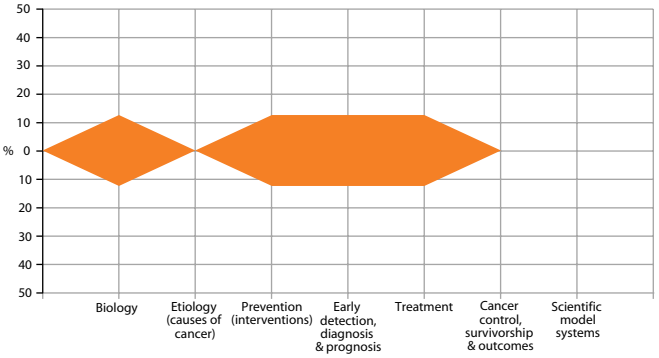
Fondation du cancer du sein du Québec / Quebec Breast Cancer Foundation



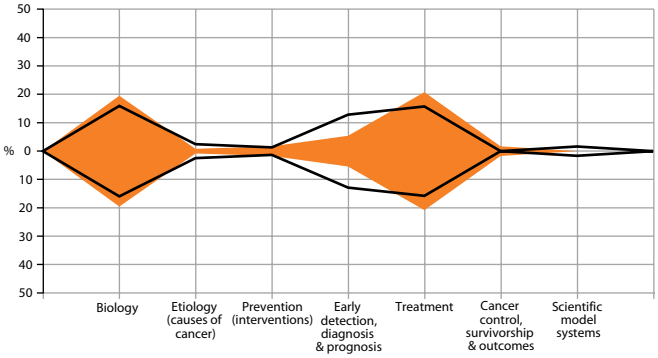
Ovarian Cancer Canada



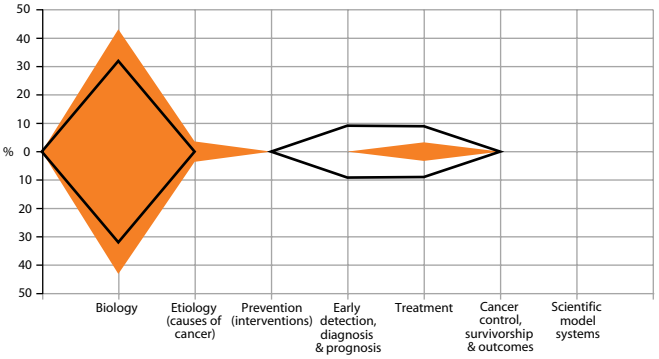
PROCURE [1]



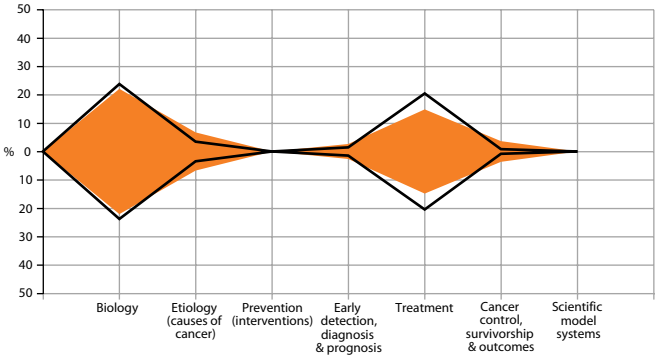
Prostate Cancer Canada



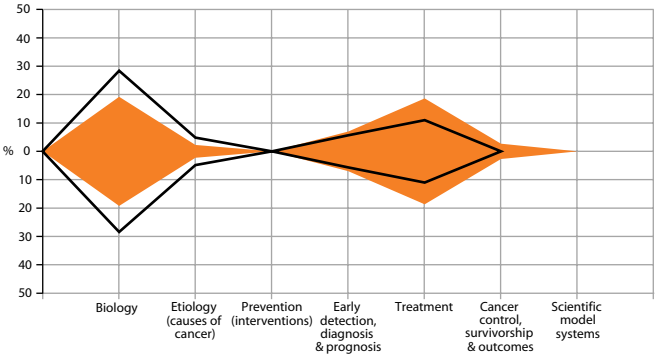
The Kidney Foundation of Canada



The Leukemia & Lymphoma Society of Canada



The Terry Fox Foundation



[1] There was no investment for this organization in 2005.

TABLE 3.2.1

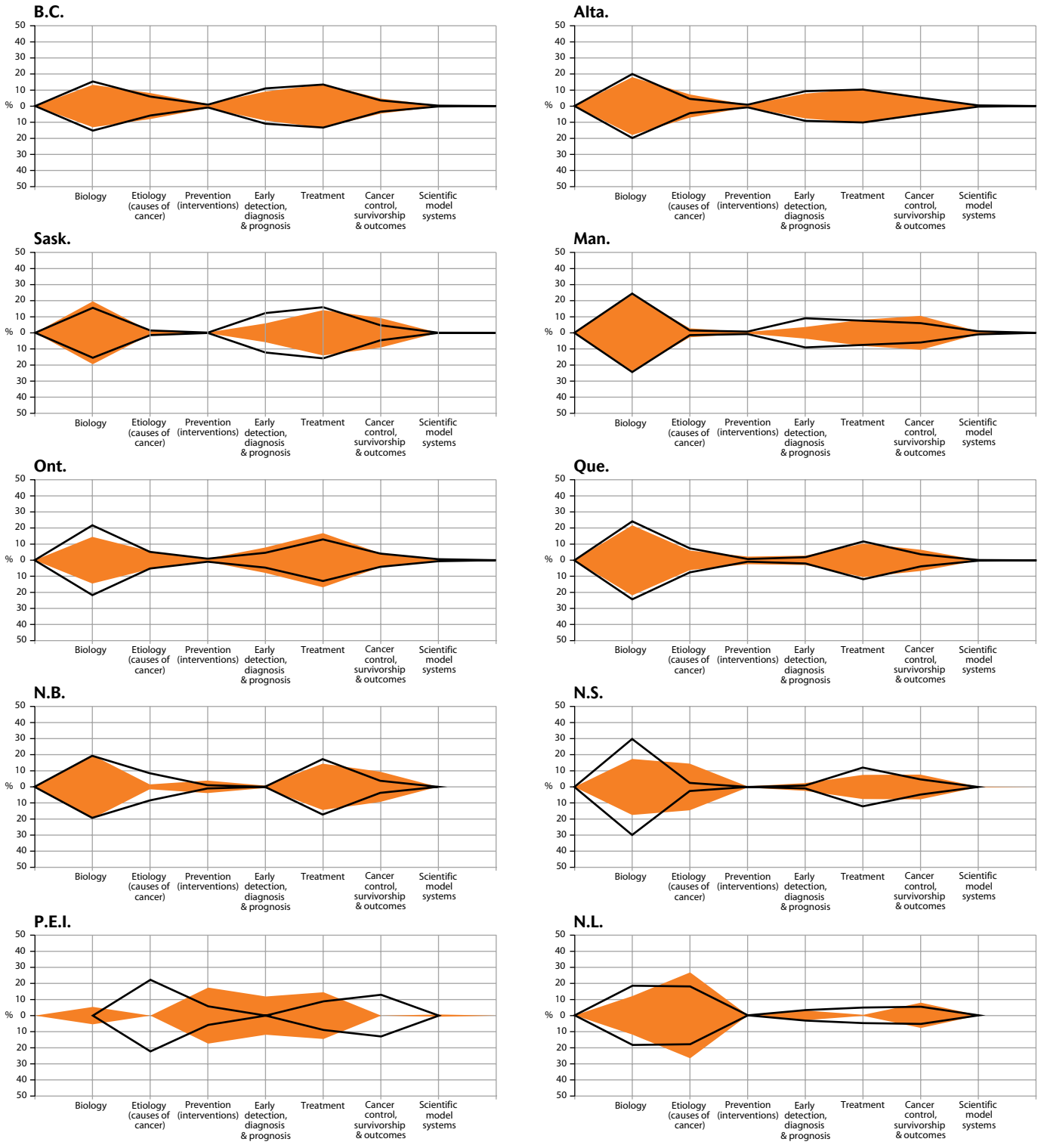
DISTRIBUTION OF 2009 CANCER RESEARCH INVESTMENT BY CSO CODES

CSO Category	CSO Code [1]	2009 Investment ($)	% Total Investment	% Category Investment
1 - BIOLOGY $179,698,405 32.9%	1.1 - Normal functioning	70,607,786	12.9	39.3
	1.2 - Cancer initiation: alterations in chromosomes	12,073,364	2.2	6.7
	1.3 - Cancer initiation: oncogenes and tumour suppressor genes	47,638,189	8.7	26.5
	1.4 - Cancer progression and metastasis	29,796,357	5.5	16.6
	1.5 - Resources and infrastructure	19,582,709	3.6	10.9
2 - ETIOLOGY (CAUSES OF CANCER) $67,621,300 12.4%	2.1 - Exogenous factors [2] in the origin and cause of cancer	19,213,950	3.5	28.4
	2.2 - Endogenous factors [3] in the origin and cause of cancer	22,255,484	4.1	32.9
	2.3 - Interactions of genes and/or genetic polymorphisms [4] with exogenous and/or endogenous factors	4,751,125	0.9	7.0
	2.4 - Resources and infrastructure	21,400,740	3.9	31.6
3 - PREVENTION (INTERVENTIONS) $13,699,765 2.5%	3.1 - Interventions to prevent cancer: personal behaviours that affect cancer risk	4,455,447	0.8	32.5
	3.2 - Nutritional science in cancer prevention	2,063,431	0.4	15.1
	3.3 - Chemoprevention	1,005,608	0.2	7.3
	3.4 - Vaccines	741,061	0.1	5.4
	3.5 - Complementary and alternative prevention approaches	254,364	0.0	1.9
	3.6 - Resources and infrastructure	5,179,853	0.9	37.8
4 - EARLY DETECTION, DIAGNOSIS & PROGNOSIS $72,978,309 13.4%	4.1 - Technology development and/or marker discovery	26,201,701	4.8	35.9
	4.2 - Technology and/or marker evaluation with respect to fundamental parameters of method	15,495,747	2.8	21.2
	4.3 - Technology and/or marker testing in a clinical setting	8,639,012	1.6	11.8
	4.4 - Resources and infrastructure	22,641,850	4.2	31.0
5 - TREATMENT $153,934,083 28.2%	5.1 - Localized therapies [5] – discovery and development	14,217,973	2.6	9.2
	5.2 - Localized therapies – clinical applications	4,254,956	0.8	2.8
	5.3 - Systemic therapies [6] – discovery and development	90,555,281	16.6	58.8
	5.4 - Systemic therapies – clinical applications	6,757,034	1.2	4.4
	5.5 - Combinations of localized and systemic therapies	1,289,943	0.2	0.8
	5.6 - Complementary and alternative treatment approaches	471,928	0.1	0.3
	5.7 - Resources and infrastructure	36,386,969	6.7	23.6
6 - CANCER CONTROL, SURVIVORSHIP & OUTCOMES $55,860,178 10.2%	6.1 - Patient care and survivorship issues	12,708,279	2.3	22.8
	6.2 - Surveillance	3,489,668	0.6	6.2
	6.3 - Behaviour	5,450,866	1.0	9.8
	6.4 - Cost analyses and health care delivery	13,497,530	2.5	24.2
	6.5 - Education and communication	2,659,233	0.5	4.8
	6.6 - End-of-life care	3,013,087	0.6	5.4
	6.7 - Ethics and confidentiality in cancer research	331,340	0.1	0.6
	6.8 - Complementary and alternative approaches for supportive care of patients and survivors	382,883	0.1	0.7
	6.9 - Resources and infrastructure	14,327,293	2.6	25.6
7 - SCIENTIFIC MODEL SYSTEMS $1,693,160 0.3%	7.1 - Development and characterization of model systems [7]	1,552,075	0.3	91.7
	7.2 - Application of model systems	-	0.0	0.0
	7.3 - Resources and infrastructure	141,085	0.0	8.3

[1] For a full description of the CSO codes, please refer to https://www.icrpartnership.org/CSO.cfm.
[2] Exogenous (originating outside) factors: Lifestyle and environmental factors, and infectious agents like viruses and bacteria that are involved in the origins and causes of cancer.
[3] Endogenous (originating within) factors: Internal factors such as free radicals and genetic factors that are involved in the origins and causes of cancer.
[4] Polymorphisms: Mutations or common variations in a person's DNA.
[5] Localized treatments: Treatments that are administered locally (such as radiotherapy and surgery).
[6] Systemic treatments: Treatments that are administered throughout the body (such as drugs).
[7] Model systems: Specially developed animals, cell cultures, and computer simulations that are used to study cancer processes.

FIGURE 3.2.3

DISTRIBUTION OF CANCER RESEARCH INVESTMENT FOR PROVINCE OF NOMINATED PI BY CSO CATEGORY, 2005 AND 2009



	B.C.	Alta.	Sask.	Man.	Ont.	Que.	N.B.	N.S.	P.E.I.	N.L.
Project equivalents 2005	447.4	461.4	75.9	144.5	1,360.0	964.6	5.9	90.2	2.8	19.1
Project equivalents 2009	625.3	583.3	76.4	176.6	1,842.2	1,173.9	14.1	119.5	6.0	23.6

3.3 CANCER SITES

A detailed breakdown of the 2009 investment by cancer site is provided in Table 3.3.1. About half (51.4%) of the investment was not attributable to specific cancers. In terms of the site-specific investment, breast cancer ($74.5M), prostate cancer ($32.3M), and leukemia ($26.0M) had the greatest share of the investment.

Research investment more than doubled from 2005 to 2009 for pancreatic, bladder, gallbladder, esophageal, and lung cancers. However, for colorectal cancer, a common malignancy, there was a small decrease in the investment (-1.2%) over the five years. Data for all five years is provided in Appendix D.

The federal government investment given the size of its investment accounted for the majority of individual site-specific investments (Table 3.3.2). The provincial government (in particular, the Ontario Institute for Cancer Research) accounted for the largest proportion of the pancreatic cancer research investment.

In terms of how the investment relates to indictors of burden of disease (see sidebar for definitions), Figure 3.3.1 shows the proportion of 2009 site-specific cancer research investment relative to the distribution of new cases, cancer deaths, and persons with cancer (based on the ten-year prevalence). The bubble chart (Figure 3.3.2) shows the eight cancers with the highest combined proportions of new cases and deaths in terms of the proportion of the cancer research investment (x-axis), estimated five-year survival ratio (y-axis), and number of new cases (bubble size). For many other cancers, including high incidence cancers such as lung, colorectal, and prostate, the research investment was not commensurate with the burden of disease as measured even though the funding for lung and prostate grew from 2005 to 2009.

Kite diagrams based on the 2005 and 2009 investments are presented for these same eight cancers in Figure 3.3.3. The distributions for leukemia and prostate cancer changed very little while the initiation of the pancreatic cancer genome project in 2009 substantially changed the distribution for pancreatic cancer (with a very large increase in Etiology). Although there was no change in the amount of research investment for colorectal cancer from 2005 to 2009, the distribution of the investment in terms of areas of research changed. In 2009, there was more colorectal cancer research investment in the areas of Biology and Cancer control, survivorship & outcomes and less in Etiology.

BURDEN OF CANCER INDICATORS

Burden of cancer refers to the health burden that cancer places on the population. There are many indicators used to assess health burden. In this report, we are using the following four.

New cancer cases: The number of cases of cancer newly diagnosed during a defined time period and location. This is a count of cancer diagnoses, and not persons with cancer. For example, two new cancer cases would be counted for one man who is diagnosed with cancers of the esophagus and stomach during the same period. In this report, we are using new cancer cases for the year 2007, which is the latest year for which actual data are available. New cancer cases may also be referred to as cancer incidence.

Cancer deaths: The number of deaths attributed to a particular type of cancer during a defined time period and location. In this report, we are using cancer deaths from the year 2007, which is the latest year for which actual data are available. Cancer deaths may also be referred to as cancer mortality.

Cancer prevalence: The number of people still alive who were diagnosed with a particular cancer in a given timeframe. In this report, we are using data on the number of people alive on January 1, 2007 who were diagnosed with cancer in the previous ten years.

Relative survival ratio (RSR): A measure of the proportion of people in a given population dying from cancer in excess to that of the general population with the same characteristics in terms of age, sex, and province. In this report, we are using five-year relative survival, which is a widely used standard for reporting site-specific cancer survival. In site-specific comparisons of RSR, lead time (the time between diagnosis and death) is an important consideration. For example, the over-diagnosis associated with prostate specific antigen (PSA) testing for prostate cancer biases the survival ratio upward so it appears higher than it would be if over-diagnosis did not exist. In addition, widespread mammography screening also adds lead time. The addition of staging data to the cancer registry systems in Canada, work currently underway through the Staging Initiative of the Surveillance Advisory Group of the Canadian Partnership Against Cancer,[1] will provide valuable information to address this bias.

1. For more information, see http://www.partnershipagainstcancer.ca/priorities/surveillance/strategic-initiatives/staging-initiative/

TREND SUMMARY

- Site-specific research in Canada continued to be dominated by a focus on breast cancer research. Proportionately more breast cancer research in 2009 focused on the areas of Early detection, diagnosis & prognosis and Treatment.
- Leukemia research was also a consistent major focus in terms of site-specific investment, reflecting Canada's historic and ongoing strength in the area of hematopoiesis and stem cell research.
- Important funding gains were made for high mortality cancers such as lung and pancreatic cancers over the five-year period, but the investment levels were still disproportionately low relative to the overall burden of these cancers.
- Colorectal cancer research investment remained unchanged in dollar amount from 2005 to 2009, although there was some shift in terms of the areas of research supported.

TABLE 3.3.1

2009 CANCER RESEARCH INVESTMENT BY CANCER SITE AND FUNDING SECTOR

	GOVERNMENT									
	Federal		Provincial		VOLUNTARY		OTHER		TOTAL	
CANCER SITE	$	%	$	%	$	%	$	%	$	%
Bladder	806,738	0.3	558,814	0.4	353,433	0.4	3,994	0.0	1,722,979	0.3
Bone and connective tissue	1,281,391	0.5	681,333	0.4	778,653	0.8	59,360	0.1	2,800,737	0.5
Brain	11,253,527	4.5	3,574,912	2.3	3,849,465	4.0	896,016	2.3	19,573,920	3.6
Breast	29,425,668	11.7	12,874,489	8.1	26,361,636	27.5	5,854,137	14.7	74,515,931	13.7
Cervix	2,984,192	1.2	1,067,192	0.7	1,261,773	1.3	23,175	0.1	5,336,332	1.0
Colorectal	11,163,666	4.4	3,701,272	2.3	3,338,281	3.5	334,435	0.8	18,537,654	3.4
Esophagus	1,277,230	0.5	353,712	0.2	457,580	0.5	66,874	0.2	2,155,396	0.4
Gallbladder	1,630	0.0	-	-	50,170	0.1	-	-	51,800	0.0
Hodgkin's disease	331,358	0.1	201,019	0.1	338,823	0.4	-	-	871,200	0.2
Kidney	1,631,764	0.6	511,439	0.3	1,137,299	1.2	363,045	0.9	3,643,548	0.7
Larynx	682,218	0.3	184,286	0.1	177,327	0.2	11,639	0.0	1,055,471	0.2
Leukemia	13,842,569	5.5	4,485,052	2.8	6,441,641	6.7	1,185,700	3.0	25,954,963	4.8
Liver	2,104,403	0.8	542,778	0.3	880,427	0.9	167,059	0.4	3,694,666	0.7
Lung	8,977,247	3.6	4,630,694	2.9	5,325,009	5.6	2,321,357	5.8	21,254,307	3.9
Multiple myeloma	1,212,449	0.5	1,037,509	0.7	1,162,075	1.2	1,640	0.0	3,413,673	0.6
Non-Hodgkin's lymphoma	4,496,157	1.8	2,085,733	1.3	3,887,489	4.1	391,428	1.0	10,860,808	2.0
Oral	2,545,656	1.0	1,659,609	1.0	1,256,705	1.3	48,839	0.1	5,510,810	1.0
Ovary	4,494,904	1.8	1,470,903	0.9	1,882,460	2.0	35,168	0.1	7,883,435	1.4
Pancreas	1,982,543	0.8	3,887,275	2.5	645,949	0.7	609,797	1.5	7,125,564	1.3
Prostate	13,449,209	5.3	7,608,926	4.8	8,734,079	9.1	2,490,236	6.3	32,282,451	5.9
Skin (Melanoma)	1,977,796	0.8	898,656	0.6	1,473,551	1.5	78,873	0.2	4,428,876	0.8
Stomach	403,116	0.2	167,526	0.1	419,709	0.4	29,726	0.1	1,020,078	0.2
Thyroid	367,788	0.1	39,775	0.0	107,413	0.1	7,500	0.0	522,476	0.1
Uterus	713,804	0.3	375,148	0.2	490,508	0.5	89,278	0.2	1,668,738	0.3
Other sites	5,351,688	2.1	1,832,917	1.2	1,709,336	1.8	570,527	1.4	9,464,468	1.7
Non-specific/All sites	128,709,322	51.2	104,093,732	65.7	23,201,893	24.2	24,129,975	60.7	280,134,922	51.4
TOTAL	**251,468,033**	**100**	**158,524,704**	**100**	**95,722,684**	**100**	**39,769,780**	**100**	**545,485,200**	**100**

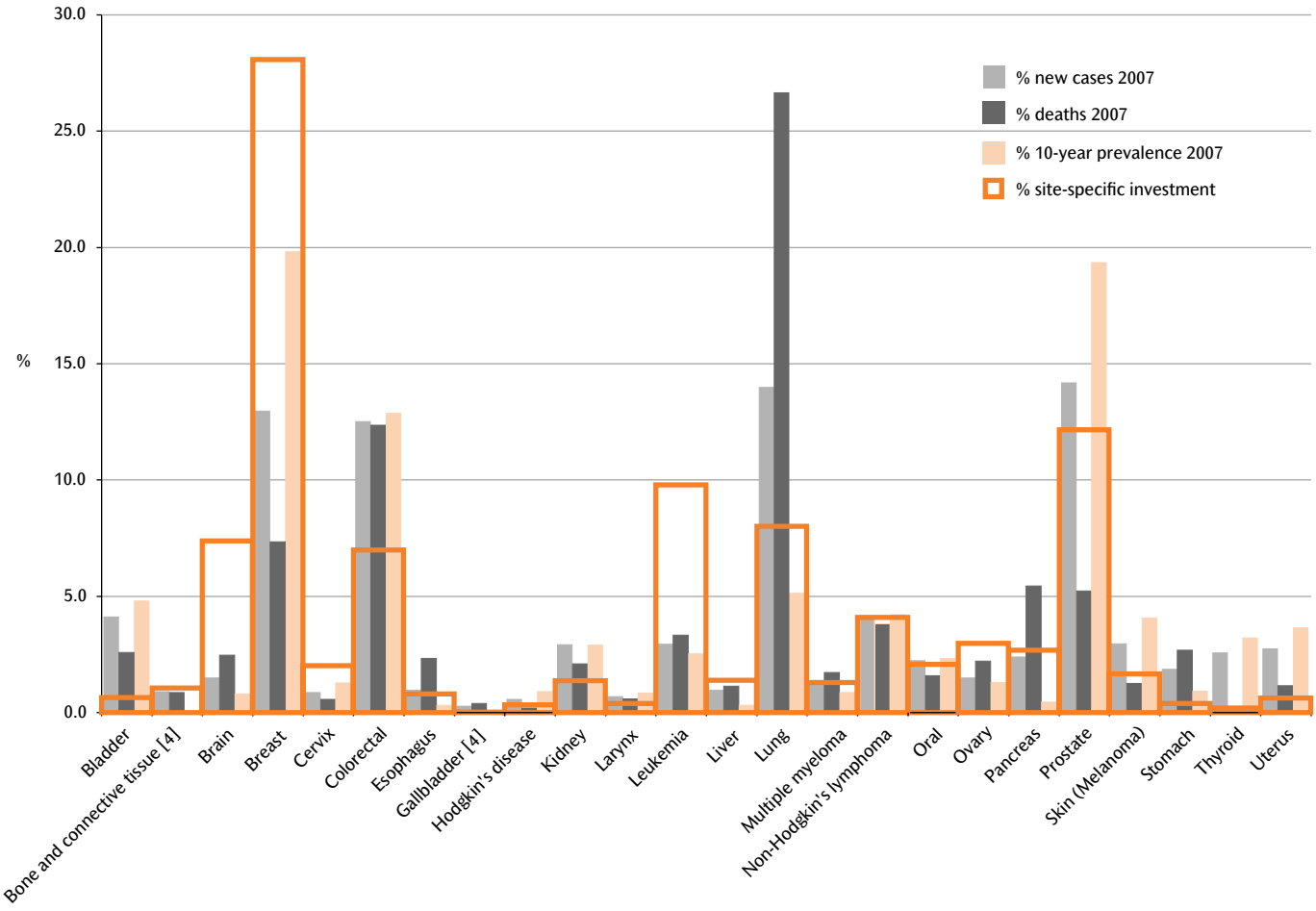
TABLE 3.3.2

DISTRIBUTION OF 2009 CANCER RESEARCH INVESTMENT BY FUNDING SECTOR FOR EACH CANCER SITE

			%				
			GOVERNMENT				
CANCER SITE	$	Project equivalents	Federal	Provincial	VOLUNTARY	OTHER	TOTAL
Bladder	1,722,979	25.7	46.8	32.4	20.5	0.2	100
Bone and connective tissue	2,800,737	40.3	45.8	24.3	27.8	2.1	100
Brain	19,573,920	168.3	57.5	18.3	19.7	4.6	100
Breast	74,515,931	922.8	39.5	17.3	35.4	7.9	100
Cervix	5,336,332	60.2	55.9	20.0	23.6	0.4	100
Colorectal	18,537,654	221.6	60.2	20.0	18.0	1.8	100
Esophagus	2,155,396	39.3	59.3	16.4	21.2	3.1	100
Gallbladder	51,800	1.7	3.1	0.0	96.9	0.0	100
Hodgkin's disease	871,200	12.6	38.0	23.1	38.9	0.0	100
Kidney	3,643,548	48.2	44.8	14.0	31.2	10.0	100
Larynx	1,055,471	15.8	64.6	17.5	16.8	1.1	100
Leukemia	25,954,963	318.5	53.3	17.3	24.8	4.6	100
Liver	3,694,666	48.5	57.0	14.7	23.8	4.5	100
Lung	21,254,307	218.9	42.2	21.8	25.1	10.9	100
Multiple myeloma	3,413,673	39.2	35.5	30.4	34.0	0.0	100
Non-Hodgkin's lymphoma	10,860,808	122.1	41.4	19.2	35.8	3.6	100
Oral	5,510,810	78.1	46.2	30.1	22.8	0.9	100
Ovary	7,883,435	113.1	57.0	18.7	23.9	0.4	100
Pancreas	7,125,564	28.8	27.8	54.6	9.1	8.6	100
Prostate	32,282,451	259.0	41.7	23.6	27.1	7.7	100
Skin (Melanoma)	4,428,876	66.5	44.7	20.3	33.3	1.8	100
Stomach	1,020,078	17.0	39.5	16.4	41.1	2.9	100
Thyroid	522,476	10.9	70.4	7.6	20.6	1.4	100
Uterus	1,668,738	24.4	42.8	22.5	29.4	5.4	100

FIGURE 3.3.1

DISTRIBUTION OF 2009 SITE-SPECIFIC CANCER RESEARCH INVESTMENT ($265.4M) BY NEW CANCER CASES IN 2007 [1], CANCER DEATHS IN 2007 [2], AND 10-YEAR PREVALENCE [3]



[1] Source for new cancer cases: CANSIM Table 103-0550 New cases for ICD-O-3 primary sites of cancer (based on the July 2010 CCR tabulation file), by age group and sex, Canada, provinces and territories, annual. Canadian Cancer Registry - 3207.

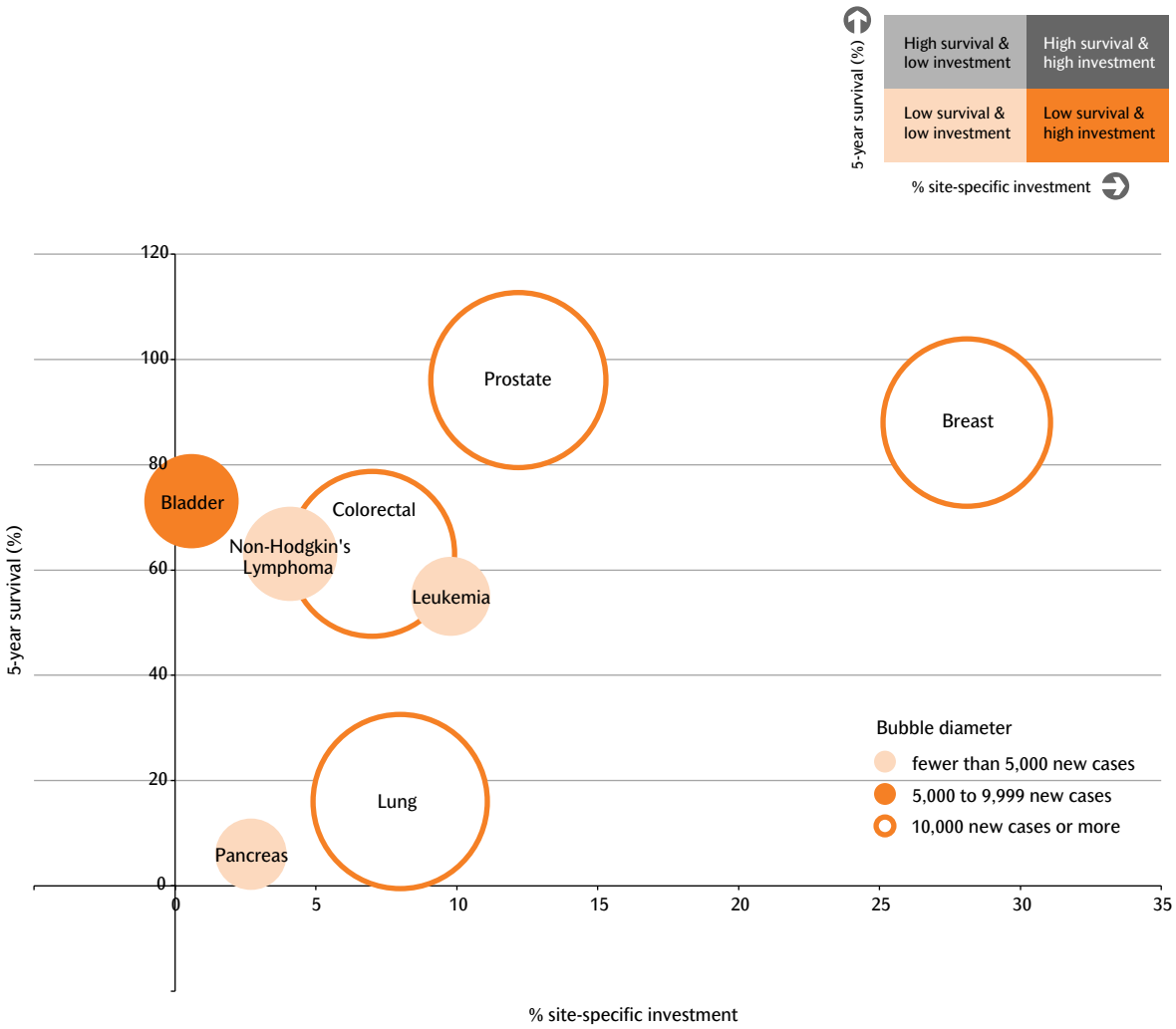
[2] Source for cancer deaths: CANSIM Table 102-0522 Deaths, by causes, Chapter II: Neoplasms (C00 to D48), age group and sex, Canada, annual (number). Vital Statistics - Death Database - 3223.

[3] Represents site-specific prevalence for patients diagnosed with cancer since 1997 who were alive on January 1, 2007. Data are available from Canadian Cancer Society's Steering Committee on Cancer Statistics, *Canadian Cancer Statistics, 2011*, May 2011. Toronto: Canadian Cancer Society.

[4] Prevalence data were not available for gallbladder and bone and connective tissue cancers.

FIGURE 3.3.2

DISTRIBUTION OF 2009 CANCER RESEARCH INVESTMENT FOR SELECTED CANCER SITES [1] BY FIVE-YEAR ESTIMATED SURVIVAL RATIO [2] AND NUMBER OF NEW CASES IN 2007 [3]



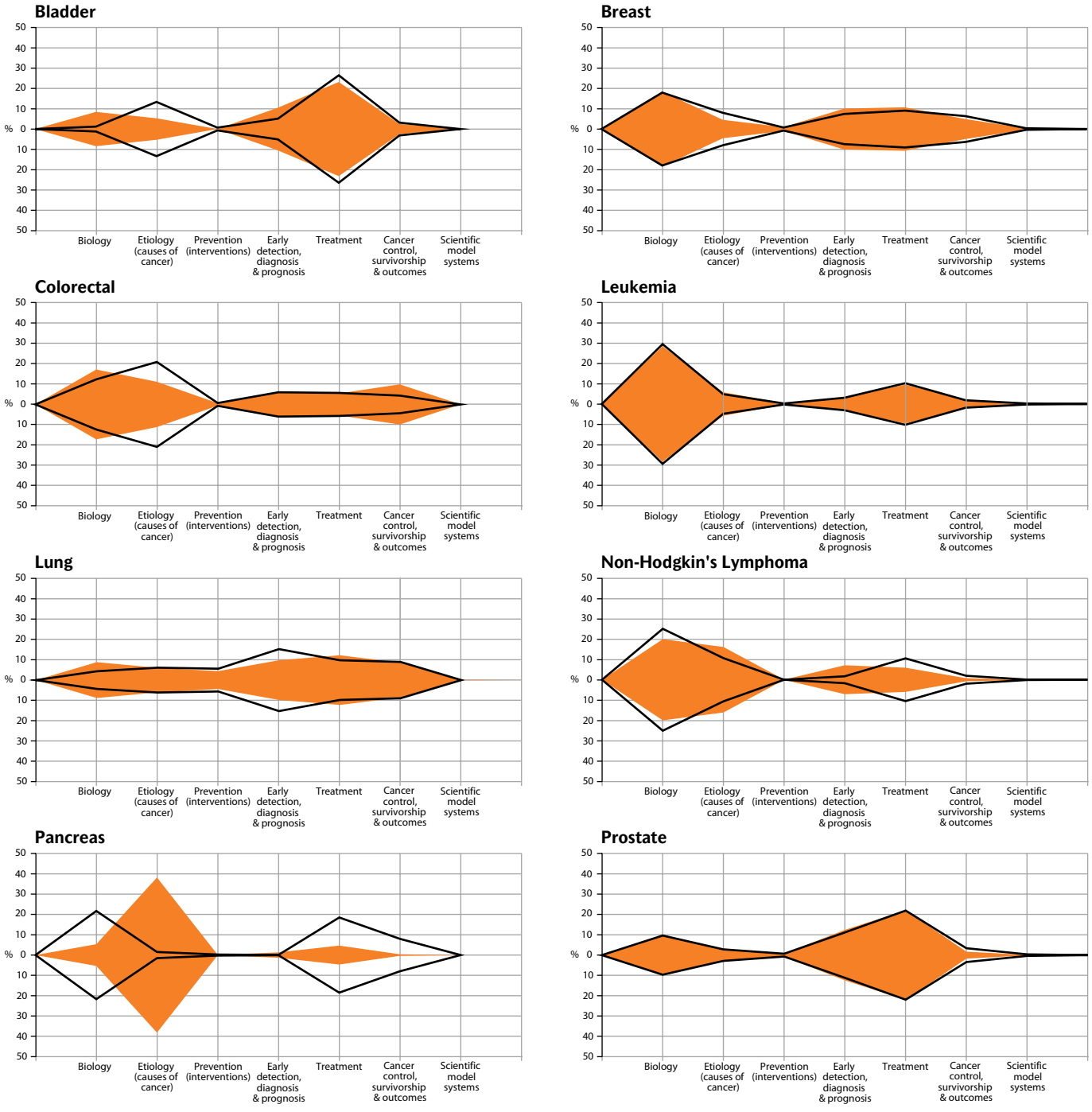
[1] Represents cancers with the highest combined proportions of new cases and deaths.

[2] Predicted five-year relative survival ratios by the population aged 15 to 99 at diagnosis, Canada excluding Quebec, 2004 to 2006. See: Ellison, LF & Wilkins, K. (2010). An update on cancer survival. *Health Reports*, 21(3), 55-60. Statistics Canada, Catalogue no 82-003-XPE.

[3] CANSIM Table 103-0550 New cases for ICD-O-3 primary sites of cancer (based on the July 2010 CCR tabulation file), by age group and sex, Canada, provinces and territories, annual. Canadian Cancer Registry - 3207.

FIGURE 3.3.3

DISTRIBUTION OF CANCER RESEARCH INVESTMENT FOR SELECTED CANCER SITES [1] BY CSO CATEGORIES, 2005 AND 2009



[1] Represents cancers with the highest combined proportions of new cases and deaths.

	Bladder	Breast	Colorectal	Leukemia	Lung	Non-Hodgkin's lymphoma	Pancreas	Prostate
2005 cancer research investment ($M)	0.7	45.8	18.8	23.4	9.9	8.4	1.5	21.0
2009 cancer research investment ($M)	1.7	74.5	18.5	26.0	21.3	10.9	7.1	32.3
Percent change from 2005 to 2009	151.2	62.6	-1.2	11.1	114.7	29.2	362.3	53.5

3.4 FUNDING MECHANISMS

This section describes the cancer research investment in terms of funding mechanisms (see Figure 3.4.1). The reader is reminded that the database contains projects that were funded on the basis of peer reviewed processes. Thus, it likely captures much of the operating funding received by PIs, but only a portion of career, equipment/infrastructure, trainee and institutional support in Canada, which may come from other sources (e.g., universities, hospital foundations, etc.).[7]

Figure 3.4.2A shows the total 2009 investment by funding sector in dollars. Half of the overall investment (50.9%, $277.8M) was for operating grants/direct research support. The federal government sector investment was the largest regardless of funding mechanism and represented most of the investment in operating grants, careers awards, trainee awards, and related support. Table 3.4.1 further elaborates the federal government investment for 2009 and includes an estimate of indirect costs.

Distribution of the 2009 investment by funding mechanism is shown in Figure 3.4.2B. Investment by the voluntary and federal government sectors was primarily for operating grants (79.9% and 58.4%, respectively). A large proportion (63.1%) of the provincial government investment was for equipment/infrastructure grants.

The 2009 investment distribution by funding mechanisms for each province is provided in Figure 3.4.2C. Operating grants comprised a minimum of 47% of all investments, regardless of province. However, the proportion of investment in career awards, trainee awards, and equipment/infrastructure grants varied among provinces. Of note, one in five of the cancer research investment dollars provided to New Brunswick investigators in 2009 was for trainee awards.

The research investment by funding mechanism for all five years is shown in Figures 3.4.3A (in dollars) and 3.4.3B (percent). Differences in the distributions of the investments by funding mechanism for the five years were negligible.

Figure 3.4.4 shows the details of the investment by funding sector for each funding mechanism for all five years. The dramatic increase in equipment infrastructure grants in 2009 by the provincial government was largely the result of the initiation of the pancreatic cancer genome project. Research-related support remained a small component of the overall funding mechanism mix, accounting for $1.2M in 2009. The dramatic increase in 2009 was largely due to more funding for cancer-related meetings, workshops, and letters of intent by CIHR.

7. We do not know the amount of cancer research funding provided by universities and foundations overall or the breakdown by type of funding.

Individual kite diagrams for each funding mechanism are provided in Figure 3.4.5. The kite diagrams for the operating grants and trainee awards were quite similar. For career awards, the highest proportion of investment was in Biology (48.6%), although this was down from 54.0% in 2005. For equipment/infrastructure grants, there was a shift in the distribution from Biology to all other categories, with Etiology having the highest percent change. Over a third (36.9%) of the investment in equipment/infrastructure grants was in Treatment in 2009. The CSO distribution for related support grants was quite different from the other funding mechanisms, with 38.8% of the investment in Cancer Control, Survivorship & Outcomes in 2009. However, the distribution shifted markedly from 2005 with proportionately higher investment in 2009 in Treatment and lower investment in Etiology and Prevention. The remainder of this chapter provides more details about the changes in the cancer research investment over the five-year period in terms of the specific funding mechanisms.

FIGURE 3.4.1

FUNDING MECHANISMS FOR CANCER RESEARCH

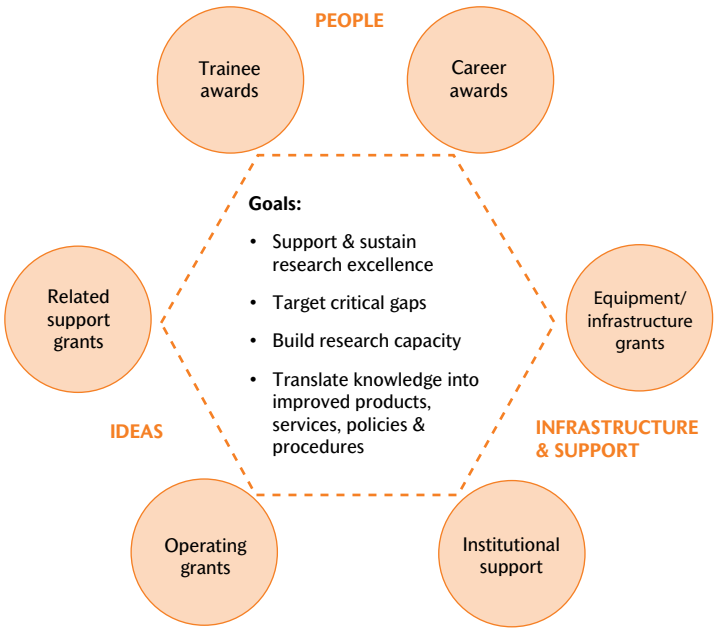


FIGURE 3.4.2A

2009 CANCER RESEARCH INVESTMENT BY FUNDING MECHANISM FOR EACH FUNDING SECTOR ($545.5M)

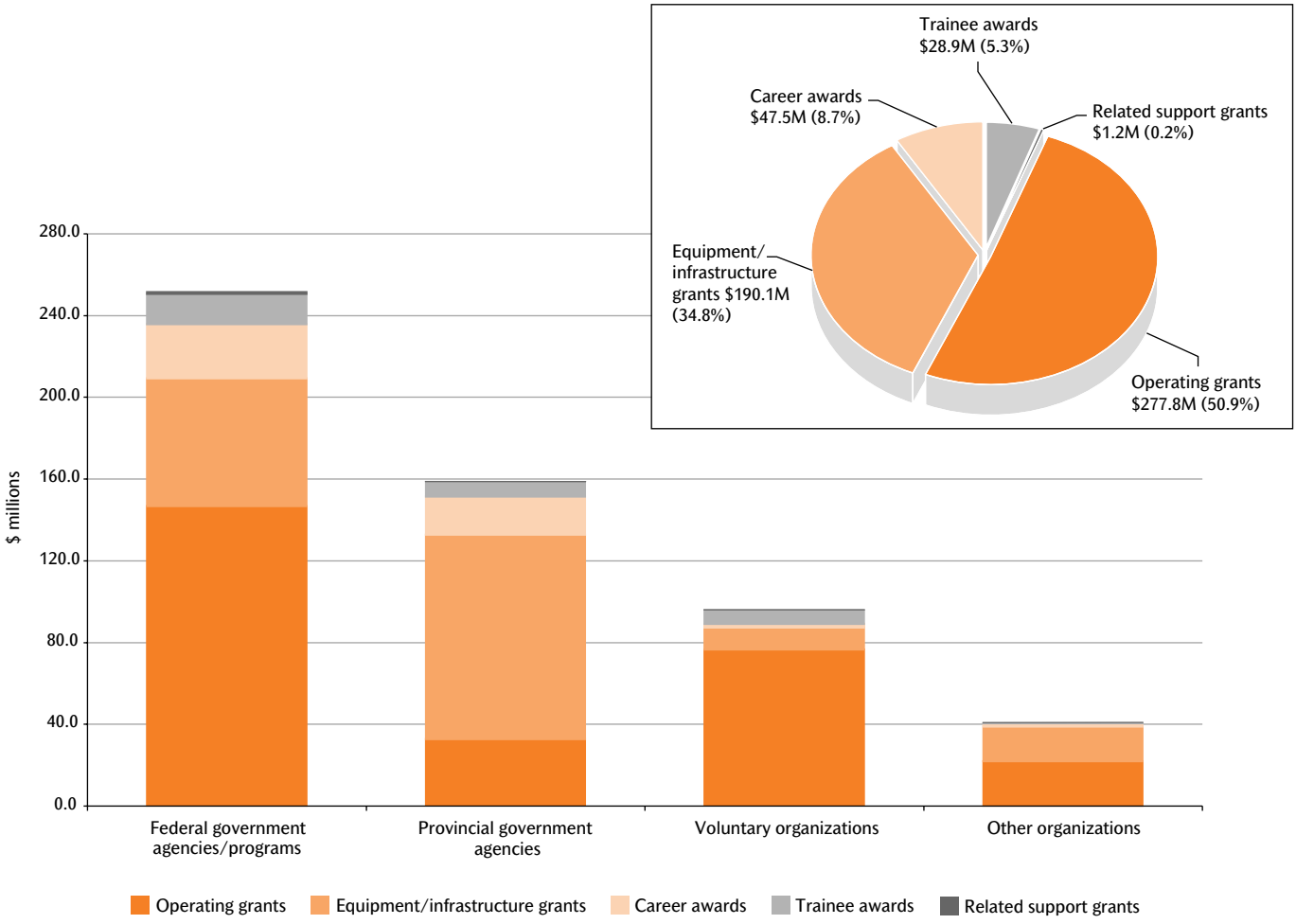


FIGURE 3.4.2B

DISTRIBUTION OF 2009 CANCER RESEARCH INVESTMENT BY FUNDING MECHANISM FOR EACH FUNDING SECTOR

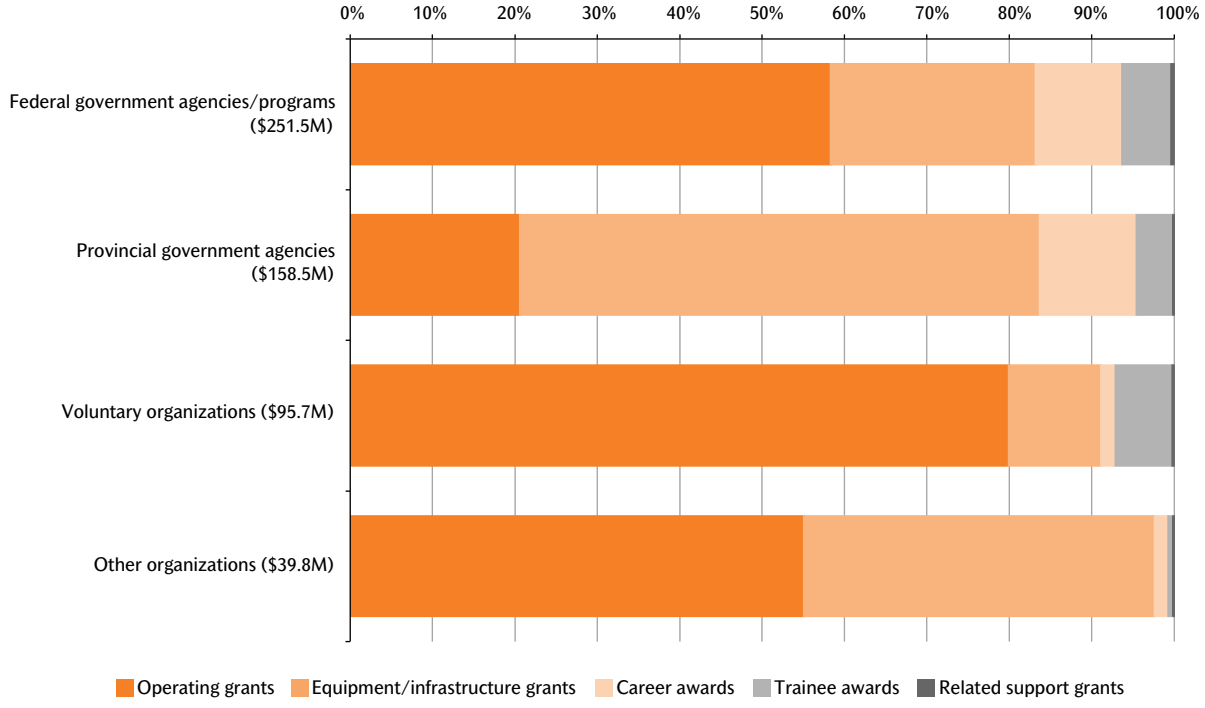
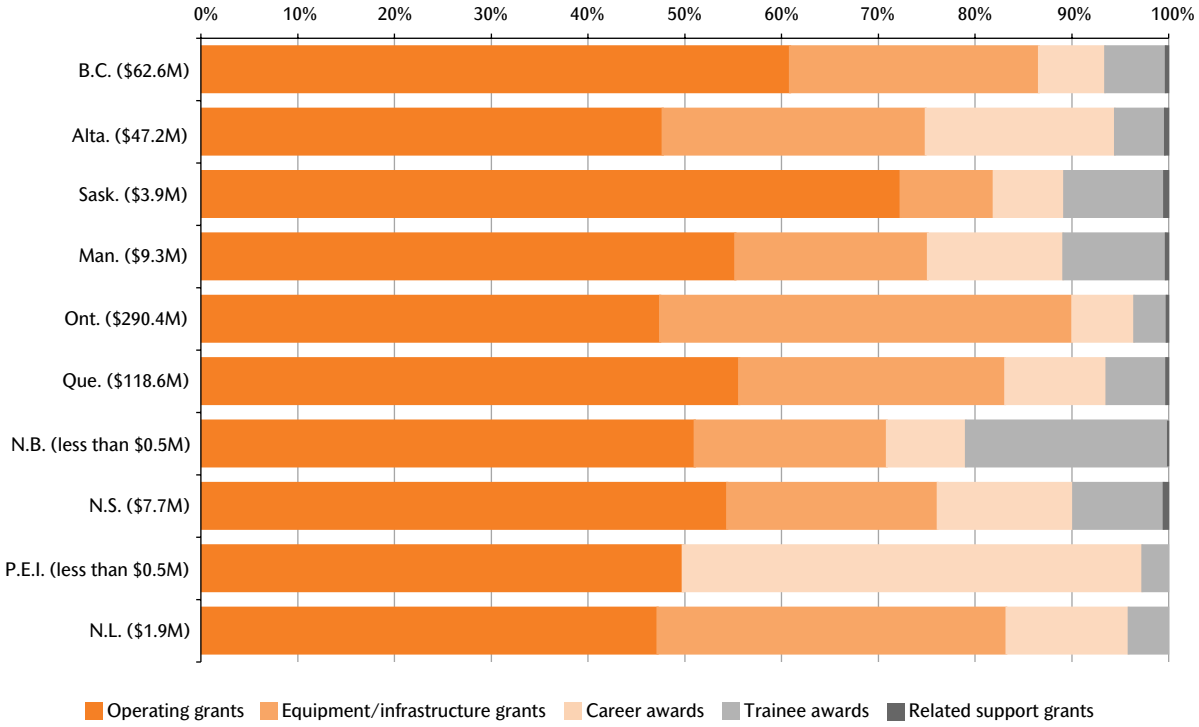


FIGURE 3.4.2C

DISTRIBUTION OF 2009 CANCER RESEARCH INVESTMENT BY PROVINCE OF NOMINATED PI AND FUNDING MECHANISM ($542.2M) [1]



[1] Excludes trainee awardees studying outside Canada and an operating grant to a PI located in the territories.

TABLE 3.4.1

2009 FEDERAL GOVERNMENT CANCER RESEARCH INVESTMENT BY FUNDING MECHANISM

	FUNDING MECHANISM						
PROGRAM/ ORGANIZATION	Operating grants	Equipment/ infrastructure grants	Institutional support (indirect costs)	Career awards	Trainee awards [1]	Related support grants	TOTAL
Canada Foundation for Innovation [2]	297,357	49,610,932	–	–	–	–	49,908,288
Canada Research Chairs Program	–	–	–	21,474,250	–	–	21,474,250
Canadian Institutes of Health Research	112,016,916	2,442,226	–	4,877,564	12,000,381	698,503	132,035,591
Canadian Partnership Against Cancer [3]	2,163,407	9,718,756	–	–	–	–	11,882,163
Genome Canada	8,278,435	–	–	–	–	–	8,278,435
Health Canada/Public Health Agency of Canada	2,899,244	–	–	139,425	–	9,072	3,047,741
Indirect Costs Program	–	–	20,686,598	–	–	–	20,686,598
National Research Council	8,778,225	–	–	–	–	142,322	8,920,547
Natural Sciences and Engineering Research Council	9,829,664	655,096	–	–	2,332,903	0	12,817,664
Networks of Centres of Excellence [4]	493,129	–	–	–	67,725	–	560,854
Social Sciences and Humanities Research Council	1,976,127	0	–	–	544,547	21,825	2,542,500
TOTAL	**146,732,504**	**62,427,010**	**20,686,598**	**26,491,240**	**14,945,557**	**871,722**	**272,154,631**

This table includes an estimate of the cancer component of the Indirect Costs Program. Unlike other tables in this report, the investment figures shown do not include partner dollars, but do include investment in other cancer funder programs not administered by federal agencies such as the multi-funded initiatives. Cells with a hyphen indicate that there were no funding mechanisms of that type offered by the federal program/organization. This is distinguished from $0 values, which indicate that funding programs within that mechanism were offered by the organization, but there were no cancer relevant projects funded in 2009.

[1] Includes Canada Graduate Scholarships totalling $6,380,556 (CIHR $5,323,237; NSERC $739,914; SSHRC $317,405).

[2] Operating grant contribution from CFI is for two Genome Canada projects.

[3] Includes $9,718,756 (equipment/infrastructure) for the Canadian Partnership for Tomorrow Project and $2,163,407 (operating grants) for the TFRI Translational Cancer Research Pilot Project.

[4] Does not include federal contributions to the management and related activities of the networks. Investment in the Centres of Excellence for Commercialization and Research (CECR) is reflected under the federal funding agencies as follows: CIHR $6,325,492; NSERC $2,052,990; and SSHRC $1,701,042 (total for 2009 is $10,079,524).

FIGURE 3.4.3A

CANCER RESEARCH INVESTMENT BY FUNDING MECHANISM, 2005 TO 2009

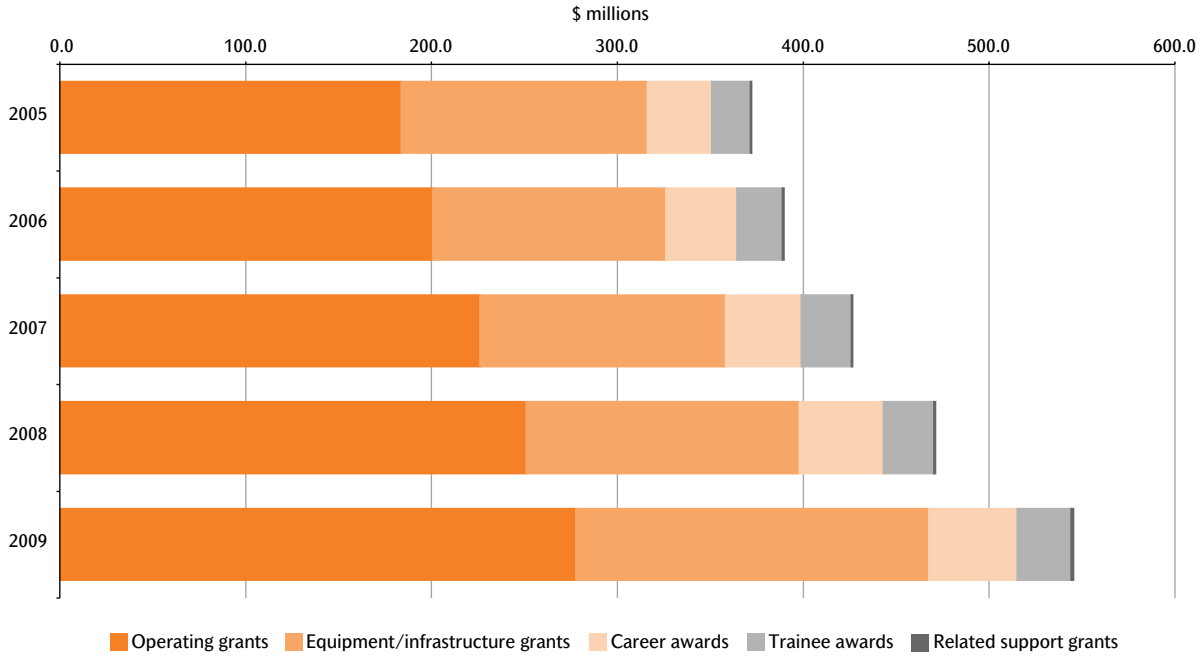


FIGURE 3.4.3B

DISTRIBUTION OF CANCER RESEARCH INVESTMENT BY FUNDING MECHANISM, 2005 TO 2009

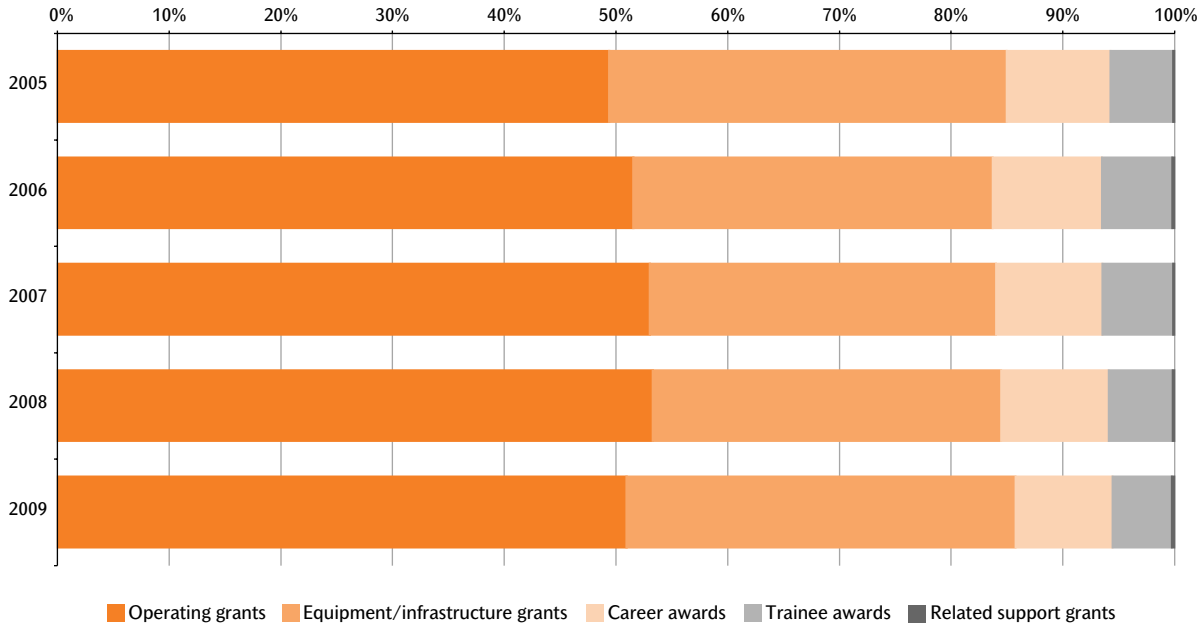


FIGURE 3.4.4

CANCER RESEARCH INVESTMENT BY FUNDING SECTOR FOR EACH FUNDING MECHANISM, 2005 TO 2009

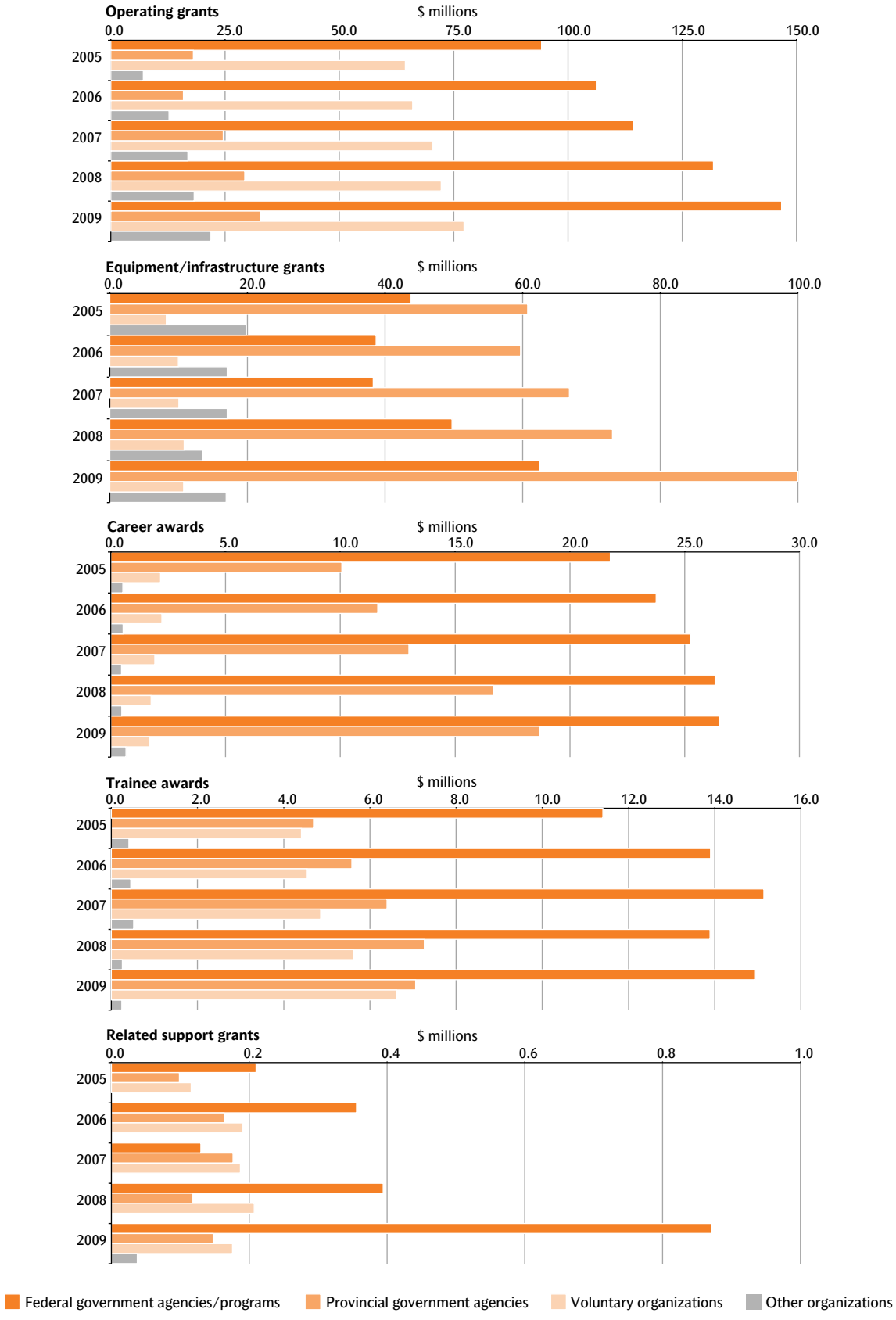
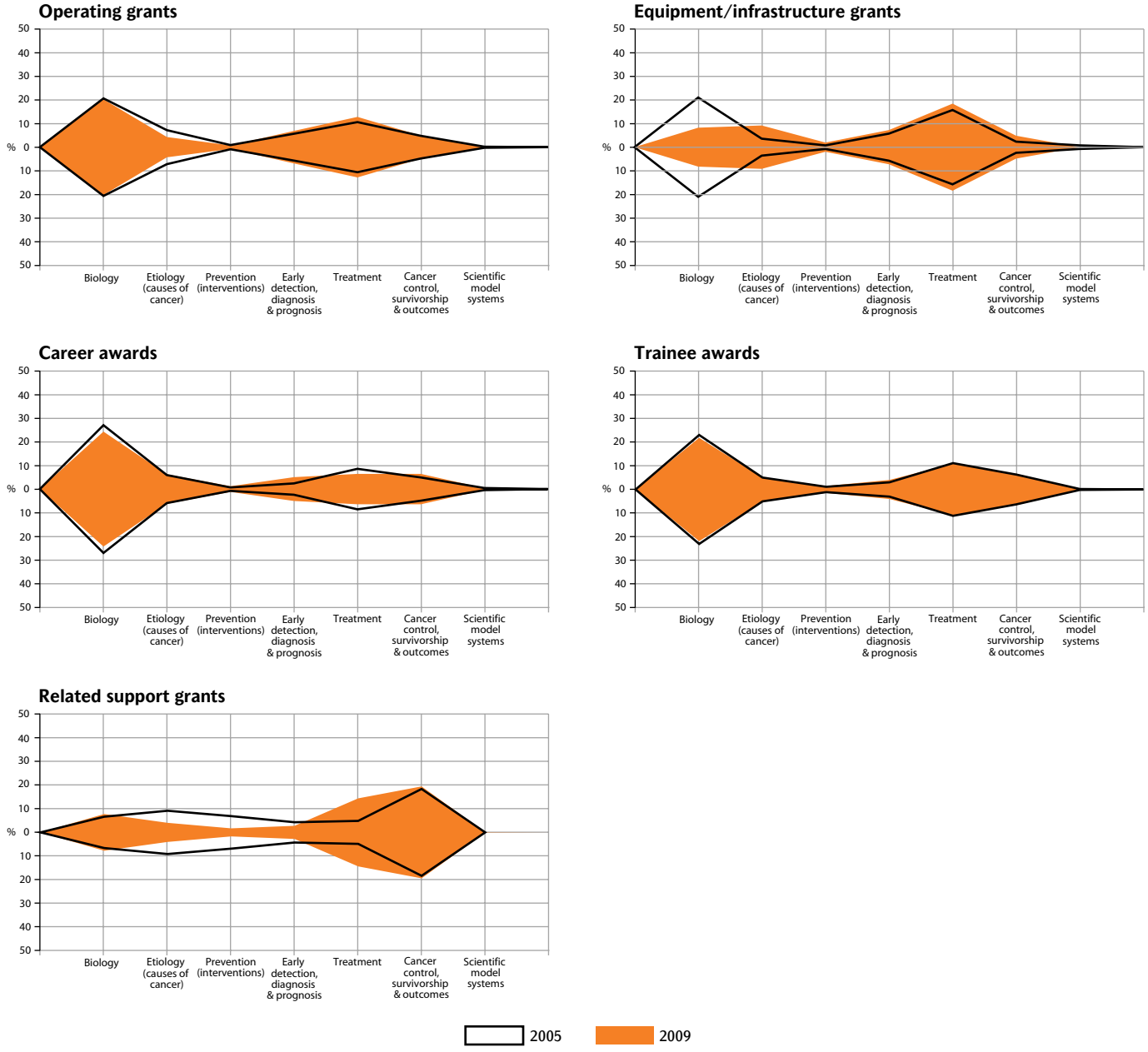


FIGURE 3.4.5

DISTRIBUTION OF CANCER RESEARCH INVESTMENT BY CSO CATEGORY FOR EACH FUNDING MECHANISM, 2005 AND 2009



	Operating grants	Equipment/ infrastructure grants	Career awards	Trainee awards	Related support grants
2005 cancer research investment ($M)	183.3	132.5	34.5	20.9	0.4
2009 cancer research investment ($M)	277.8	190.0	47.5	28.9	1.2
Percent change from 2005 to 2009	51.1	43.4	37.7	38.1	190.3

Operating Grants

Operating grants, or direct support for research, may require applicants to focus on specific areas of research and/or cancer sites, or may be researcher-directed/open. Overall, 62.6% of the 2009 operating grant investment was for researcher-directed operating grants that were not site-specific (Figure 3.4.6A). Site-specific operating grants programs were primarily the domain of the voluntary sector.

In Figure 3.4.6B, these data are stratified further by funding program reach. Operating grants offered by regional funding programs increased by 175.5% from 2005 to 2009 compared to 36.2% for national funding programs. There was a four-fold increase in the researcher-directed/open operating grants among regional funding programs. Researcher-directed/open operating grants offered by regional funding programs represented 2.7% of the total investment in operating grants in 2005 and 9.9% in 2009.

In terms of the CSO, there were substantial increases in the research investment from 2005 to 2009 in the areas of Early diagnosis, detection & prognosis and Treatment (Figure 3.4.6C). A near-tripling of the investment in Early diagnosis, detection & prognosis occurred among non-focused operating grants. Among focused operating grants, there was a doubling of the investment in the Biology and Cancer control, survivorship & outcomes categories.

Figure 3.4.6D provides kite diagrams of the CSO distributions for the 2005 and 2009 investments by non-focused/open operating grants and focused operating grants. Non-focused open operating grants changed very little. Most notably, the proportion of focused operating grants contracted for Etiology from 19.7% in 2005 to 8.9% in 2009.

FIGURE 3.4.6A

2009 CANCER RESEARCH INVESTMENT IN OPERATING GRANTS BY FOCUS FOR EACH FUNDING SECTOR ($277.8M)

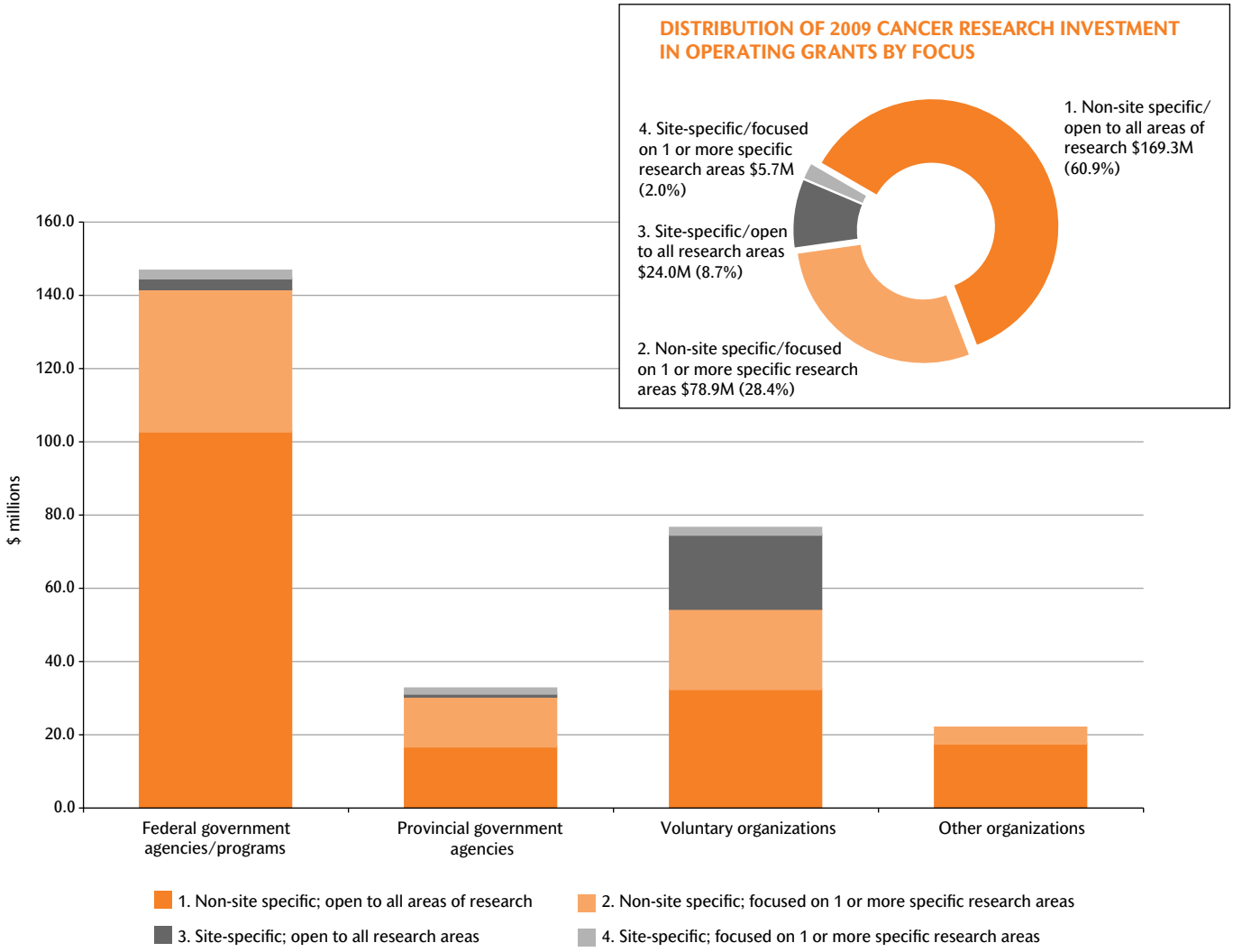
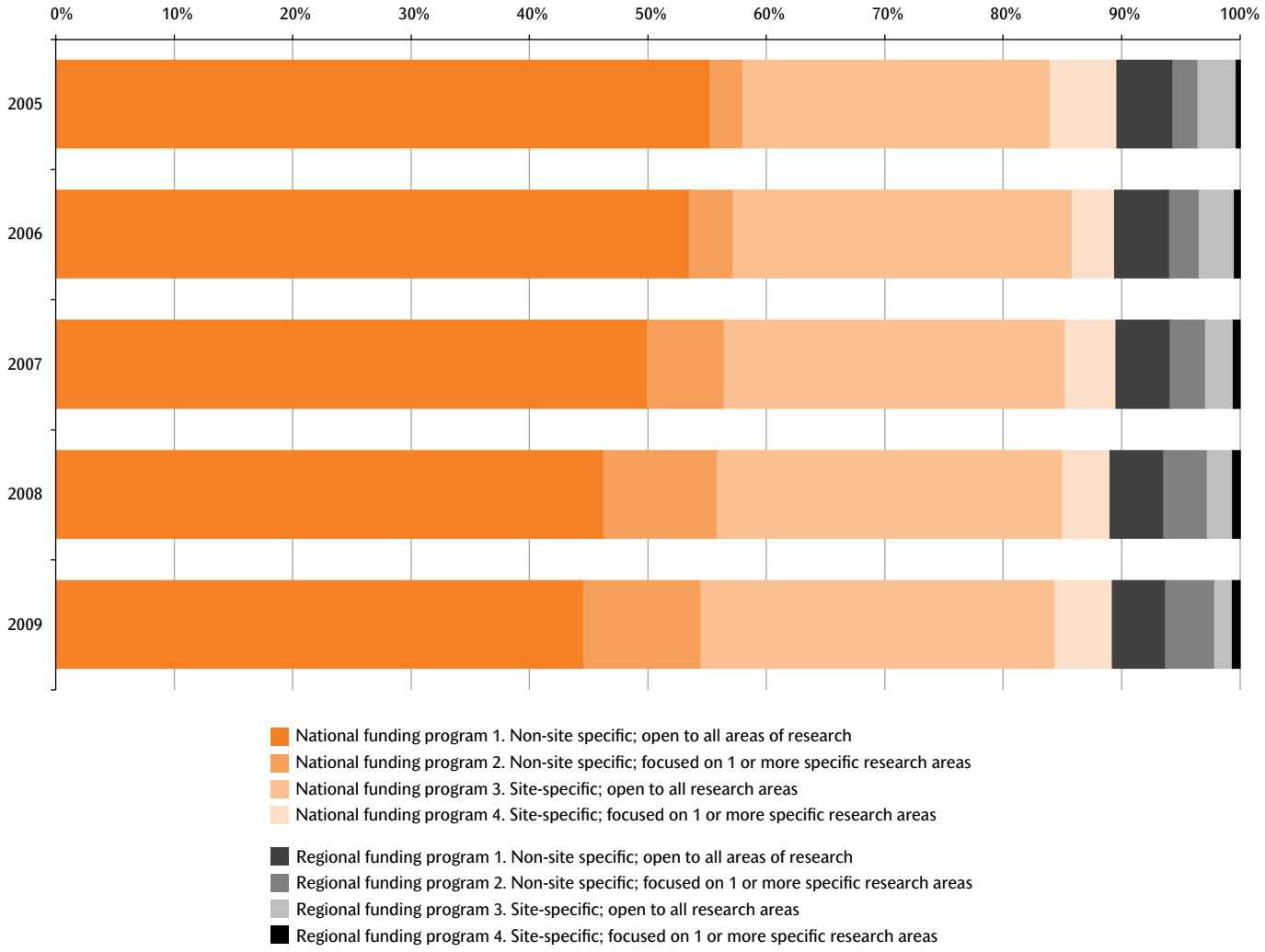


FIGURE 3.4.6B

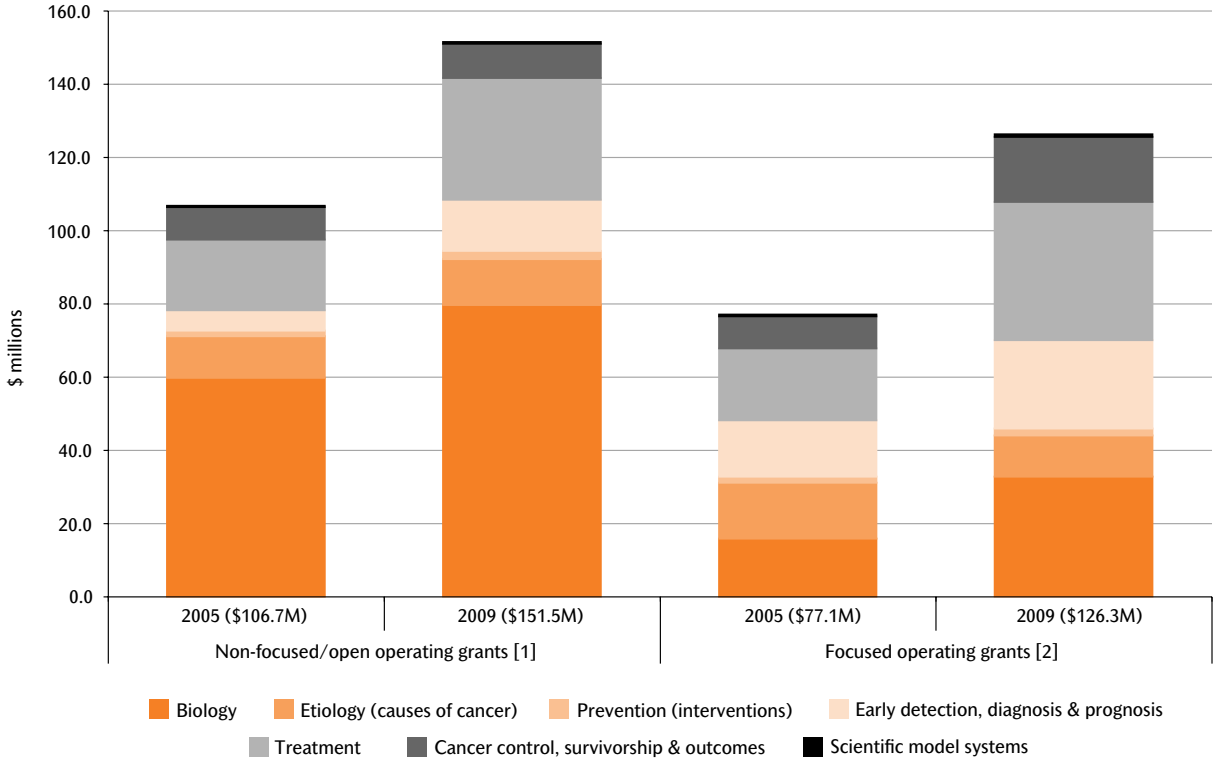
DISTRIBUTION OF CANCER RESEARCH INVESTMENT IN OPERATING GRANTS BY PROGRAM REACH AND FOCUS, 2005 TO 2009



		1. Non-site specific; open to all areas of research	2. Non-site specific; focused on 1 or more specific research areas	3. Site-specific; open to all research areas	4. Site-specific; focused on 1 or more specific research areas
National funding program	2005 cancer research investment ($M)	101.7	47.8	8.7	6.0
	2009 cancer research investment ($M)	124.0	83.1	12.4	4.2
	Percent change from 2005 to 2009	21.9	73.9	43.2	-30.9
Regional funding program	2005 cancer research investment ($M)	5.0	10.3	3.9	0.4
	2009 cancer research investment ($M)	27.5	13.5	11.6	1.6
	Percent change from 2005 to 2009	447.7	30.7	197.9	276.7
All operating grants	2005 cancer research investment ($M)	106.7	58.1	12.6	6.4
	2009 cancer research investment ($M)	151.5	96.6	24.0	5.7
	Percent change from 2005 to 2009	42.0	66.2	91.0	-11.1

FIGURE 3.4.6C

CANCER RESEARCH INVESTMENT IN OPERATING GRANTS BY FOCUS AND CSO CATEGORY, 2005 AND 2009

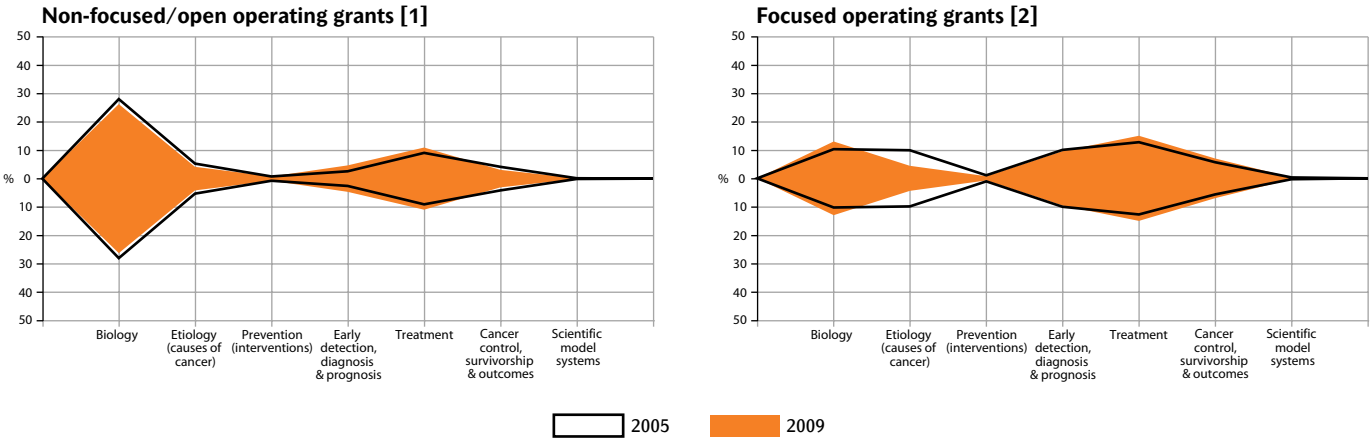


		Biology	Etiology (causes of cancer)	Prevention (interventions)	Early detection, diagnosis & prognosis	Treatment	Cancer control, survivorship & outcomes	Scientific model systems	TOTAL
Percent change from 2005 to 2009	Non-focused/ open operating grants [1]	33.1	11.0	45.0	154.6	71.2	6.0	49.1	42.0
	Focused operating grants [2]	106.5	-26.4	15.8	56.5	92.6	101.5	49.2	63.8
	All operating grants	48.5	-10.5	29.9	82.3	82.0	53.5	49.2	51.1

[1] Includes group 1 - Non-site specific; open to all areas of research, both national and regional funding programs.
[2] Includes all other types of operating grants.

FIGURE 3.4.6D

DISTRIBUTION OF CANCER RESEARCH INVESTMENT IN OPERATING GRANTS BY FOCUS AND CSO CATEGORY, 2005 AND 2009



[1] Includes group 1 - Non-site specific; open to all areas of research, both national and regional funding programs.

[2] Includes all other types of operating grants.

Career Awards

A breakdown in terms of types of career/salary awards is provided in Table 3.4.2A. On December 31, 2009, there were 246 Canada Research Chairs (CRC), 112 Tier 1 and 134 Tier 2, engaged in research of which at least some portion was cancer-related. CIHR was the granting agency for 80.1% of these chairs. Over seventy percent (73.2%) of the chairs were working at institutions in Ontario (106 chairs) and Quebec (74 chairs).

Although the Canada Chairs Program represented 45% of the investment in career awards in 2009, provincial cancer agencies (i.e., Cancer Care Ontario and Alberta Cancer) and charitable organizations, (specifically, the Canadian Breast Cancer Foundation, Canadian Cancer Society, and the Cancer Research Society) substantially increased their support of research chairs from 2005 to 2009. Table 3.4.2B shows a tripling of the investment from 2005 to 2009 for chair awards supported by non-federal government sources. CIHR, Fonds de recherche du Québec – Santé, Michael Smith Foundation for Health Research, and Alberta Innovates – Health Solutions continued to be the main funders of non-chair salary awards.

Figure 3.4.7A provides the provincial breakdown of the 2009 investment. Nearly one of every five cancer research investment dollars in career awards in 2009 went to PIs in Alberta, in contrast to the 8.7% of the overall cancer research investment going to PIs in Alberta. Nearly one of every five cancer research investment dollars in careers awards in 2009 went to PIs in Alberta (in contrast, 8.7% of the overall cancer research investment went to PIs in Alberta). Nearly three-quarters (73.2%) of this investment came from provincial funders (i.e., Alberta Innovates – Health Solutions accounted for 55.0% and Alberta Cancer, 18.2%), a higher proportion than found in any other province.

The 2005 and 2009 investment data for career awards in terms of CSO categories and program reach is shown in Figure 3.4.7B. There was dramatic growth in the investment among regionally based funders, particularly in the areas of Prevention, Early detection, diagnosis & prognosis, and Cancer control, survivorship & outcomes. Figure 3.4.8C compares the kite diagrams for these same data. The distribution of the CSO categories for career awards funded through national funding programs did not change. For regional funding programs, however, there were slight proportionate decreases for Biology and Treatment, and proportionate increases for Early detection, diagnosis & prognosis, and Cancer control, survivorship & outcomes.

TABLE 3.4.2A

2009 CANCER RESEARCH INVESTMENT IN CAREER AWARDS BY AWARD TYPE AND NUMBER OF PROJECTS

TYPE OF AWARD	2009 Investment		Number of projects	Number of projects weighted at 100%
	$	%		
Career/salary	21,110,551	44.4	333	252
Establishment	1,588,305	3.3	59	46
Tier 1 CRC	13,529,000	28.5	126	55
Tier 2 CRC	7,945,250	16.7	148	59
Other chair	3,339,233	7.0	29	23
TOTAL	**47,512,340**	**100**	**695**	**435**

TABLE 3.4.2B

CANCER RESEARCH INVESTMENT IN CAREER AWARDS, 2005 TO 2009

TYPE OF AWARD	Investment ($)					Percent change from 2005 to 2009
	2005	2006	2007	2008	2009	
Career/salary	15,703,809	16,867,188	17,736,704	20,427,608	21,110,551	34.4
Establishment	1,135,700	895,494	853,413	1,083,404	1,588,305	39.9
Tier 1 CRC	11,221,472	12,690,666	13,473,167	13,834,333	13,529,000	20.6
Tier 2 CRC	5,702,833	6,596,083	7,377,917	7,906,333	7,945,250	39.3
Other chair	751,895	1,109,683	1,201,025	1,970,083	3,339,233	344.1
TOTAL	**34,515,709**	**38,159,113**	**40,642,225**	**45,221,763**	**47,512,340**	**37.7**

FIGURE 3.4.7A

DISTRIBUTION OF 2009 CANCER RESEARCH INVESTMENT IN CAREER AWARDS BY PROVINCE OF NOMINATED PI ($47.5M)

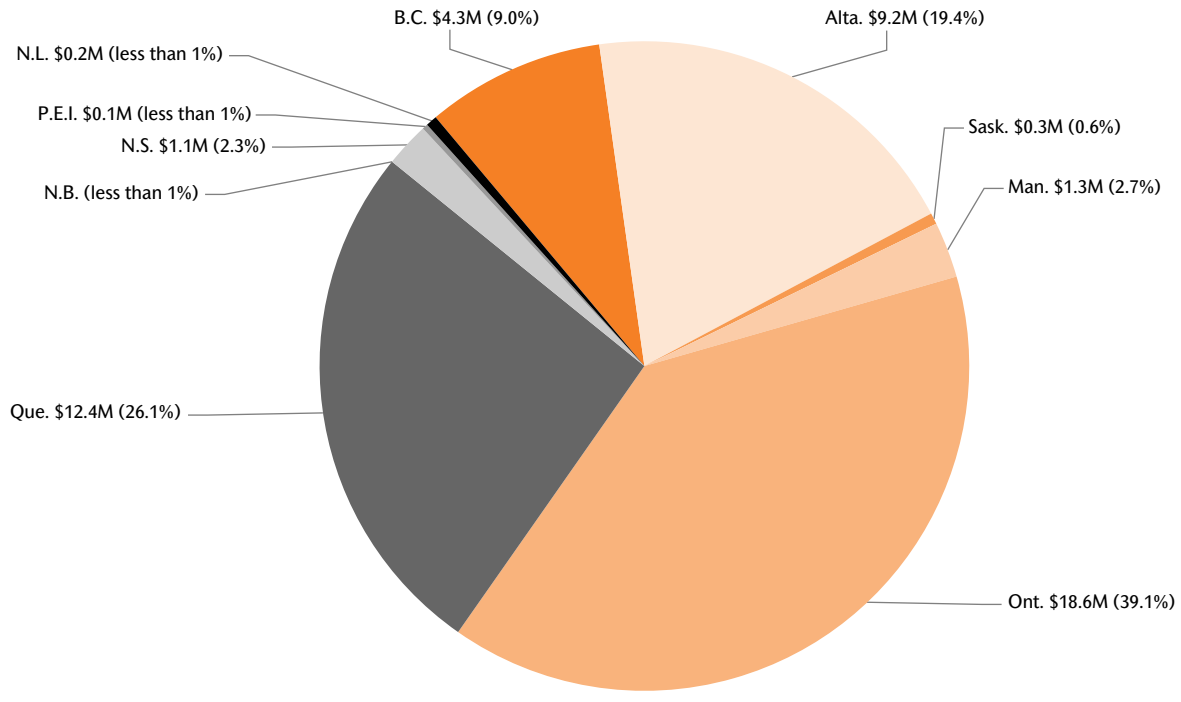
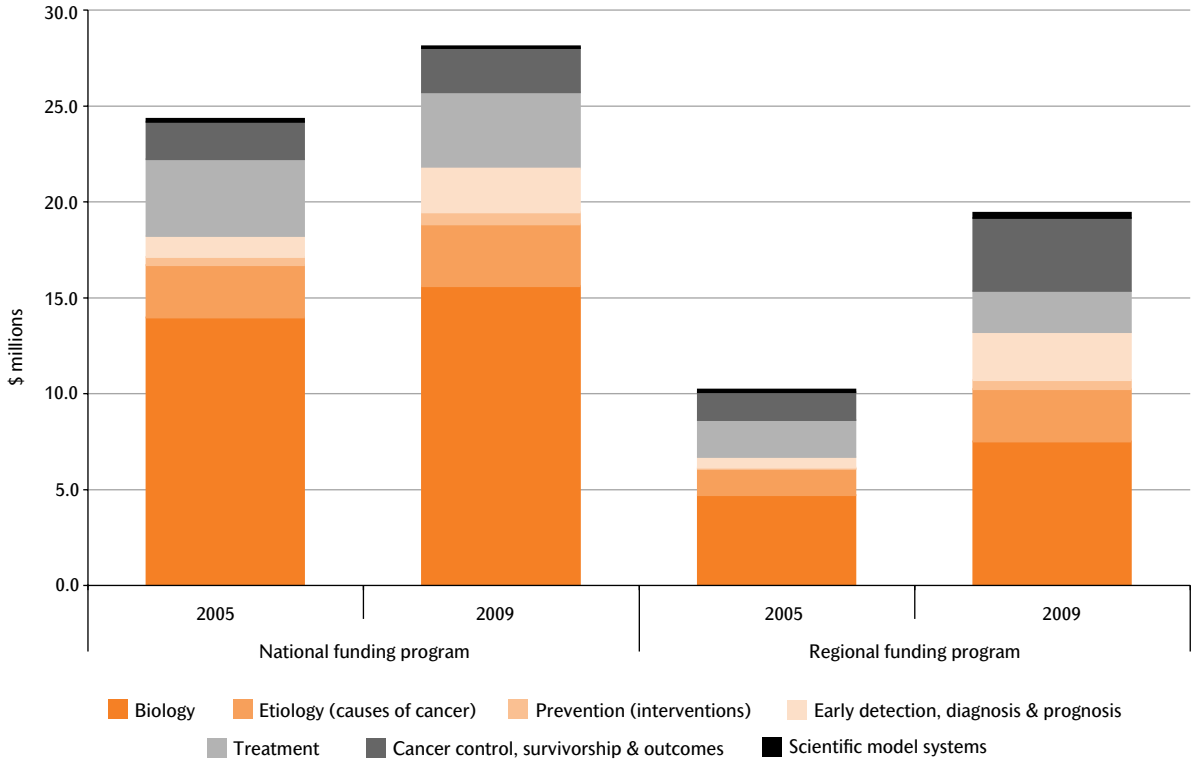


FIGURE 3.4.7B

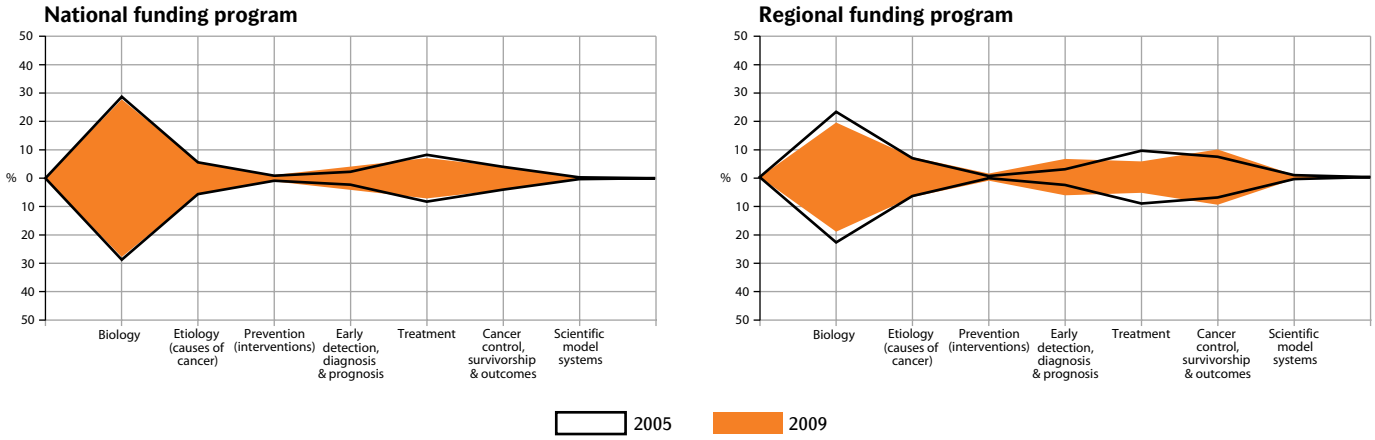
CANCER RESEARCH INVESTMENT IN CAREER AWARDS BY PROGRAM REACH AND CSO CATEGORY, 2005 AND 2009



		Biology	Etiology (causes of cancer)	Prevention (interventions)	Early detection, diagnosis & prognosis	Treatment	Cancer control, survivorship & outcomes	Scientific model systems	TOTAL
Percent change from 2005 to 2009	National funding program	11.8	17.4	48.7	107.9	-0.4	18.0	-43.5	15.5
	Regional funding program	59.4	101.1	517.7	344.4	12.8	159.4	106.2	90.4
	All career awards	23.7	45.2	122.0	188.2	3.9	78.6	25.3	37.7

FIGURE 3.4.7C

DISTRIBUTION OF CANCER RESEARCH INVESTMENT IN CAREER AWARDS BY PROGRAM REACH AND CSO CATEGORY, 2005 AND 2009



Equipment/Infrastructure Grants

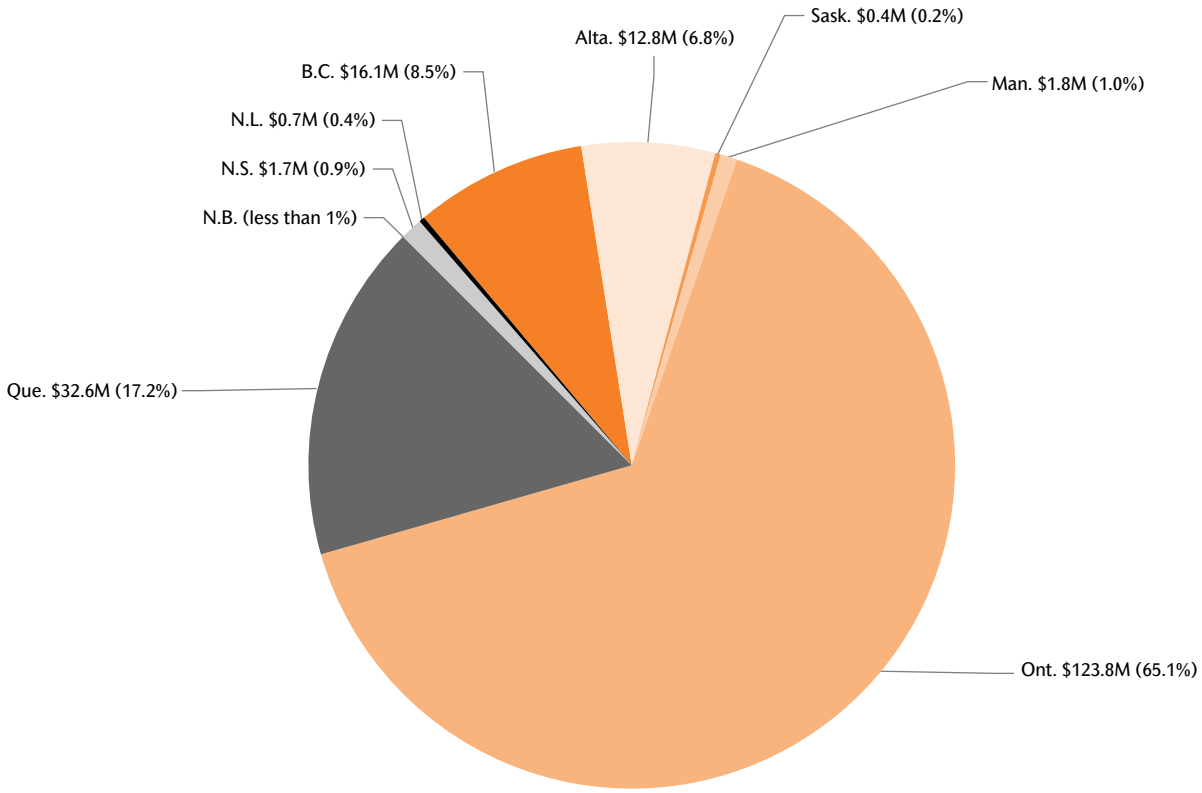
Figure 3.4.8A shows the distribution of the 2009 investment in equipment/infrastructure grants by province of PI. The federal portion of the CFI grants represented 26.1% of the $190.0M invested in equipment/infrastructure grants. There was a doubling of investment in equipment/infrastructure in Ontario from 2005 to 2009, with Ontario representing 65.1% of the total equipment/infrastructure investment in 2009 (in contrast to 49.1% in 2005). Nova Scotia, Newfoundland and Labrador, and New Brunswick also had an infusion of equipment/infrastructure dollars over the five-year period. Saskatchewan had a dramatic drop in equipment/infrastructure investment in 2009.

Figure 3.4.8B looks at the equipment/infrastructure investment in more detail by comparing the funding from nationally-based and regionally-based funders in terms of CSO categories for 2005 and 2009. Figure 3.4.8C provides kite diagrams for these same data. The equipment/infrastructure investment in 2009 for Etiology was more than triple the size of the investment in 2005. Etiological research was significantly boosted by the pancreatic cancer genome project spearheaded by the Ontario Institute for Cancer Research (with additional support from CFI) and the Canadian Partnership for Tomorrow project supported by the Canadian Partnership Against Cancer and its regional partners. Regional funding programs (most markedly, the Ontario Institute for Cancer Research) accounted for the dramatic increase in equipment/infrastructure funding in Early detection, diagnosis & prognosis from 2005 to 2009.

There were also double-digit percent changes in investment for Prevention and Cancer control, survivorship & outcomes. The Prevention investment was largely due to increased investment by CFI and the Canadian Cancer Society while the increase in Cancer control, survivorship & outcomes resulted from new projects supported by CFI, Cancer Care Ontario, and the Ontario Institute for Cancer Research. Equipment/infrastructure investment in the Biology and Scientific Model Systems areas, however, fell by over 40% from 2005 to 2009.

FIGURE 3.4.8A

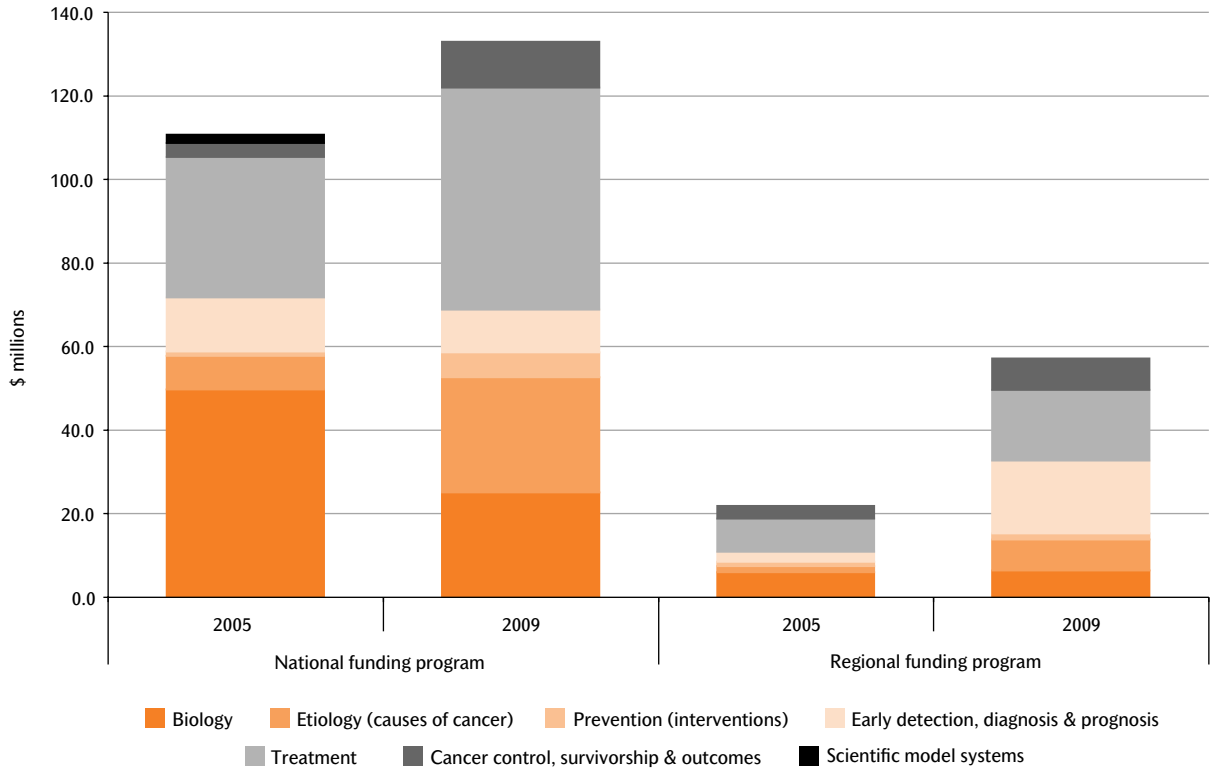
DISTRIBUTION OF 2009 CANCER RESEARCH INVESTMENT IN EQUIPMENT/INFRASTRUCTURE GRANTS BY PROVINCE OF NOMINATED PI ($190.0M) [1]



[1] There was no investment in equipment/infrastructure grants for P.E.I. in 2009.

FIGURE 3.4.8B

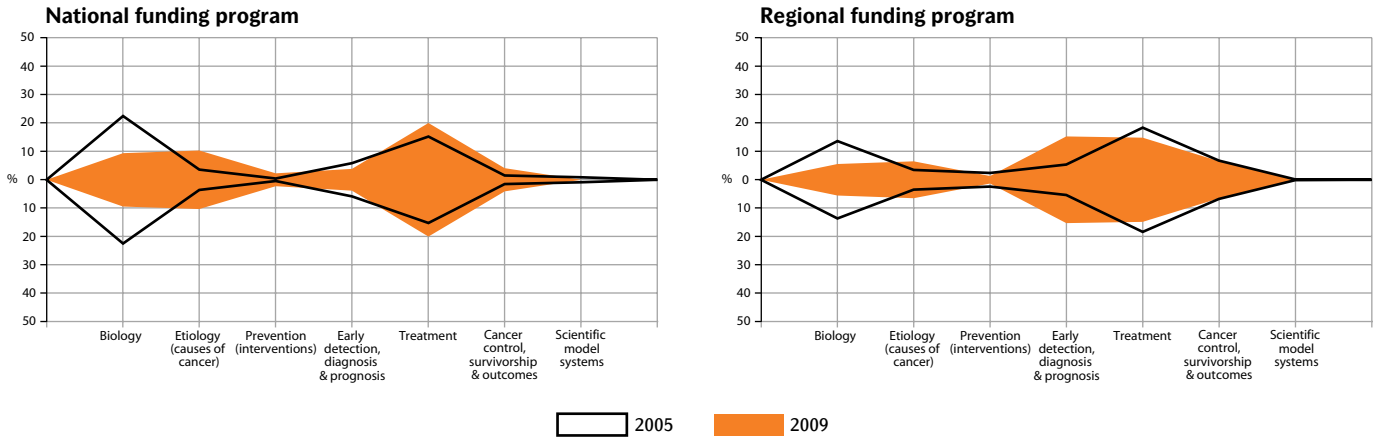
CANCER RESEARCH INVESTMENT IN EQUIPMENT/INFRASTRUCTURE GRANTS BY PROGRAM REACH AND CSO CATEGORY, 2005 AND 2009



		Biology	Etiology (causes of cancer)	Prevention (interventions)	Early detection, diagnosis & prognosis	Treatment	Cancer control, survivorship & outcomes	Scientific model systems	TOTAL
Percent change from 2005 to 2009	National funding program	-49.7	243.6	490.6	-21.2	58.0	230.3	-97.8	20.1
	Regional funding program	6.8	392.0	42.9	645.1	111.3	153.8	-	161.2
	All equipment/ infrastructure grants	-43.6	267.2	264.4	80.8	68.2	194.1	-97.9	43.4

FIGURE 3.4.8C

DISTRIBUTION OF CANCER RESEARCH INVESTMENT IN EQUIPMENT/INFRASTRUCTURE GRANTS BY PROGRAM REACH AND CSO CATEGORY, 2005 AND 2009



Trainee Awards

There were 1,858 graduate level awards out of a total of 2,951 trainee awards funded in 2009 (see Table 3.4.3A). Nearly half (47.5%) of graduate level trainee award investment in 2009 was represented by the Canada Graduate Scholarship program, which is supported by the three federal government research agencies (i.e., CIHR $5,323,237; NSERC $739,914; SSHRC $317,405). Postdoctoral fellowships accounted for 41.4% of the overall trainee investment.

Table 3.4.3B shows the highest percent increase for 2005 to 2009 for undergraduate awards (which comprised a very small proportion of all trainee awards) and a 71.4% increase in graduate trainee awards. Investment in institutional training awards fell by 30%, with the winding down in 2008 and 2009 of the initial round of training programs supported by CIHR's Strategic Training Initiative in Health Research (STIHR). The percent increase from 2005 to 2009 in postdoctoral fellowships was largely due to increased investment on the part of the Canadian Breast Cancer Foundation, Fonds de recherche du Québec – Santé, and The Terry Fox Foundation.

The investment in awards for trainees studying at institutions outside Canada totaled $3.2M in 2009 (Table 3.4.9C). One-quarter of the investment in postdoctoral fellowships in 2009 was awarded to trainees at institutions outside Canada, the lowest proportion in the five-year period. The investment in graduate awards for trainees at institutions outside Canada peaked in 2009 at 2% of the total graduate awards investment.

The distribution of graduate awards and postdoctoral fellowships by CSO categories changed negligibly from 2005 to 2009 (Figure 3.4.9A). For graduate awards, the investment in Early detection, diagnosis & prognosis had the highest percent increase from 2005 to 2009. Among postdoctoral fellowships, the investment in Prevention research more than tripled from 2005 to 2009.

The provincial distribution of trainee awards is shown in Figure 3.4.9B. Funding for trainee awards (from all sources) rose from 2005 to 2009 for all provinces and the percent change was highest for the provinces in Atlantic Canada (data not shown).

TABLE 3.4.3A

2009 CANCER RESEARCH INVESTMENT IN TRAINEE AWARDS BY AWARD TYPE AND NUMBER OF PROJECTS

TYPE OF TRAINEE AWARD	2009 Investment		Number of projects	Number of projects weighted at 100%
	$	%		
Undergraduate	305,648	1.1	178	173
Graduate	13,430,890	46.5	1,858	1,614
Postdoctoral	11,954,816	41.4	865	760
Institutional	3,187,846	11.0	50	33
TOTAL	**28,879,200**	**100**	**2,951**	**2,580**

TABLE 3.4.3B

CANCER RESEARCH INVESTMENT IN TRAINEE AWARDS, 2005 TO 2009

TYPE OF TRAINEE AWARD	Investment ($)					Percent change from 2005 to 2009
	2005	2006	2007	2008	2009	
Undergraduate	30,911	37,700	220,335	310,214	305,648	888.8
Graduate	7,835,090	9,014,699	9,686,223	11,357,783	13,430,890	71.4
Postdoctoral	8,498,041	10,496,260	11,614,110	11,784,240	11,954,816	40.7
Institutional	4,551,078	4,935,125	5,396,488	3,580,875	3,187,846	-30.0
TOTAL	**20,915,120**	**24,483,783**	**26,917,156**	**27,033,113**	**28,879,200**	**38.1**

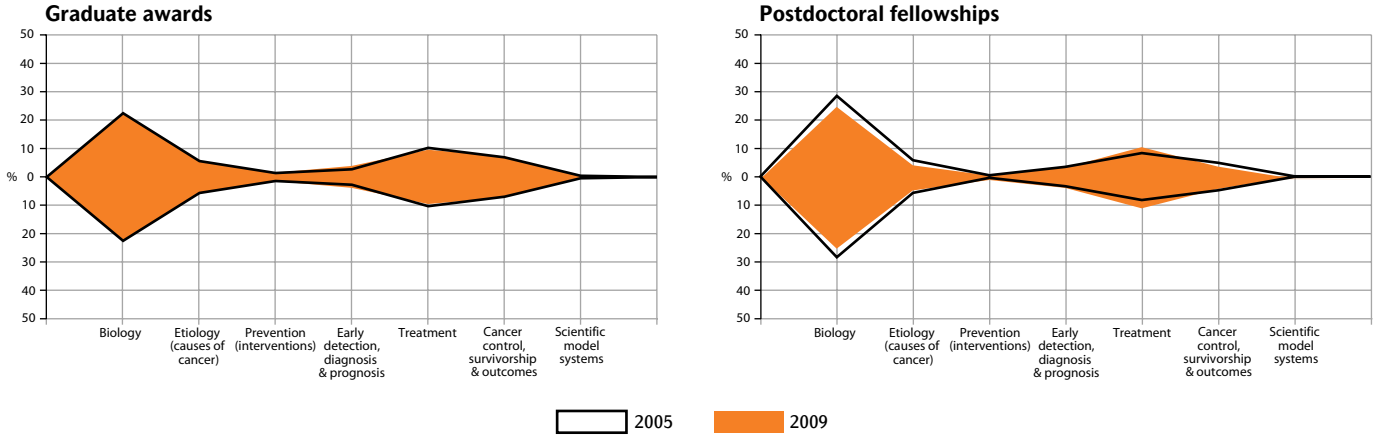
TABLE 3.4.3C

GRADUATE AWARDS AND POSTDOCTORAL FELLOWSHIPS BY INSTITUTIONAL AFFILIATION OF TRAINEE, 2005 TO 2009

TYPE OF TRAINEE AWARD	INSTITUTION	2005	2006	2007	2008	2009
Graduate	Canadian ($)	7,736,397	8,921,439	9,616,483	11,196,567	13,166,540
	Outside Canada ($)	98,693	93,260	69,740	161,217	264,350
	Outside Canada (%)	1.3	1.0	0.7	1.4	2.0
Postdoctoral	Canadian ($)	6,117,920	7,017,865	7,727,947	8,317,665	8,981,067
	Outside Canada ($)	2,380,121	3,478,394	3,886,163	3,466,575	2,973,750
	Outside Canada (%)	28.0	33.1	33.5	29.4	24.9

FIGURE 3.4.9A

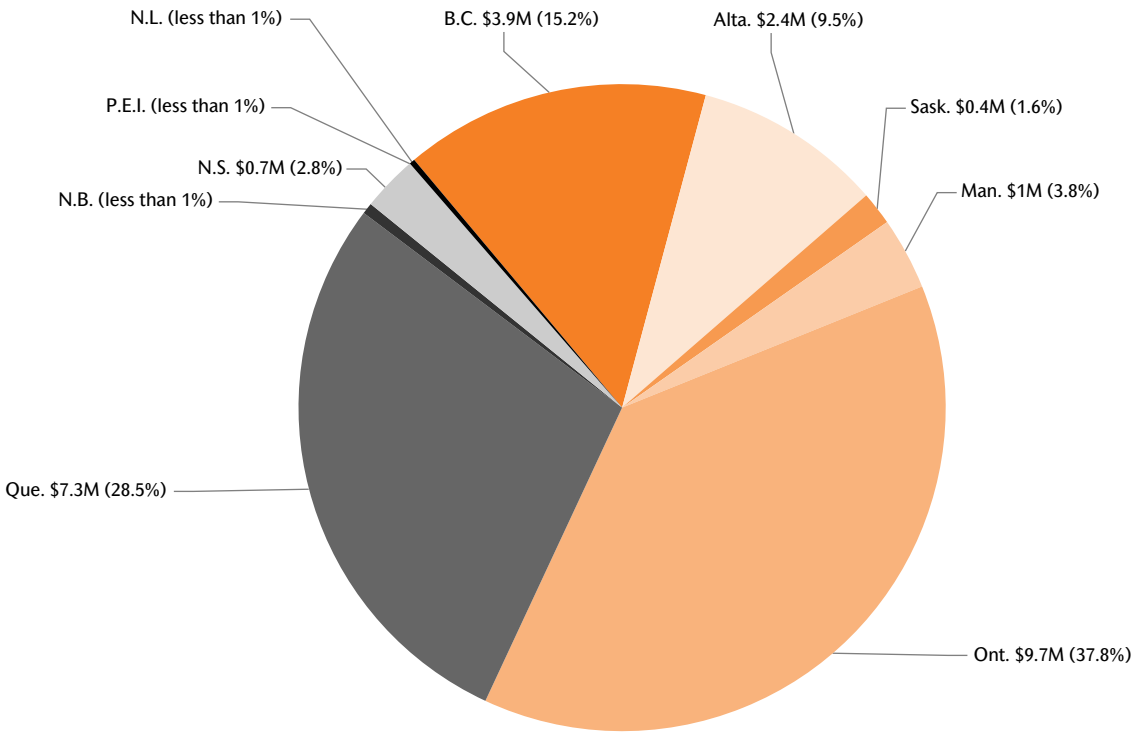
DISTRIBUTION OF GRADUATE AWARDS AND POSTDOCTORAL FELLOWSHIPS BY CSO CATEGORY, 2005 AND 2009



		Biology	Etiology (causes of cancer)	Prevention (interventions)	Early detection, diagnosis & prognosis	Treatment	Cancer control, survivorship & outcomes	Scientific model systems	TOTAL
Percent change from 2005 to 2009	Graduate awards	69.8	66.8	81.6	138.0	58.4	77.5	-28.2	71.4
	Postdoctoral fellowships	26.2	19.0	280.9	64.8	90.3	26.5	-6.7	40.7

FIGURE 3.4.9B

DISTRIBUTION OF 2009 CANCER RESEARCH INVESTMENT IN TRAINEE AWARDS BY PROVINCE OF NOMINATED PI ($25.6M) [1]



[1] Excludes trainee awardees studying outside Canada.

Indirect Costs

An estimate of the "cancer" component of the federal Indirect Costs Program (ICP) was calculated as one source of institutional support received by institutions that employ researchers engaged in cancer research (see sidebar for details on how this estimate was calculated).[8] The estimate for the ICP was $20.7M for 2009. The provincial distribution is shown in Figure 3.4.10.

INDIRECT COSTS CALCULATION

The estimate of the "cancer" component of the federal ICP was calculated in the following way:

1. All projects within the survey database for CIHR, NSERC and SSHRC were identified.
2. The funding programs for each federal granting agency were included/excluded/weighted according to the ICP program guidelines, and host organizations that were not universities were mapped to affiliated universities, where applicable.
3. The proportion of Indirect Costs paid to institutions in 2009/10 relative to averaged funding received by researchers for fiscal years 2006/07, 2007/08, and 2008/09 by all three funding agencies (data supplied by the ICP program) was applied to the 2006, 2007 and 2008 CCRS data. The assumption is that all projects at an institution receive the same level of support.

Example: University of Alberta

a. Three-year total paid to all University of Alberta researchers by CIHR, NSERC, and SSHRC: $258.7M; averaged annual $86.2M

b. Indirect cost payment in 2010/11: $16.3M

c. Proportion ($16.3M/$86.2M) = 18.9%

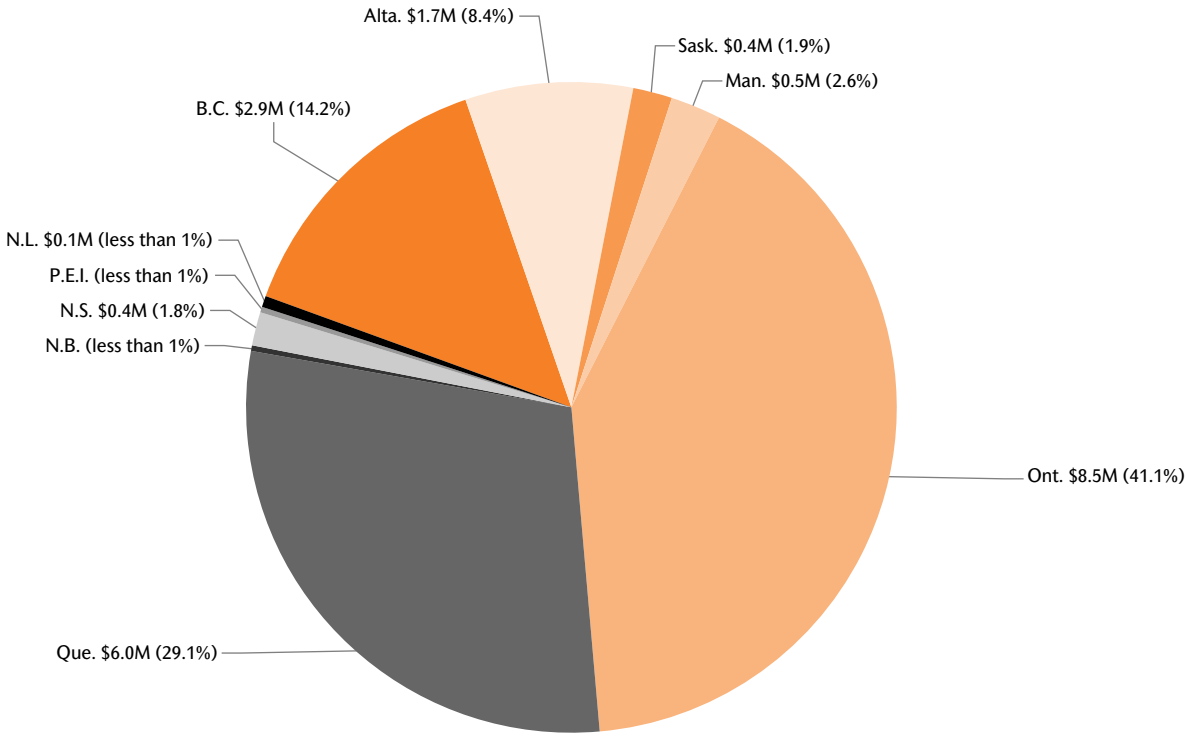
d. Three-year total paid to cancer researchers by CIHR, NSERC, and SSHRC (from survey database): $16.0M; averaged annual $5.3M

e. Calculated indirect costs for cancer research ($5.3M*18.9%) = $1.0M

8. Provincial and institutional sources of indirect costs are not included.

FIGURE 3.4.10

DISTRIBUTION OF CANCER-RELATED INDIRECT COSTS ESTIMATED FOR 2009 BY PROVINCE OF NOMINATED PI ($20.7M)



TREND SUMMARY

- Funding in direct support/operating grants increased by 51% from 2005 to 2009, with the most pronounced gains in the Early detection, diagnosis & prognosis and Treatment areas of research. The near tripling of operating grant support for Early detection, diagnosis & prognosis research suggests there may be growing capacity in this burgeoning field of research. In addition, in Ontario, increased investment in major early detection/ diagnostic platforms significantly raised the level of equipment/infrastructure investment for this category of research.
- The investment in direct support/operating grants for etiological research dropped by 26%, although on the equipment/infrastructure side, investment in Etiology was enhanced by large-scale provincial and federal initiatives.
- Prevention research equipment/infrastructure investment was significantly boosted during the period by investments from CFI and the Quebec government for the project, "Translational Research and Intervention Across the Lifespan," funded as part of CFI's Research Hospital Fund. The Canadian Cancer Society also increased its support of the Propel Centre for Population Health Impact from 2005 to 2009.
- During this period, a number of provincial and charitable funders started directing their investment to support research chairs. The provinces of Alberta, B.C., Manitoba, Nova Scotia, Ontario, and Quebec benefited from these investments.
- The infusion of federal funding for the Canada Graduate Scholarships program in 2009 raised the level of investment in graduate level trainee awards in cancer research, with the tri-agency funders accounting for nearly two-thirds of this investment in that year. However, non-federal sources accounted for the increased investment in postdoctoral fellowships over the five-year period.

APPENDIX A. ABBREVIATIONS

AIHS	Alberta Innovates – Health Solutions
CARO	Canadian Association of Radiation Oncology
CBCF	Canadian Breast Cancer Foundation
CBCRA	Canadian Breast Cancer Research Alliance
CCMB	CancerCare Manitoba
CCNS	Cancer Care Nova Scotia
CCO	Cancer Care Ontario
CCRA	Canadian Cancer Research Alliance
CCRS	Canadian Cancer Research Survey
CCS	Canadian Cancer Society
CECR	Centres of Excellence for Commercialization and Research
CFI	Canada Foundation for Innovation
CIHR	Canadian Institutes of Health Research
CIPI	Canadian Institute for Photonic Innovations (an NCE)
CLS	Canadian Light Source
COG	Children's Oncology Group
CPCRI	Canadian Prostate Cancer Research Initiative
CRC	Canada Research Chair
CRS	Cancer Research Society
CSO	Common Scientific Outline
CTCRI	Canadian Tobacco Control Research Initiative
FRQS	Fonds de recherche du Québec – Santé
ICD-10	International Statistical Classification of Disease and Related Health Problems, 10th Revision
ICGC	International Cancer Genome Consortium
ICP	Indirect Costs Program (federal)
ICRP	International Cancer Research Partnership
KFOC	The Kidney Foundation of Canada
LLSC	The Leukemia & Lymphoma Society of Canada
MEDI	Ontario Ministry of Economic Development & Innovation
MHRC	Manitoba Health Research Council
MITACS	Mathematics of Information Technology & Complex Systems (an NCE)
MRFNB	Medical Research Fund of New Brunswick
MSFHR	Michael Smith Foundation for Health Research
NCE	Networks of Centres of Excellence
NCI	National Cancer Institute (US)
NCIC CTG	NCIC Clinical Trials Group (CCS)
NCRI	National Cancer Research Institute (UK)
NRC	National Research Council of Canada
NSERC	Natural Sciences and Engineering Research Council
NSHRF	Nova Scotia Health Research Foundation
OCC	Ovarian Cancer Canada
OICR	Ontario Institute for Cancer Research
PCC	Prostate Cancer Canada
PHAC	Public Health Agency of Canada
PI	Principal Investigator
QBCF	Quebec Breast Cancer Foundation/Fondation du cancer du sein du Québec
SCA	Saskatchewan Cancer Agency
SCN	Stem Cell Network (an NCE)
SHRF	Saskatchewan Health Research Foundation
SSHRC	Social Sciences and Humanities Research Council
STIHR	Strategic Training Initiative in Health Research
TFF	The Terry Fox Foundation
TFRI	Terry Fox Research Institute

APPENDIX B. DATA CAVEATS FOR INDIVIDUAL ORGANIZATIONS

ORGANIZATION [1]	NUMBER OF PROJECTS [2]	CAVEATS		
		PROJECT DESCRIPTIONS [3]	IMPUTED BUDGETS	IMPUTED START &/ END DATES
Alberta Cancer [4]	544	No descriptions for 9 projects. 78 projects with lay abstracts only.		
Alberta Innovates - Health Solutions	261	No description for 1 project. 1 project with lay abstract only.	107 career awards. [5]	
Brain Tumour Foundation of Canada	29	Lay abstracts only.		
C^{17} Research Network	15	Lay abstracts only.		
Canada Foundation for Innovation	492	Keywords only; no descriptions provided.	CFI maximum contribution used for CFI. Partner investment assumed to 2.25 times the CFI maximum contribution.	Final decision dates were used as start dates unless other data were available. 156 end dates were unavailable. [6]
Canada Research Chairs Program	375	All descriptions obtained from web site.		
Canadian Association of Radiation Oncology	52	No description for 1 project.		13 end dates.
Canadian Breast Cancer Foundation	351	No descriptions for 3 projects. 32 projects with lay abstracts only.		
Canadian Breast Cancer Research Alliance	202			
Canadian Cancer Society	1,121	No descriptions for 13 projects. 41 projects with lay abstracts only.	2 projects.	2 end dates.
Canadian Institutes of Health Research	3,688	No descriptions for 116 projects. 335 projects with lay abstracts only.	CIHR investment known for all projects. Partner investment is estimated for 263 projects.	5 end dates.
Canadian Partnership Against Cancer	9	Descriptions obtained from internal sources		
Canadian Prostate Cancer Research Initiative	16	2 projects with lay abstracts only.		
Canadian Tobacco Control Research Initiative	196	170 projects with lay abstracts only.		
Canary Foundation of Canada	13			
Cancer Care Nova Scotia	48	34 projects with lay abstracts only.		9 end dates.
Cancer Care Ontario	45	No descriptions for 18 projects. 24 projects with lay abstracts only.		
CancerCare Manitoba	107	No descriptions for 4 projects. 63 with only lay abstracts		
Cancer Research Society	306	5 projects with lay abstracts only.		
Fondation du cancer du sein du Québec / Quebec Breast Cancer Foundation	11			
Fonds de recherche du Québec - Santé	529	No descriptions for 8 projects. 12 projects with lay abstracts only.		
Genome Canada	15	All descriptions obtained from web site		
Manitoba Health Research Council	94	No descriptions for 30 projects. 48 projects with lay abstracts only.	1 project.	1 end dates.
Medical Research Fund of New Brunswick	6	3 projects with lay abstracts only.		
Michael Smith Foundation for Health Research	309	131 projects with lay abstracts only.		1 end dates.
National Research Council	42	16 projects with lay abstracts only.		
Natural Sciences and Engineering Research Council	792	No descriptions for 488 projects. 298 projects with lay abstracts only.	31 projects.	166 end dates. [7]
Networks of Centres of Excellence	49	No description for 1 project. 48 projects with lay abstracts only.	14 projects.	
Newfoundland and Labrador Centre for Applied Health Research	3	Lay abstracts only.	3 projects.	
Nova Scotia Health Research Foundation	57	No descriptions for 5 projects. 50 projects with lay abstracts only.	1 project.	28 end dates.
Ontario Institute for Cancer Research	258	No descriptions for 6 projects. 24 with lay abstracts only.		
Ontario Ministry of Economic Development and Innovation	70	No descriptions for 7 projects. 63 projects with lay abstracts only.	MEDI investment is known for all projects. Partner investment is estimated for 66 projects.	56 end dates.
Ovarian Cancer Canada	25	No descriptions for 12 projects. 12 projects with lay abstracts only.	3 projects.	18 end dates.
PROCURE	1			
Prostate Cancer Canada	90	No descriptions for 5 projects.		
Saskatchewan Cancer Agency	19	1 project with a lay abstract.		
Saskatchewan Health Research Foundation	46	Lay abstracts only.		
Social Sciences and Humanities Research Council	84	No descriptions for 81 projects.	6 projects.	43 end dates. [7]
The Kidney Foundation of Canada	13			
The Leukemia & Lymphoma Society of Canada	126	No descriptions for 50 projects.		
The Terry Fox Foundation	436	35 projects with lay abstracts only.		

[1] Projects are listed under the program that administered them. This list does not contain the Indirect Costs Program given the nature of the program, which is institution-specific, and not research project-specific.
[2] Number of projects included in the CCRA database. Overall total is 10,945.
[3] Descriptions are important to the coding/project classification process. The more information available for a given project, the more confidence we have in the classification results. Where no descriptions were available, public information (i.e., thesis abstracts, publications, web-based information) was used to code a given project.
[4] Alberta Cancer represents an amalgamation of different funding sources over the 2005 to 2009 period, including Alberta Cancer Board, Alberta Cancer Foundation, Alberta Health Services, Alberta Heritage Foundation for Medical Research, and AIHS. These programs were administered by the Alberta Cancer Foundation or the former Alberta Cancer Board.
[5] AIHS does not disclose salary grants by researcher, and provided CCRA with averaged salary figures for these projects. For all other projects where total project budget information was not made available, budgets were imputed on the basis of "like" grants.
[6] Dates were imputed on the basis of "like" grants for which data were available or other public information.
[7] Proactive public disclosure of start dates for NSERC and SSHRC grants over $25,000 was announced by the Government of Canada on October 21, 2005. Both organizations publish this information on their respective web sites.

APPENDIX C. INVESTMENT BY CSO CODES, 2005 TO 2009 [1]

	$					Percent change from 2005 to 2009
CSO Code	2005	2006	2007	2008	2009	
1 - BIOLOGY	**159,740,499**	**176,057,694**	**191,442,669**	**180,101,211**	**179,698,405**	**12.5**
1.1 - Normal functioning	56,000,209	68,975,726	74,698,066	68,269,674	70,607,786	26.1
1.2 - Cancer initiation: alterations in chromosomes	10,089,320	9,570,064	9,463,665	11,934,015	12,073,364	19.7
1.3 - Cancer initiation: oncogenes and tumour suppressor genes	33,908,954	39,099,650	47,733,319	49,059,511	47,638,189	40.5
1.4 - Cancer progression and metastasis	21,804,840	24,737,591	26,448,210	27,772,293	29,796,357	36.7
1.5 - Resources and infrastructure	37,937,176	33,674,664	33,099,409	23,065,718	19,582,709	-48.4
2 - ETIOLOGY	**42,279,758**	**38,280,208**	**43,023,031**	**49,098,211**	**67,621,300**	**59.9**
2.1 - Exogenous factors in the origin and cause of cancer	11,191,199	11,828,224	12,252,785	17,576,190	19,213,950	71.7
2.2 - Endogenous factors in the origin and cause of cancer	19,396,584	17,425,419	20,997,875	20,182,732	22,255,484	14.7
2.3 - Interactions of genes and/or genetic polymorphisms with exogenous and/or endogenous factors	3,040,929	2,319,746	2,475,186	4,589,666	4,751,125	56.2
2.4 - Resources and infrastructure	8,651,047	6,706,818	7,297,185	6,749,624	21,400,740	147.4
3 - PREVENTION (INTERVENTIONS)	**6,356,199**	**7,330,727**	**7,937,512**	**10,650,097**	**13,699,765**	**115.5**
3.1 - Interventions to prevent cancer: personal behaviours that affect cancer risk	2,823,030	3,515,663	4,201,755	4,692,923	4,455,447	57.8
3.2 - Nutritional science in cancer prevention	582,155	714,154	762,668	783,930	2,063,431	254.4
3.3 - Chemoprevention	880,267	682,693	754,255	880,096	1,005,608	14.2
3.4 - Vaccines	119,138	256,366	367,348	694,641	741,061	522.0
3.5 - Complementary and alternative prevention approaches	467,317	510,210	342,167	313,717	254,364	-45.6
3.6 - Resources and infrastructure	1,484,293	1,651,641	1,509,319	3,284,790	5,179,853	249.0
4 - EARLY DETECTION, DIAGNOSIS & PROGNOSIS	**39,175,306**	**40,242,632**	**49,931,666**	**58,047,079**	**72,978,309**	**86.3**
4.1 - Technology development and/or marker discovery	13,266,948	15,624,524	20,993,890	20,962,951	26,201,701	97.5
4.2 - Technology and/or marker evaluation with respect to fundamental parameters of method	7,845,280	7,620,466	8,540,372	10,653,436	15,495,747	97.5
4.3 - Technology and/or marker testing in a clinical setting	2,409,814	3,215,391	5,348,869	6,836,098	8,639,012	258.5
4.4 - Resources and infrastructure	15,653,264	13,782,250	15,048,536	19,594,593	22,641,850	44.6
5 - TREATMENT	**91,336,343**	**92,168,881**	**95,116,703**	**125,746,786**	**153,934,083**	**68.5**
5.1 - Localized therapies – discovery and development	7,069,813	7,466,775	7,973,206	10,066,371	14,217,973	101.1
5.2 - Localized therapies – clinical applications	2,371,556	3,227,526	3,649,614	4,609,612	4,254,956	79.4
5.3 - Systemic therapies – discovery and development	40,830,361	43,706,023	50,385,010	68,973,060	90,555,281	121.8
5.4 - Systemic therapies – clinical applications	6,452,431	6,756,106	7,327,318	7,168,480	6,757,034	4.7
5.5 - Combinations of localized and systemic therapies	954,272	819,656	928,408	1,001,388	1,289,943	35.2
5.6 - Complementary and alternative treatment approaches	364,756	417,093	265,760	242,763	471,928	29.4
5.7 - Resources and infrastructure	33,293,154	29,775,703	24,587,386	33,685,111	36,386,969	9.3
6 - CANCER CONTROL, SURVIVORSHIP & OUTCOMES	**30,096,622**	**31,843,605**	**35,671,075**	**46,029,729**	**55,860,178**	**85.6**
6.1 - Patient care and survivorship issues	8,399,052	9,002,881	10,209,742	10,948,410	12,708,279	51.3
6.2 - Surveillance	2,116,661	1,988,126	2,397,919	2,846,708	3,489,668	64.9
6.3 - Behaviour	4,454,736	4,227,939	4,886,446	5,284,642	5,450,866	22.4
6.4 - Cost analyses and health care delivery	3,714,584	4,431,720	5,741,379	10,214,527	13,497,530	263.4
6.5 - Education and communication	2,010,564	2,292,278	2,180,179	1,964,058	2,659,233	32.3
6.6 - End-of-life care	2,949,670	3,384,975	3,442,413	3,294,579	3,013,087	2.1
6.7 - Ethics and confidentiality in cancer research	551,950	317,629	146,892	364,156	331,340	-40.0
6.8 - Complementary and alternative approaches for supportive care of patients and survivors	716,027	684,853	576,515	451,917	382,883	-46.5
6.9 - Resources and infrastructure	5,183,378	5,513,205	6,089,590	10,660,734	14,327,293	176.4
7 - SCIENTIFIC MODEL SYSTEMS	**3,218,082**	**3,708,669**	**3,381,518**	**1,436,785**	**1,693,160**	**-47.4**
7.1 - Development and characterization of model systems	2,827,076	3,161,791	2,938,892	1,278,535	1,552,075	-45.1
7.2 - Application of model systems	-	-	-	-	-	-
7.3 - Resources and infrastructure	391,006	546,879	442,626	158,249	141,085	-63.9
TOTAL	**372,202,809**	**389,632,416**	**426,504,173**	**471,109,898**	**545,485,200**	**46.6**

[1] Category totals are shown in boldfaced, upper case letters. This table does not include investment estimates for the Indirect Costs Program or other province-specific and institution-specific funding sources not captured in the CCRS.

APPENDIX D. INVESTMENT BY CANCER SITE, 2005 TO 2009 [1]

CANCER SITE	2005		2006		2007		2008		2009		Percent change from 2005 to 2009
	$	%	$	%	$	%	$	%	$	%	
Bladder	685,767	0.4	848,681	0.4	902,862	0.4	1,269,564	0.5	1,722,979	0.6	151.2
Bone and connective tissue	3,762,100	2.0	3,360,863	1.7	2,137,962	1.0	2,418,246	1.0	2,800,737	1.1	-25.6
Brain	10,336,251	5.6	13,443,270	6.9	15,762,358	7.3	20,085,794	8.6	19,573,920	7.4	89.4
Breast	45,821,510	24.8	51,026,150	26.3	60,984,782	28.2	66,579,468	28.5	74,515,931	28.1	62.6
Cervix	4,358,268	2.4	3,927,713	2.0	4,725,437	2.2	5,188,866	2.2	5,336,332	2.0	22.4
Colorectal	18,760,542	10.2	16,164,592	8.3	15,568,330	7.2	16,100,082	6.9	18,537,654	7.0	-1.2
Esophagus	978,299	0.5	1,123,956	0.6	1,483,730	0.7	1,863,474	0.8	2,155,396	0.8	120.3
Gallbladder	21,916	0.0	25,045	0.0	25,790	0.0	32,878	0.0	51,800	0.0	136.4
Hodgkin's disease	1,079,092	0.6	1,060,506	0.5	977,641	0.5	820,596	0.4	871,200	0.3	-19.3
Kidney	2,211,763	1.2	2,181,126	1.1	2,256,542	1.0	2,689,596	1.2	3,643,548	1.4	64.8
Larynx	638,350	0.3	707,226	0.4	884,905	0.4	1,062,468	0.5	1,055,471	0.4	65.3
Leukemia	23,362,383	12.6	23,924,727	12.3	25,190,691	11.7	26,390,191	11.3	25,954,963	9.8	11.1
Liver	2,520,362	1.4	3,211,380	1.7	3,531,559	1.6	3,671,775	1.6	3,694,666	1.4	46.6
Lung	9,900,440	5.4	12,483,450	6.4	14,175,086	6.6	16,807,894	7.2	21,254,307	8.0	114.7
Multiple myeloma	3,290,909	1.8	3,263,459	1.7	3,622,258	1.7	3,484,497	1.5	3,413,673	1.3	3.7
Non-Hodgkin's lymphoma	8,407,788	4.6	9,769,138	5.0	12,355,650	5.7	11,610,778	5.0	10,860,808	4.1	29.2
Oral	3,731,560	2.0	3,681,058	1.9	4,042,081	1.9	4,659,714	2.0	5,510,810	2.1	47.7
Ovary	8,046,080	4.4	6,732,703	3.5	7,404,166	3.4	6,739,694	2.9	7,883,435	3.0	-2.0
Pancreas	1,541,228	0.8	1,796,487	0.9	2,104,904	1.0	1,605,010	0.7	7,125,564	2.7	362.3
Prostate	21,024,454	11.4	20,432,313	10.5	22,408,198	10.4	26,287,870	11.2	32,282,451	12.2	53.5
Skin (Melanoma)	5,286,053	2.9	5,604,996	2.9	5,732,419	2.7	4,472,629	1.9	4,428,876	1.7	-16.2
Stomach	973,186	0.5	849,415	0.4	837,940	0.4	988,413	0.4	1,020,078	0.4	4.8
Thyroid	306,625	0.2	398,725	0.2	629,855	0.3	622,550	0.3	522,476	0.2	70.4
Uterus	2,127,353	1.2	2,071,398	1.1	1,836,113	0.8	1,404,404	0.6	1,668,738	0.6	-21.6
Other sites	5,598,863	3.0	5,894,254	3.0	6,577,055	3.0	6,861,666	2.9	9,464,468	3.6	69.0
TOTAL	**184,771,142**	**100**	**193,982,629**	**100**	**216,158,313**	**100**	**233,718,116**	**100**	**265,350,278**	**100**	**43.6**

[1] This table excludes investment in research that is relevant to all cancer sites/not site-specific.

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