

CANCER RESEARCH INVESTMENT IN CANADA, 2005 TO 2014

HIGHLIGHTS

- There was nearly five billion dollars invested from 2005 to 2014 for the total of 19,621 projects covered in the survey. The Canadian Institutes of Health Research (CIHR) was the largest funder, accounting for one of every four dollars invested in the decade. CIHR invested \$136M more in cancer research from 2010–2014 than 2005–2009.
- Years 2008 to 2012 were characterized by expanded investment in equipment/infrastructure by the Canada Foundation for Innovation and provincial funders. This investment supported the establishment of national and regional research facilities and platforms. Continued operating grant funding to ensure that these facilities and platforms are fully utilized is needed in the years ahead.
- The decade was also characterized by a tremendous influx in funding by the Ontario government with the ramp-up of the Ontario Institute for Cancer Research and other funding programs offered through the Ontario Ministry of Research, Innovation and Science.
- While the investment rose from the first to the second quinquennial across all funding sectors, there were decreased investments in recent years for all sectors but the charitable sector with four organizations accounting for most of this increase: the Canadian Breast Cancer Foundation, Prostate Cancer Canada, the Alberta Cancer Foundation, and The Terry Fox Research Institute.
- The investments in all areas of research, with the exception of biology, were higher at the end of the decade than at the beginning. Increased investment from the first to second quinquennial was most pronounced for research in early detection, diagnosis and prognosis and treatment, and this was, in part, attributable to the increased investment from priority-driven operating grant programs.
- Over one-quarter of the total site-specific investment in both periods was for breast cancer research. In addition to breast cancer, research on prostate and pancreas cancers, leukemias, and brain, ovarian, lung, colorectal, and liver cancers also had large growth in investment from 2005–2009 to 2010–2014.
- There were more researchers and trainees with funded grants/awards in the second quinquennial, which suggests that research capacity grew over the decade.
- The number of funding partnerships, particularly among CCRA members, have not supplanted those that occurred under the now-defunct multi-funded initiatives. Facilitation of funding partnerships in areas of mutual interest is an important area of ongoing work by CCRA.

This summary report describes the trend in the investment in cancer research in Canada for the decade 2005 to 2014, building on previous work published by the CCRA. Data come from the Canadian Cancer Research Survey (CCRS). The CCRS was designed to help inform CCRA members on how to optimize their research investment by addressing gaps, capitalizing on opportunities to partner on funding, and reducing duplication. The CCRS was the first joint activity undertaken by the CCRA.

Funding information is captured from 42 organizations/programs. The CCRS captures most of the peer-reviewed research from the governmental and voluntary sectors. It does not, however, include institution-specific funding from hospital foundations, research supported by private foundations or industry R&D unless part of funding partnerships of projects captured in the CCRA. We have

estimated that coverage by the CCRS represents 60–80% of the overall cancer research funding in Canada.

This report was made possible by the Canadian Partnership Against Cancer, an independent, not-for-profit organization funded to accelerate action on cancer control for all Canadians. The Partnership is committed to enhancing the cancer research environment in Canada through its support of the CCRA and CCRA's role in coordinating the cancer research funding system. As a member and funder of the CCRA, the Partnership collaborates with other member organizations to enable the strategy for cancer research in Canada. The Partnership is funded by Health Canada.

The views expressed herein are those of the CCRA.



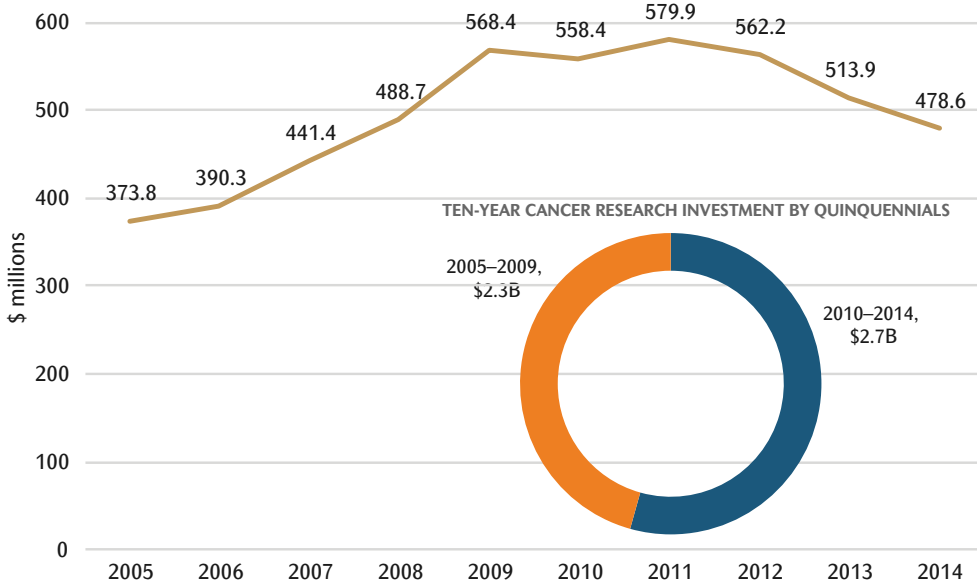
Canadian Cancer Research Alliance • Alliance canadienne pour la recherche sur le cancer

We are an alliance of organizations that collectively fund most of the cancer research conducted in Canada – research that will lead to better ways to prevent, diagnose, and treat cancer and improve survivor outcomes. Our members include federal research funding programs/agencies, provincial research agencies, provincial cancer care agencies, cancer charities, and other voluntary associations.

We are motivated by the belief that, through effective collaboration, Canadian cancer research funding organizations can maximize their collective impact on cancer control and accelerate discovery for the ultimate benefit of Canadians affected by cancer.

MARCH 2017

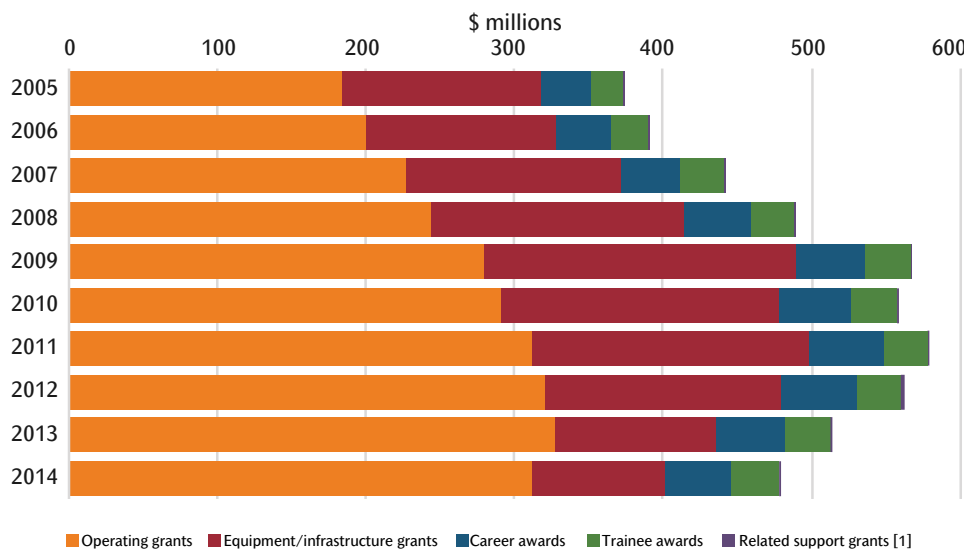
FIGURE 1
CANCER RESEARCH INVESTMENT, 2005-2014



DEFINITIONS OF FUNDING MECHANISMS

Operating grants support all the direct costs involved in conducting specific research projects including salaries for laboratory staff and research assistants, costs of supplies, samples, etc. The funding programs supporting these grants may be open (non-focused) or focused on specific cancer sites and/or research areas. **Equipment/infrastructure** grants cover the cost of new research facilities, equipment, software, databases, etc. needed for the research activities of one or more researchers. **Career awards**, also known as salary awards, provide protected time for research. **Trainee awards** support exceptional trainees during their undergraduate, graduate, or post-graduate training. **Related support grants** cover conference travel, workshops costs as well as researcher time for proposal development. For detailed definitions of funding mechanisms, please consult our 2008–2012 trends report.

FIGURE 2
CANCER RESEARCH INVESTMENT BY FUNDING MECHANISM, 2005-2014



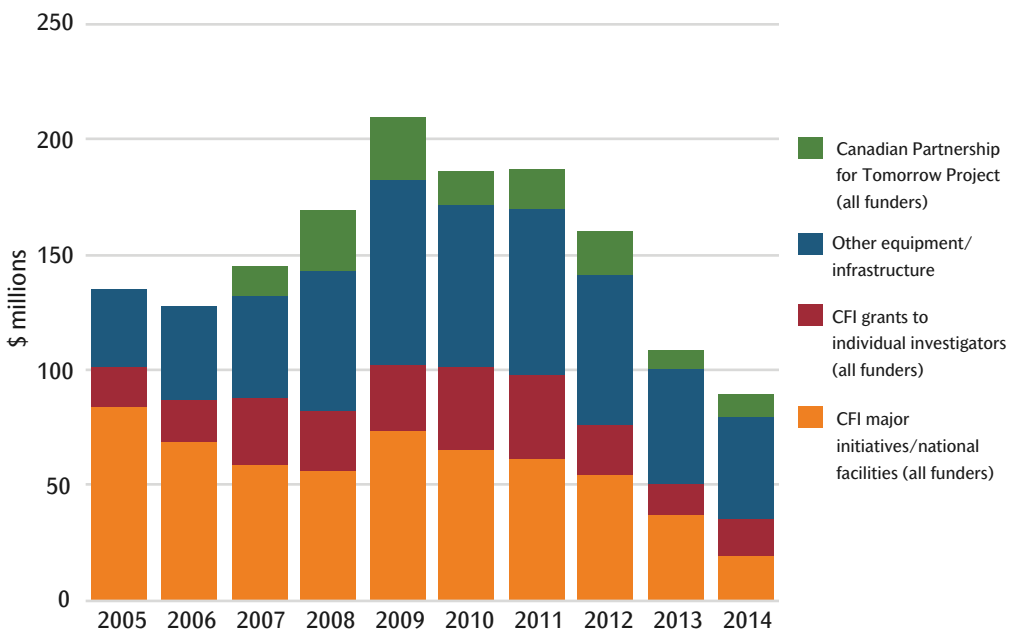
[1] Related support grants account for less than one percent of the investment and are difficult to see on the graph.

- From 2005 to 2014, nearly five billion dollars was invested in cancer research by the 42 organizations captured in the CCRS and their partners, with \$2.7 billion being in the latest quinquennial (Figure 1 inset). The investment trend showed a steep increase from 2005 to 2009, plateaued for years 2010 to 2012 and then declined slightly in 2013 and again in 2014 (Figure 1). There were 19,621 projects that received funding in the decade and these projects varied in their cancer relevance from 5% to 100%.
- There was a change in the distribution of the investment by funding mechanism (Figure 2). The investment in operating grants grew each year until 2014. Years 2008 to 2012 were characterized by expanded investment in equipment/ infrastructure largely through programs administered by the Canada Foundation for Innovation (CFI), the Ontario Institute for Cancer Research (OICR), the Canadian Institutes of Health Research (CIHR), the Canadian Partnership Against Cancer, the Alberta Cancer Foundation and Alberta Innovates.
- The investment in equipment/ infrastructure varied according to the type of funding program/project (Figure 3, next page). The investment in the Canadian Partnership for Tomorrow Project, funded by the Canadian Partnership Against Cancer and provincial funders, is separately identified as it represented 9% of the entire equipment/infrastructure investment over the decade. Of note, the investment from 2012 to 2013 dropped by \$8M or more for each type of funding program/project.

IMPORTANT

Data are updated annually and will vary from previously published reports. Investment figures presented are nominal, not adjusted for inflation. Figures may differ from those reported by contributing organizations because investments are prorated to calendar year periods. This report focuses on investment trends from 2005 to 2014 as well as differences in the two quinquennials, 2005–2009 and 2010–2014.

FIGURE 3
CANCER RESEARCH INVESTMENT IN EQUIPMENT/INFRASTRUCTURE GRANTS BY TYPE, 2005-2014



- The increased investment in operating grants was fuelled by an increase in investment through priority-driven programs, and this increase was significant for regional funders (Figure 4).
- When stratified by research pillar, investment in biomedical research was higher in the 2010–2014 period regardless of whether the program was national or regional, investigator-initiated or priority-driven (Figure 5, next page). In terms of the ten-year view, cumulative investment in operating grants supporting biomedical research was \$2.2 billion, or 80% of the total investment in operating grants.
- The operating grant investments in clinical research and health services research also increased from the first to the second quinquennial.

Investigator-initiated programs support research that is determined solely by the researcher. One example would be CIHR’s open operating grants program. **Priority-driven programs** support research that focuses on the priorities/foci articulated by the funding organization. Genome Canada’s Applied Genomics and Proteomics Research in Human Health program is one example of a priority-driven program.

FIGURE 4
CANCER RESEARCH INVESTMENT IN OPERATING GRANTS BY PROGRAM REACH AND FOCUS, 2005-2014

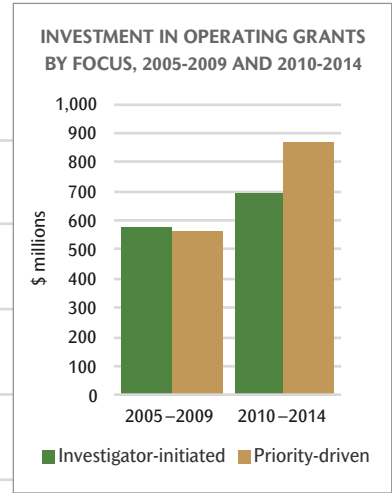
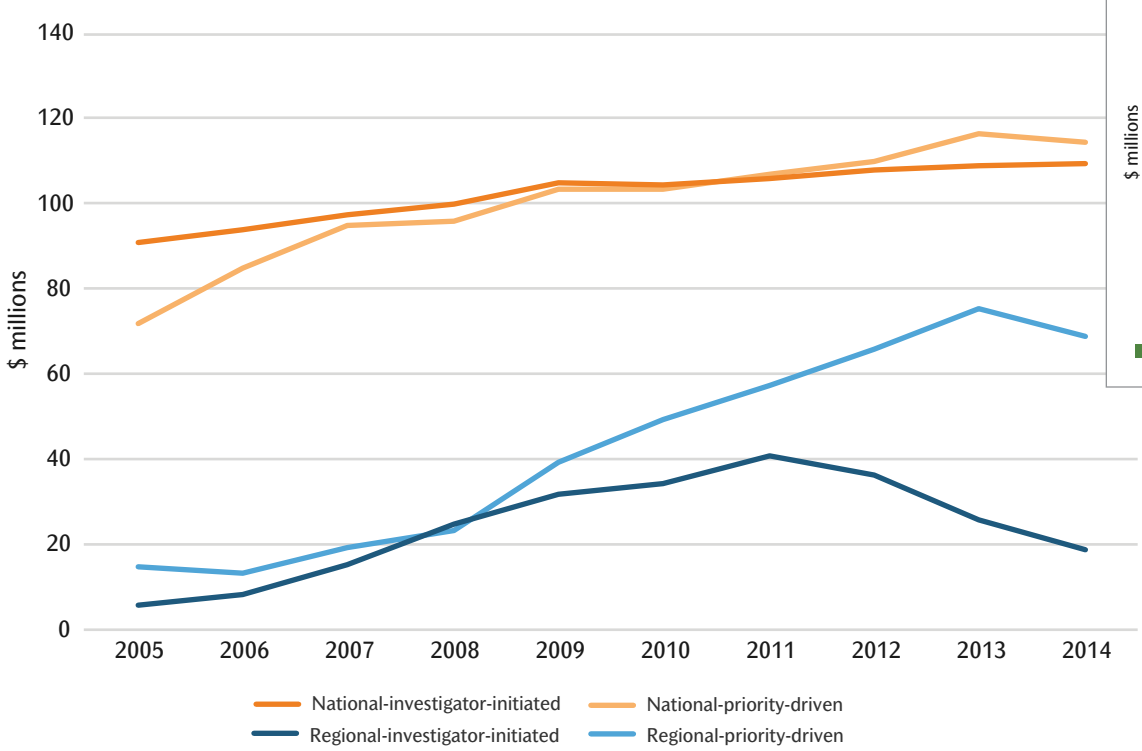
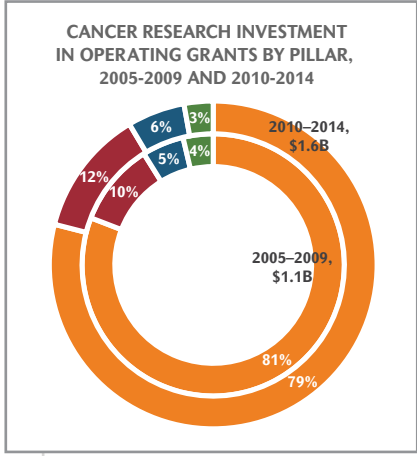
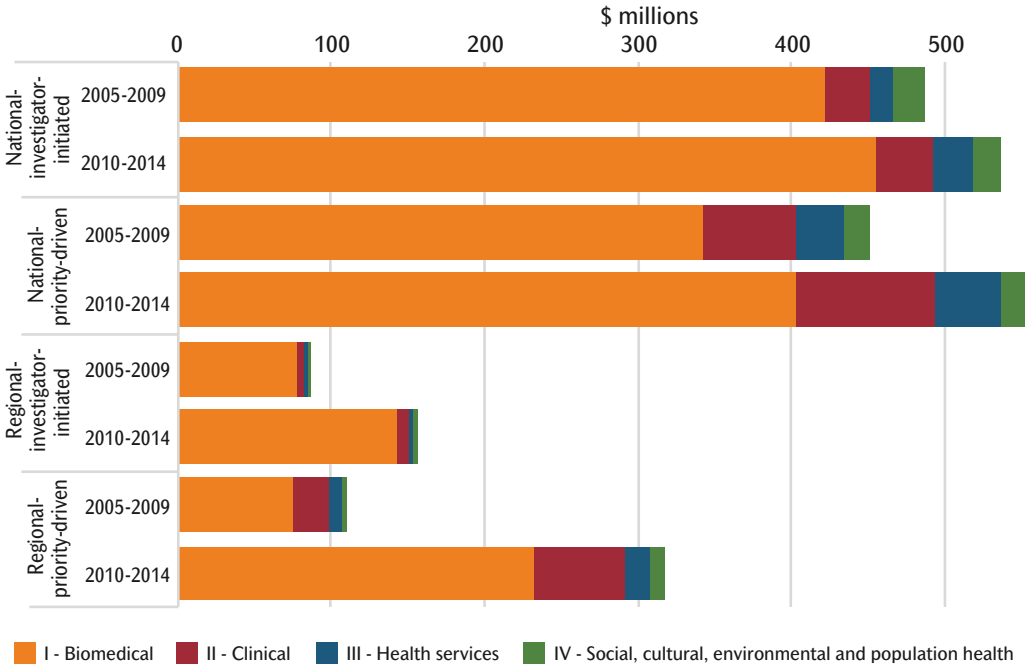


FIGURE 5
CANCER RESEARCH INVESTMENT IN OPERATING GRANTS BY PROGRAM REACH, FOCUS AND PILLAR, 2005-2009 AND 2010-2014



DEFINITIONS OF RESEARCH PILLARS*

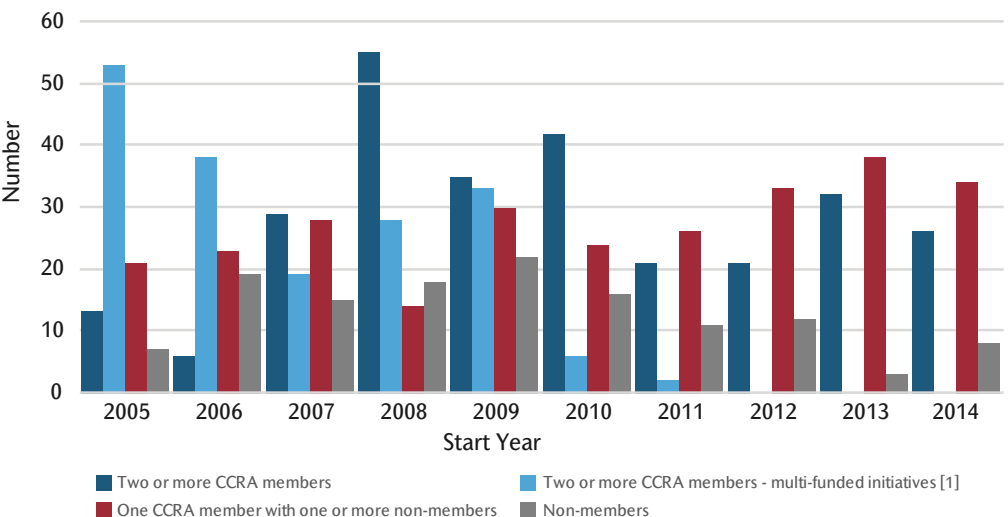
I. Biomedical: Research with the goal of understanding normal and abnormal human functioning, at the molecular, cellular, organ system and whole body levels, including development of tools and techniques to be applied for this purpose. **II. Clinical:** Research with the goal of improving the diagnosis, and treatment (including rehabilitation and palliation), of disease and injury; and improving the health and quality of life of individuals as they pass through normal life stages. **III. Health services:** Research with the goal of improving the efficiency and effectiveness of health professionals and the health care system, through changes to practice and policy. **IV. Social, cultural, environmental and population health:** Research with the goal of improving the health of the Canadian population, or of defined sub-populations, through a better understanding of the ways in which social, cultural, environmental, occupational and economic factors determine health status.

*Source: Canadian Institutes of Health Research

Application: Within the CCRS, each project was coded to a single pillar. Biomedical projects with a clinical component were assigned to Pillar II.

- Part of CCRA's mandate is to facilitate funding partnership among members around research projects of mutual interest. Figure 6 presents the number of partnered operating grants by grant start year for projects by type of partnership. Non-members are funding organizations that are tracked in the survey but are not CCRA members. The data show that partnered projects that were not already part of the three multi-funded initiatives increased from the early part of the decade, but the spike in 2008 has not been maintained. The number of projects where a CCRA member partnered with a non-member, however, was higher in the last part of the decade than it was in the beginning.

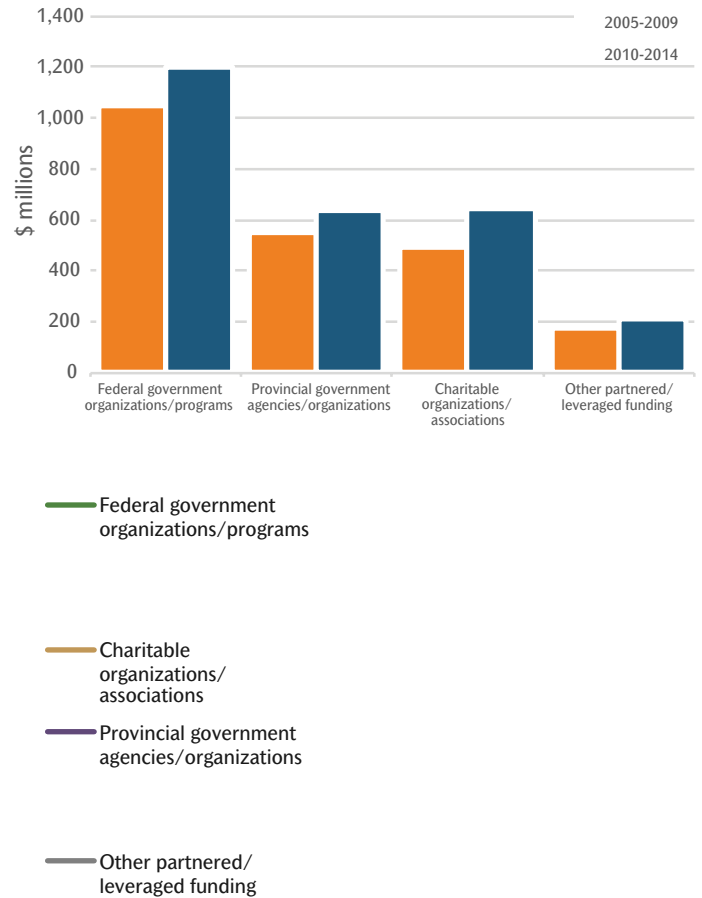
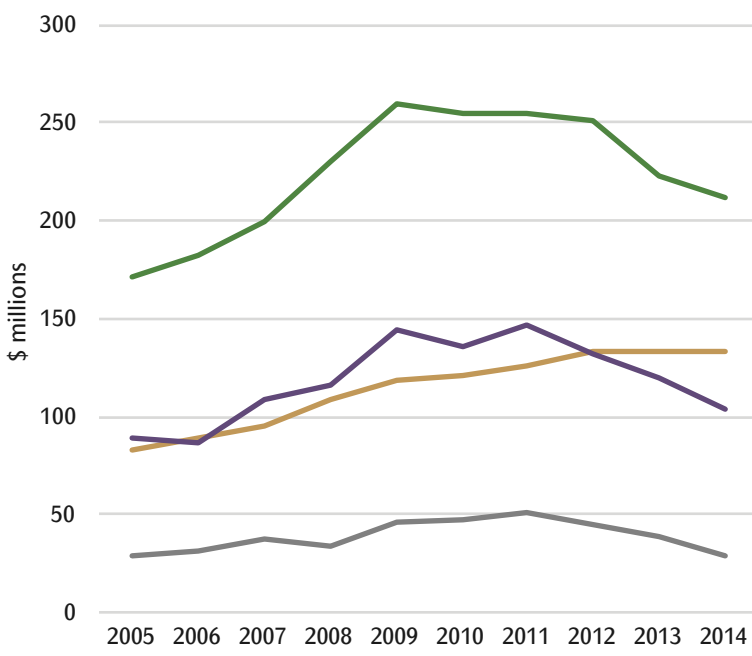
FIGURE 6
NUMBER OF PARTNERED OPERATING GRANTS BY TYPE AND GRANT START YEAR, 2005-2014



[1] Multi-funded initiatives include the Canadian Breast Cancer Research Alliance (which ended in 2010, although two programs with residual funds were funded in 2011), the Canadian Tobacco Control Research Initiative (which ended in 2009), and the Canadian Prostate Cancer Research Initiative (which ended in 2009).

CANCER RESEARCH INVESTMENT BY FUNDING SECTOR, 2005-2009 AND 2010-2014

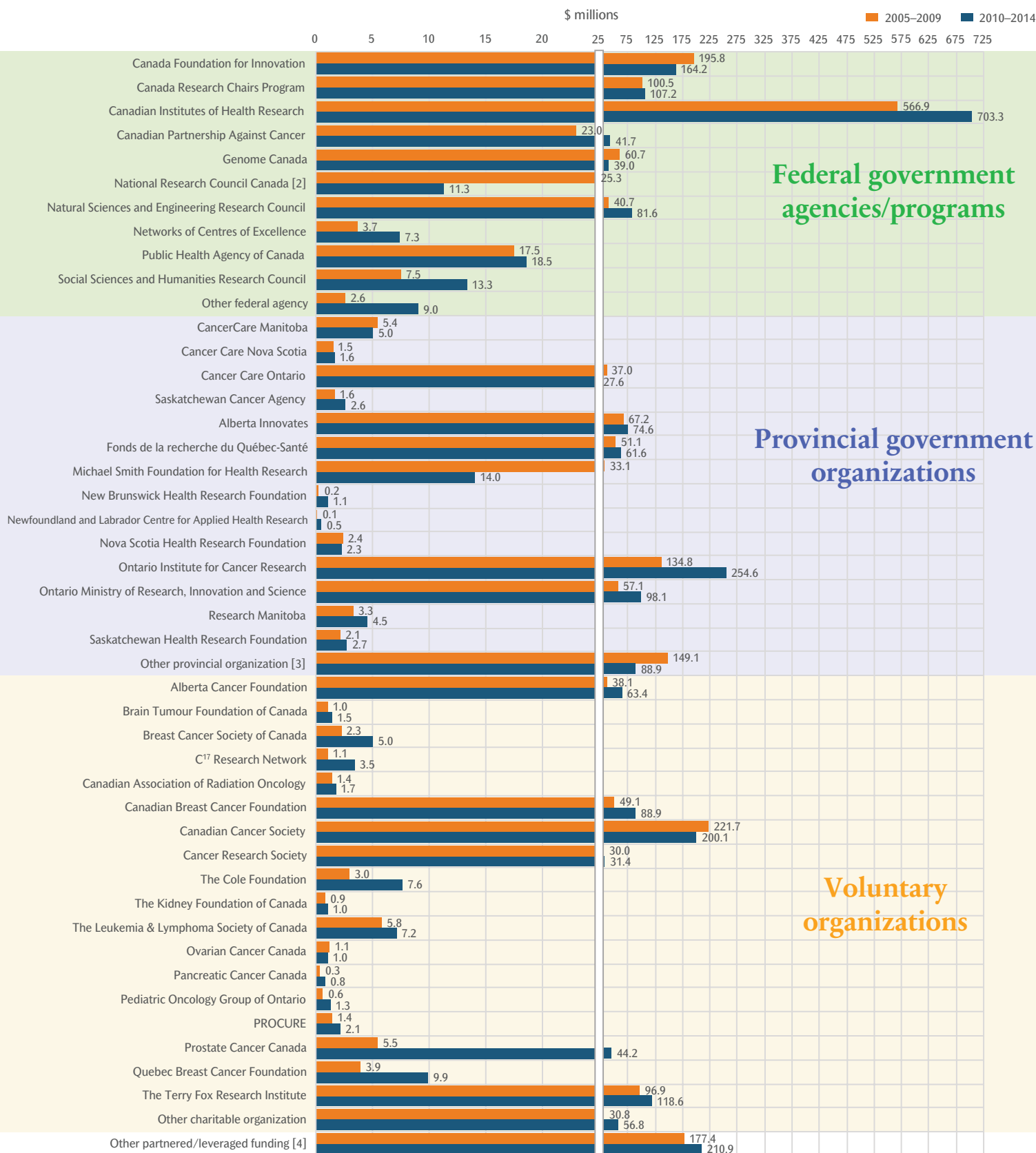
FIGURE 7
CANCER RESEARCH INVESTMENT BY FUNDING SECTOR, 2005-2014



- The increase in the investment from the first to the second quinquennial was found across funding sectors, although there were decreased investments in recent years for all sectors but the voluntary sector, which is comprised of charitable organizations and associations (Figure 7).
- Organization-specific data for all ten years is presented in supplementary data tables available on the CCRA website. Considering the investment over the entire ten years, two-thirds of the investment was accounted for by seven organizations: CIHR, the Canadian Cancer Society (CCS), OICR, CFI, The Terry Fox Research Institute, and the Canada Research Chairs Program. CIHR was the largest overall funder, accounting for one of every four dollars invested in the decade.
- In Figure 8 (next page) the investment by quinquennial is presented for all 42 organizations tracked in the survey. This graph has a broken axis so that investment data for all organizations can be viewed in a single graph.
- There were significant changes in the investments from the first to the second period for several organizations. Among the Federal government agencies/organizations, the investment for CIHR had the largest increase (\$136.4M), but other organizations also had increased investments in excess of five million dollars—the Natural Sciences and Engineering Research Council (\$40.8M), the Canadian Partnership Against Cancer (\$18.7M), the Canada Research Chairs Program (\$6.7M), and the Social Sciences and Humanities Research Council (\$5.9M). For CFI and Genome Canada, the investments in 2010–2014 were lower than in 2005–2009 by \$31.5M and \$21.7M, respectively.
- Among the provincial organizations, OICR and the Ontario Ministry of Research, Innovation and Science had the highest investment gains from the first to the second period at \$119.8M and \$40.9M, respectively, but Fonds de la recherche du Québec - Santé (FRQS) and Alberta Innovates also had multi-million dollar increases (FRQS at \$10.5M and Alberta Innovates at \$7.4M). The investments were significantly lower in the second quinquennial for both Michael Smith Foundation for Health Research (\$19.0M) and Cancer Care Ontario (\$9.4M).
- In terms of the organizations within the voluntary sector, large increases in investment from the first to the second period were found for the Canadian Breast Cancer Foundation (\$39.7M), Prostate Cancer Canada (\$38.8M), Alberta Cancer Foundation (\$25.3M), and The Terry Fox Research Institute (\$21.7M). CCS had the largest reduction in the investment from 2005–2009 to 2010–2014 at \$21.6M.

FIGURE 8

CANCER RESEARCH INVESTMENT BY PARTICIPATING ORGANIZATIONS/PROGRAMS, 2005-2009 AND 2010-2014 [1]



[1] For detailed annual investments by funding organization, please consult the supplementary data file available on the CCRA website.

[2] No new data were supplied for years 2011 to 2014.

[3] Includes provincial support for CFI grants as well as other provincial funding.

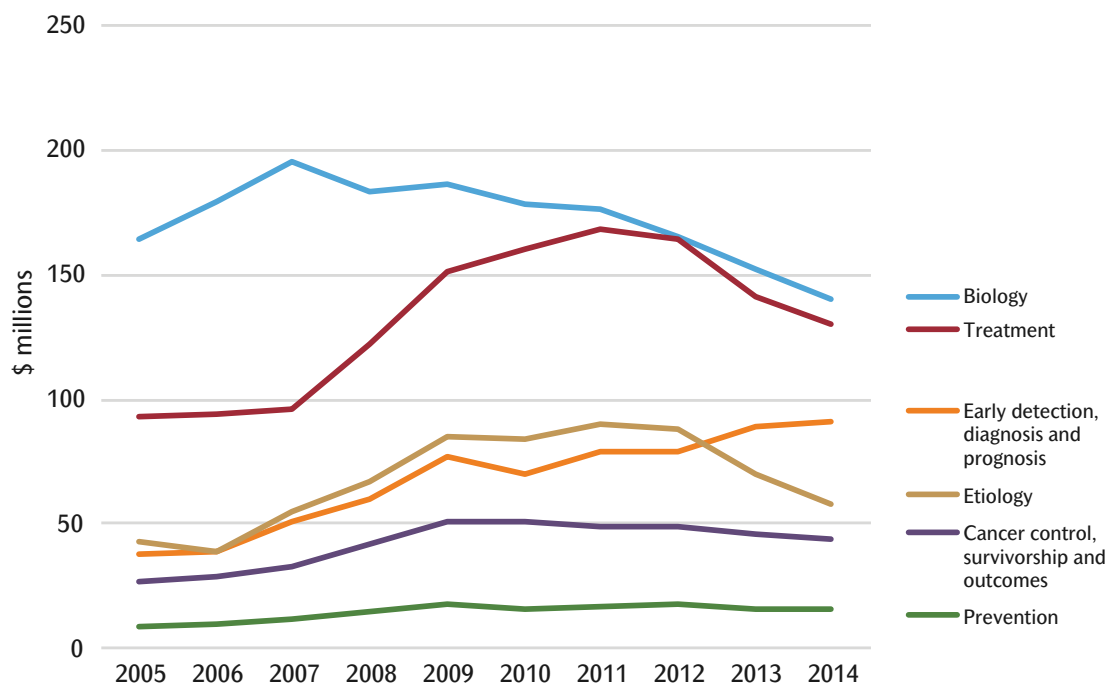
[4] Co-funding of projects supported by organizations participating in the CCRA by institutional, industry, and foreign sources.

- In terms of the CSO categories, all categories but Biology, were higher at the end of the decade than they were at the beginning of the decade (Figure 9). The investment in Early detection, diagnosis and prognosis had the highest net gain from 2005 to 2014 and was the only area that showed an increase in 2014. There was \$53M more invested in this area in 2014 than in 2005. Six organizations accounted for 55% of the investment in Early detection, diagnosis and prognosis in 2014: CIHR (19%), OICR (12%), the Natural Sciences and Engineering Research Council (7%), Prostate Cancer Canada (6%), The Terry Fox Research Institute (6%), and Alberta Cancer Foundation (5%).

- Investment in Treatment research also had a significant net increase—\$37.4M more in 2014 than in 2005. Six organizations accounted for nearly 60% of the investment in Treatment research in 2014: CIHR (24%), CCS (11%), OICR (10%), Natural Sciences and Engineering Research Council (5%), The Terry Fox Research Institute (5%), and the Canadian Breast Cancer Foundation (4%).

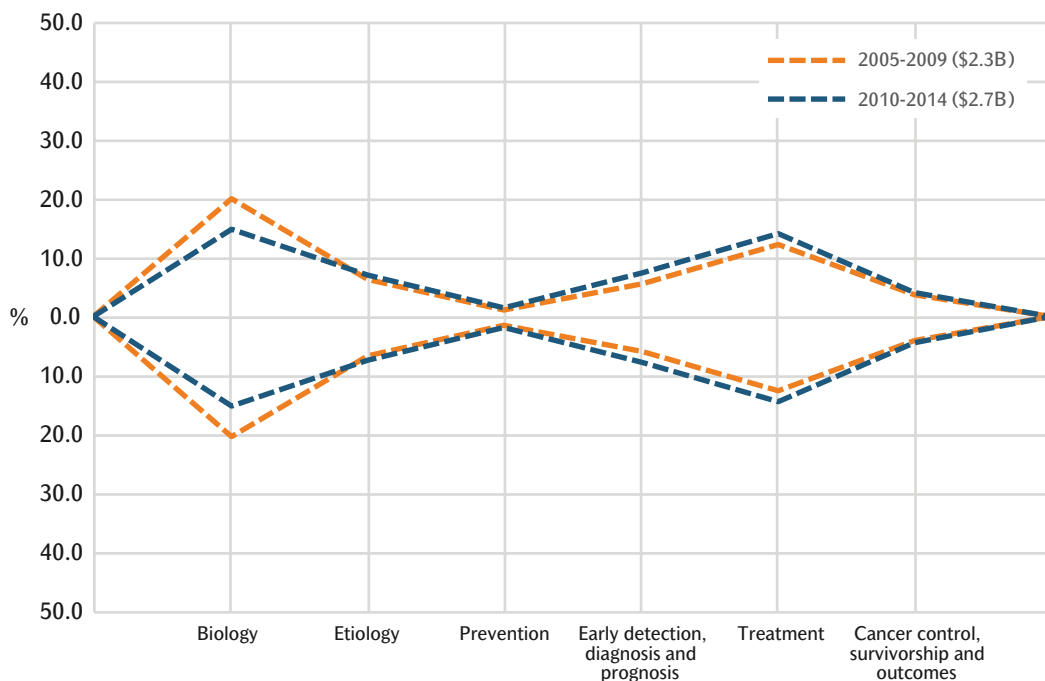
- The change in the distribution of the investment by CSO from the first to the second quinquennial echoes the patterns found in the ten-year trend above (Figure 10). The diminishing investment in Biology was largely attributable to funding declines by Canada Foundation Innovation (and concomitant provincial funding), the CCS, Genome Canada and, to a lesser extent, The Terry Fox Research Institute and Cancer Care Ontario.

FIGURE 9
CANCER RESEARCH INVESTMENT BY CSO V.2 CATEGORY [1], 2005–2014



[1] For further information about the Common Scientific Outline (CSO) V.2, please see <https://www.icrpartnership.org/cso>.

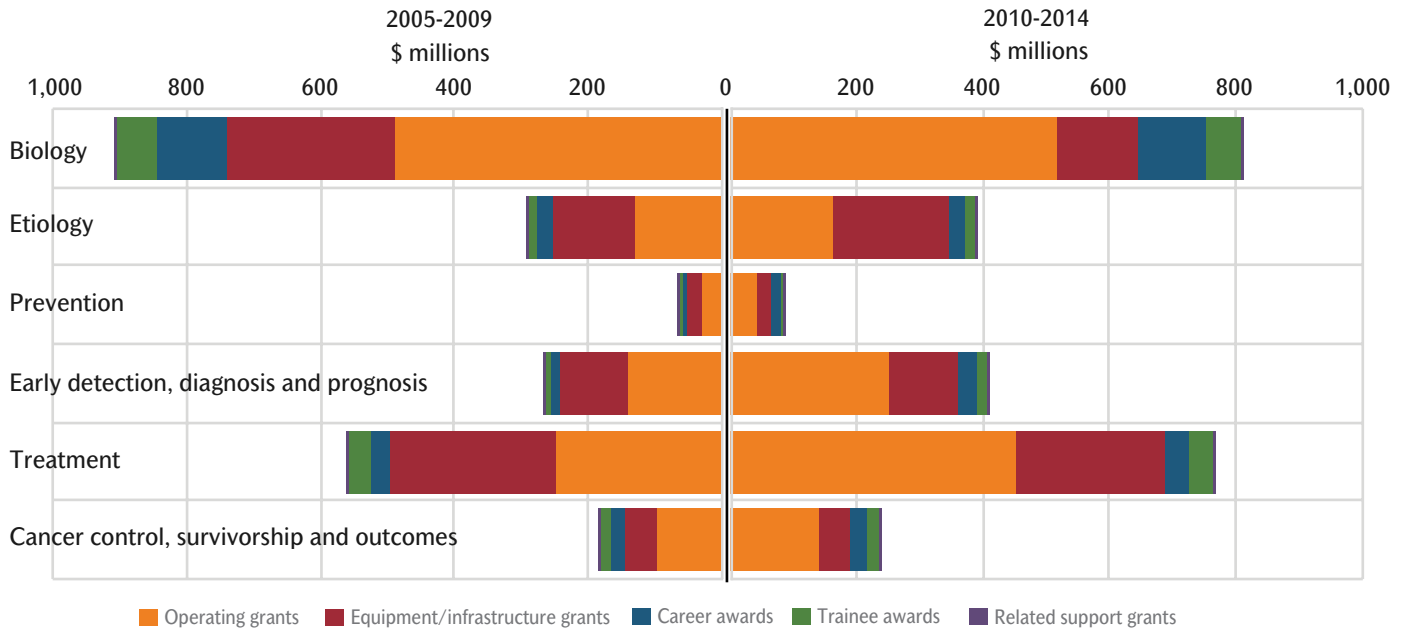
FIGURE 10
DISTRIBUTION OF CANCER RESEARCH INVESTMENT BY CSO V.2 CATEGORY [1], 2005–2009 AND 2010–2014



Proportion of investment	2005-2009	2010-2014
Biology	40	30
Etiology	13	14
Prevention	3	3
Early detection, diagnosis and prognosis	12	15
Treatment	25	28
Cancer control, survivorship and outcomes	8	9

[1] For further information about the Common Scientific Outline (CSO) V.2, please see <https://www.icrpartnership.org/cso>.

FIGURE 11
CANCER RESEARCH INVESTMENT BY FUNDING MECHANISMS FOR CSO CATEGORIES, 2005-2009 AND 2010-2014



- The increased investment in operating grants was across all CSO categories, although the increase was most pronounced in the Treatment and Early detection, diagnosis and prognosis categories (Figure 11). The reduction in equipment/infrastructure funding was largest in the Biology category.
- Considering only the operating grant investment, the investment in Biology was significantly larger than the other CSO categories when investigator-initiated programs were examined in either period (Figure 12). The investment pattern for priority-driven programs showed much higher investments for Treatment, Early detection, diagnosis and prognosis, and to a lesser extent, Cancer control, survivorship and outcomes. This suggests that priority-driven operating grant programs provided important sources of funding for research in areas other than Biology.

FIGURE 12
CANCER RESEARCH INVESTMENT IN OPERATING GRANTS BY CSO V.2 CATEGORY BY PROGRAM FOCUS, 2005-2009 AND 2010-2014

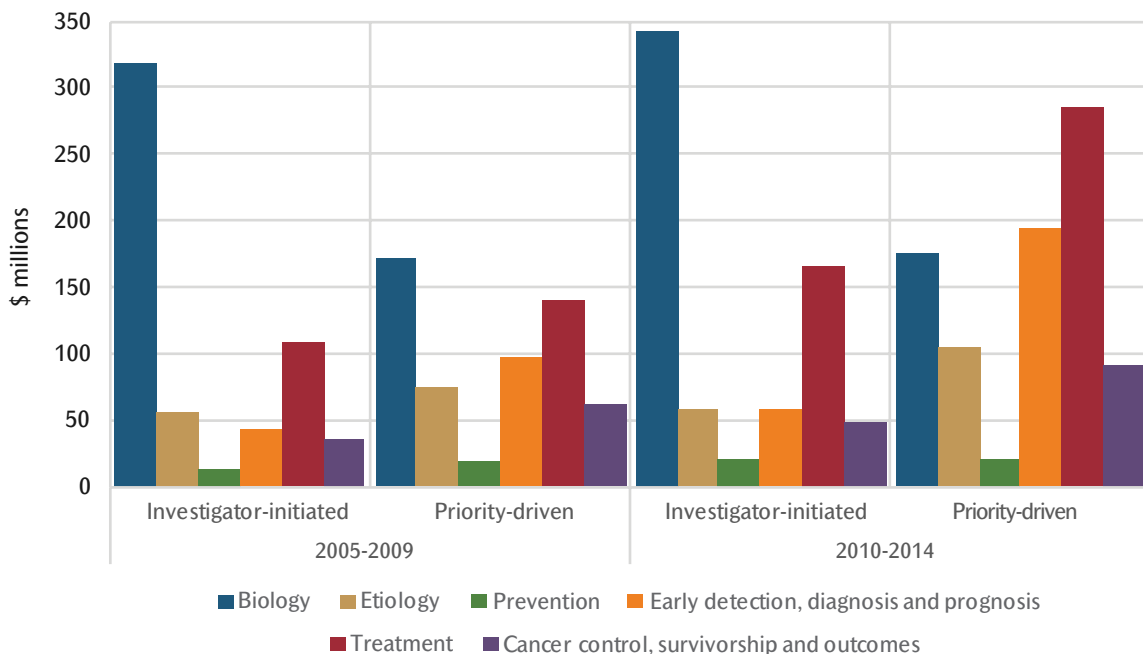
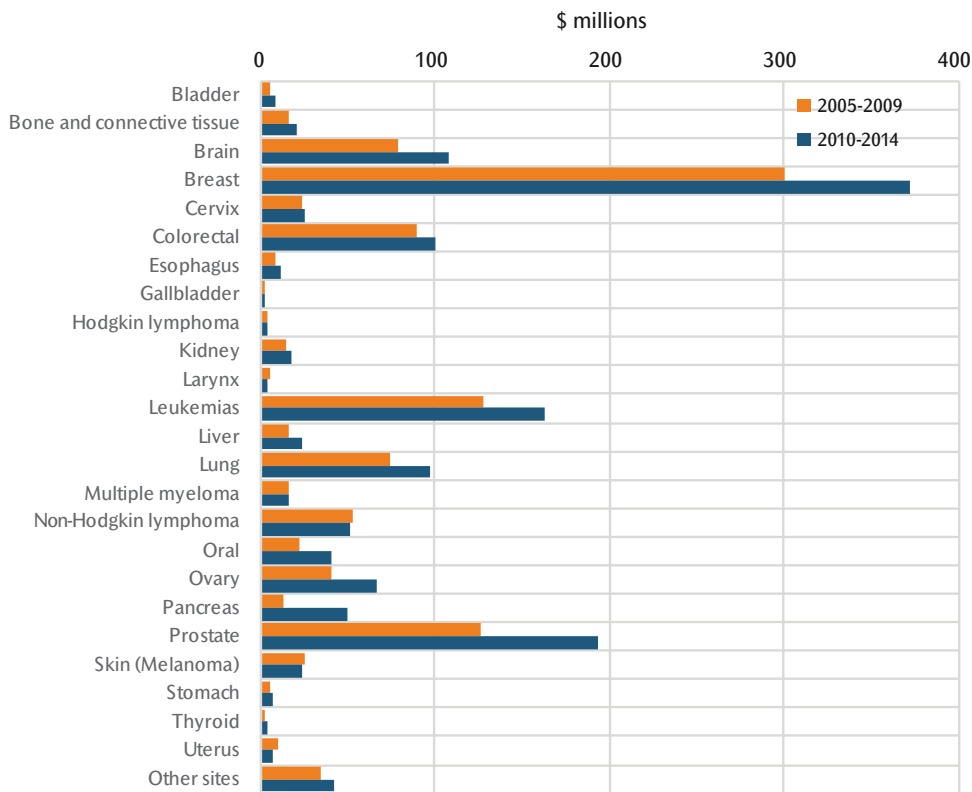


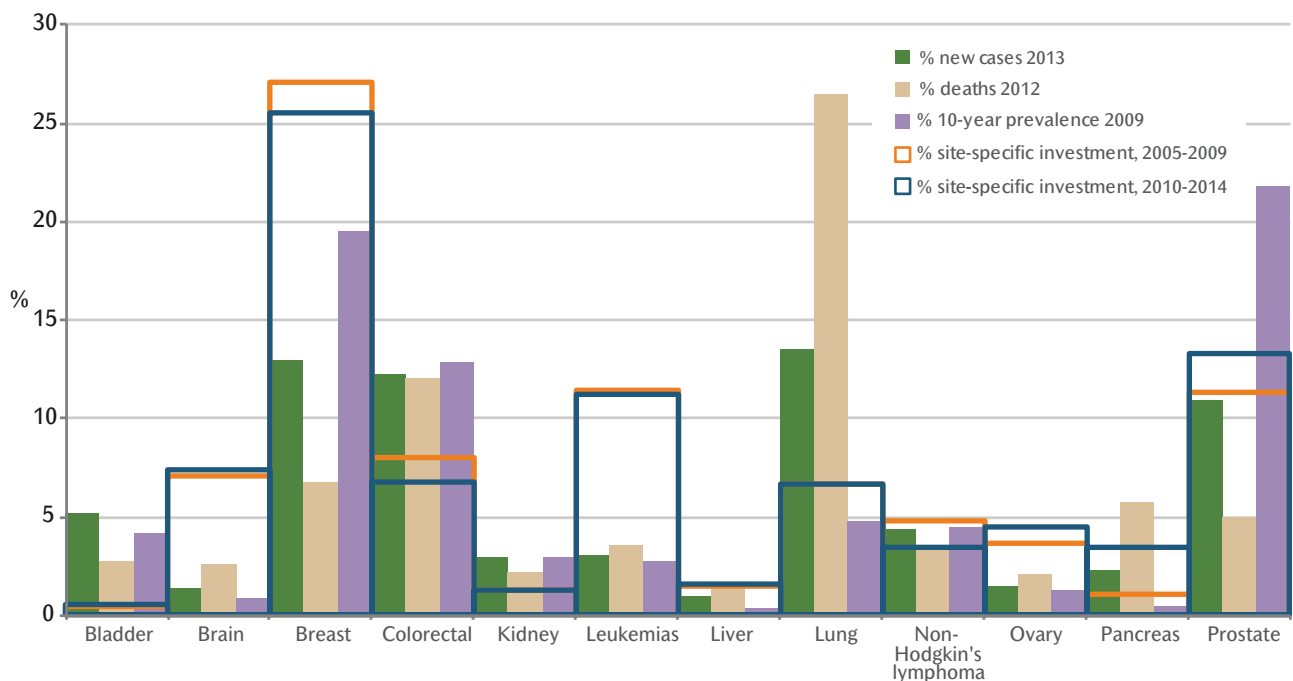
FIGURE 13
CANCER RESEARCH INVESTMENT BY CANCER SITE, 2005-2009 AND 2010-2014 [1]



[1] For detailed annual investments by cancer site, please consult the supplementary data file available on the CCRA website.

- There was proportionately more research focused on one or more specific cancer sites in the second quinquennial, 54% in 2010–2014 compared to 49% in 2005–2009. The investment in breast cancer comprised over one-quarter of the total site-specific investment in both periods.
- For a number of sites, the investment increased at more than \$5M from 2005–2009 to 2010–2014. In descending order, these sites were: breast (\$71.4M), prostate (\$66.7M), pancreas (\$37.8M), leukemias (\$35.9M), brain (\$28.5M), ovary (\$25.8M), lung (\$22.8M), colorectal (\$9.8M), and liver (\$7.4M) (Figure 13).
- Pancreas, prostate, and ovarian cancer research comprised proportionately more of the site-specific investment in 2010–2014, while breast, non-Hodgkin’s lymphoma and colorectal represented proportionately less (Figure 14). There remains a poor correlation between disease burden and site-specific research investment, especially for lung and colorectal cancers, which account for significant cancer burden.

FIGURE 14
DISTRIBUTION OF SITE-SPECIFIC CANCER RESEARCH INVESTMENT IN 2005–2009 AND 2010–2014 BY NEW CANCER CASES IN 2013 [1], CANCER DEATHS IN 2012 [2] AND 10-YEAR PREVALENCE [3], SELECTED CANCER SITES

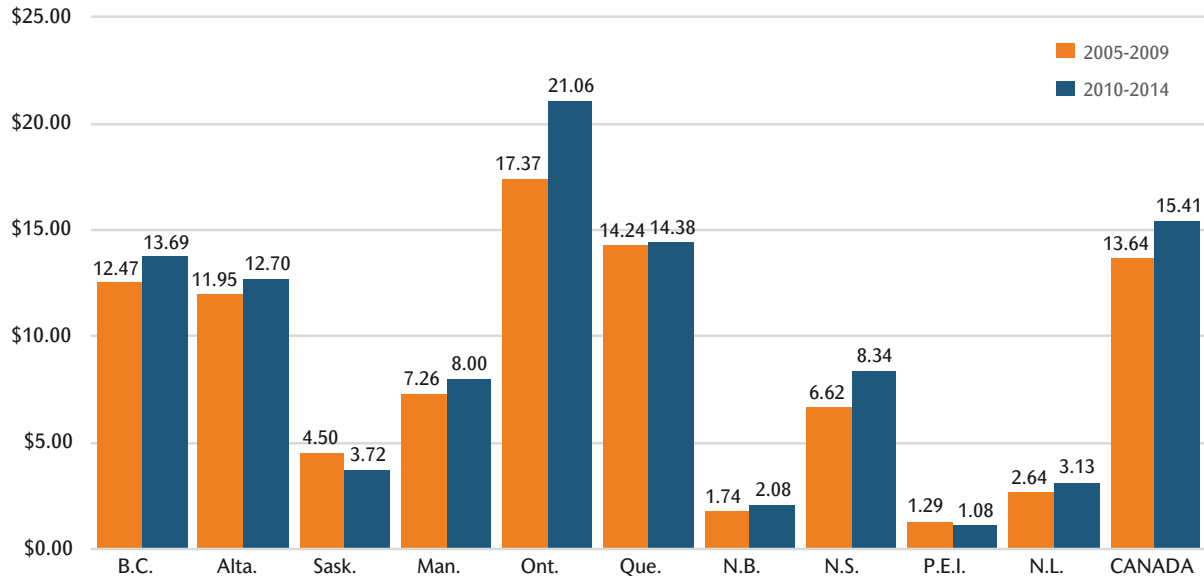


[1] Source: Statistics Canada. Table 103-0553 - New cases and 1991 age-standardized rate for primary cancer (based on the August 2015 CCR tabulation file), by cancer type and sex, Canada, provinces and territories, annual (accessed: February 3, 2017)

[2] Source: Statistics Canada. Table 102-0522 - Deaths, by cause, Chapter II: Neoplasms (C00 to D48), age group and sex, Canada, annual (number), CANSIM (database). (accessed: February 3, 2017)

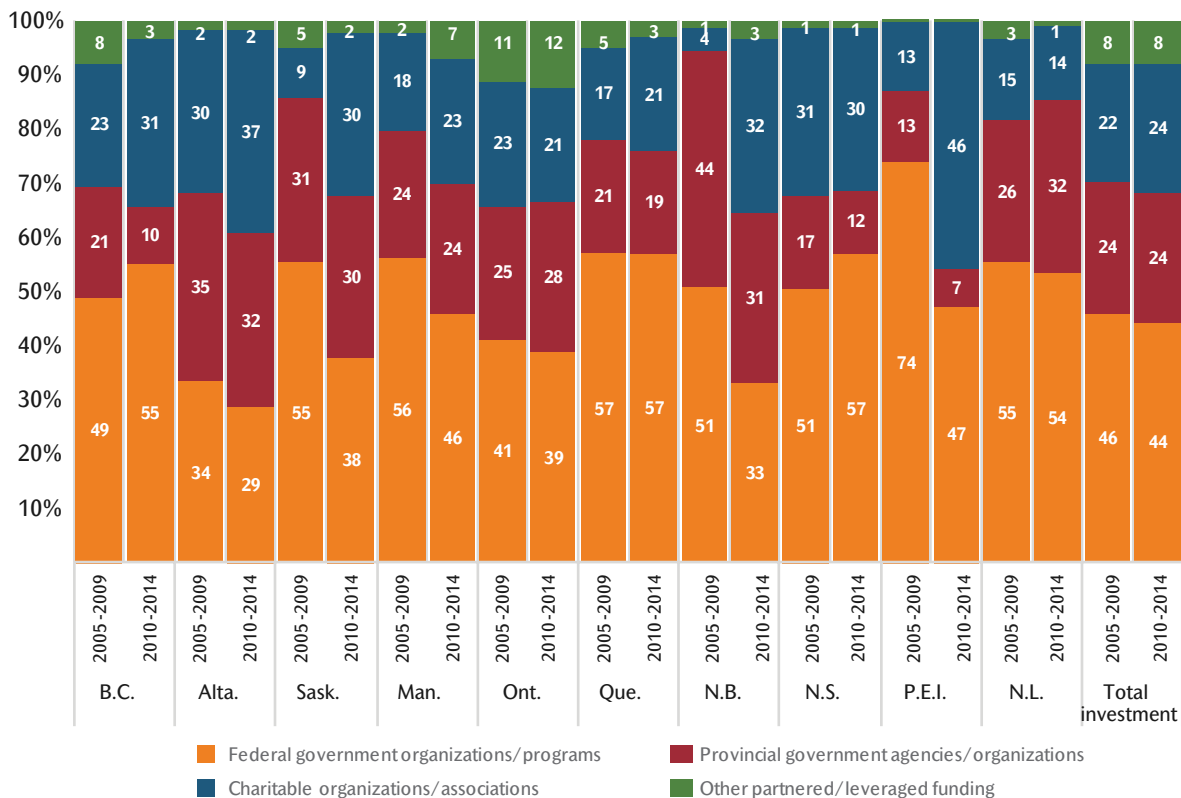
[3] Source: Canadian Cancer Society’s Advisory Committee on Cancer Statistics (2016). Canadian Cancer Statistics 2016. Toronto, ON: Canadian Cancer Society.

FIGURE 15
PER CAPITA CANCER RESEARCH INVESTMENT BY PROVINCE OF NOMINATED PRINCIPAL INVESTIGATOR, 2005-2009 AND 2010-2014



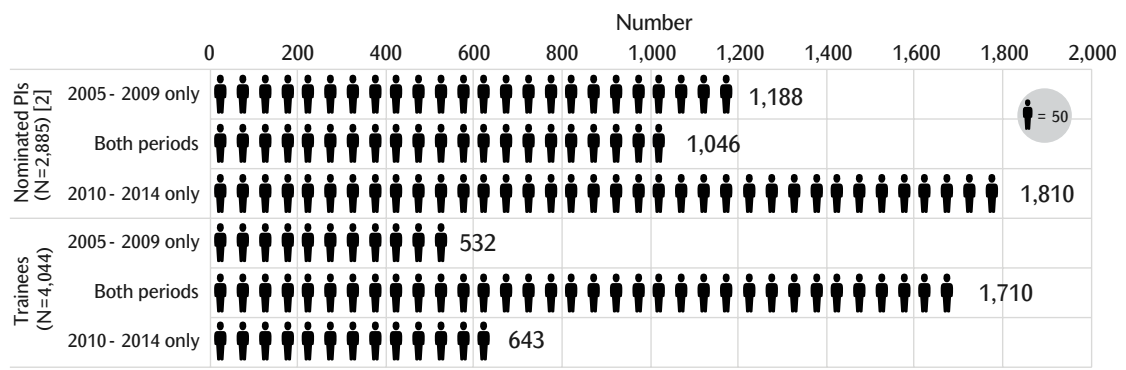
- The investment in the two periods stratified by the province of the nominated principal investigator (PI) and examined on a per capita basis showed the largest increases from 2005–2009 to 2010–2014 for Ontario, Nova Scotia and British Columbia (Figure 15).
- The distribution of the investment by funding sector for each province varied from period to period (Figure 16). Observable shifts in the distributions of the province-specific investments were found for Prince Edward Island, Nova Scotia, New Brunswick, and Saskatchewan. These variations are, in part, due to the small number of projects involved.

FIGURE 16
DISTRIBUTION OF CANCER RESEARCH INVESTMENT BY FUNDING SECTOR FOR PROVINCES OF NOMINATED PRINCIPAL INVESTIGATORS, 2005-2009 AND 2010-2014



- From 2005 to 2014, there were 2,885 nominated PIs who received one or more operating grant, career award, and/or equipment/ infrastructure grant where at least one of these grants had a cancer relevance of 80% or higher. There was a net gain of 111 nominated PIs from 2005-2009 to 2010-2014 (Figure 17).
- Although the vast majority of trainees are supported through operating grants, a small group of trainees do receive awards to facilitate completion of their research training. There were 4,044 recipients of trainee awards over the course of the decade. Of these, 201 (5%) had subsequently received an operating grant, career award or equipment/ infrastructure grant within the ten-year period.
- There was \$17.5M more invested in graduate-level trainee awards in 2010–2014 than 2005–2009 (Figure 18). CIHR alone represented 45% of the \$125.5M invested in graduate-level awards over the decade. Among post-doctoral awards, there was an increase of \$9.2M by regional funders from the first to the second quinquennial.
- The distribution of the investment in operating grants and trainee awards by CSO category is shown in Figure 19. There was proportionately more investment in the Biology and Cancer control, survivorship and outcomes for trainee awards in both quinquennials when compared with operating grants.

FIGURE 17
NUMBER OF RECIPIENTS OF GRANTS AND TRAINEE AWARDS [1] BY TIME PERIOD (N=6,728)



[1] Includes trainees or nominated PIs with at least one award/grant with a cancer weighting of 80% or more and active during one or both time periods. Recipients of related support grants who did not receive any other funding were not included.
 [2] Includes recipients of trainee awards who subsequently received one or more operating grant, career award, or equipment/infrastructure grant.

FIGURE 18
CANCER RESEARCH INVESTMENT IN TRAINING AWARDS BY PROGRAM REACH AND TIME PERIOD

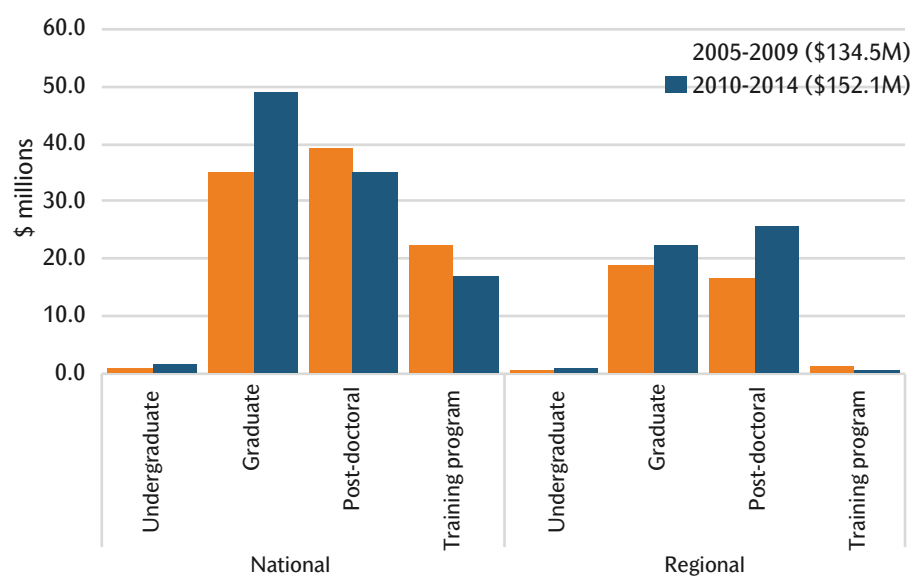
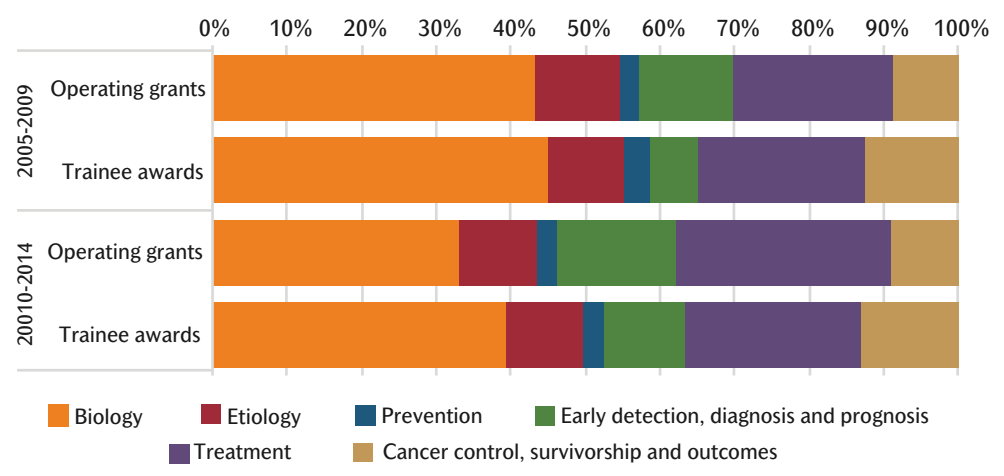


FIGURE 19
DISTRIBUTION OF CANCER RESEARCH INVESTMENT BY FUNDING MECHANISM AND CSO V.2 CATEGORY, 2005–2009 AND 2010–2014



OUR MEMBERS

Alberta Cancer Foundation	The Kidney Foundation of Canada
Alberta Innovates	The Leukemia & Lymphoma Society of Canada
Brain Tumour Foundation of Canada	Michael Smith Foundation for Health Research
Breast Cancer Society of Canada	National Research Council
BC Cancer Agency	Natural Sciences and Engineering Research Council of Canada
C ¹⁷ Research Network	New Brunswick Cancer Network
Canadian Association of Provincial Cancer Agencies	Nova Scotia Health Research Foundation
Canadian Association of Radiation Oncology	Ontario Institute for Cancer Research
Canadian Breast Cancer Foundation*	Ovarian Cancer Canada
Canadian Cancer Society	Pancreatic Cancer Canada
Canadian Institutes of Health Research	PROCURE
Canadian Partnership Against Cancer	Prostate Cancer Canada
CancerCare Manitoba	Public Health Agency of Canada
Cancer Care Nova Scotia	Quebec Breast Cancer Foundation
Cancer Care Ontario	Research Manitoba
Cancer Research Society	Saskatchewan Cancer Agency
Fonds de recherche du Québec – Santé	The Terry Fox Research Institute
Genome Canada	Affiliate member: BioCanRx

* As of February 1, 2017, the Canadian Cancer Society and the Canadian Breast Cancer Foundation merged operations. The data in this report reflects the investments made by these individual organizations prior to this merger.

For details on the methodology used for this report, please consult our report, *Cancer Research Investment in Canada, 2008–2012*, at <http://www.ccra-acrc.ca>. A slide deck based on the results of this analysis is also available on our website under the Publications menu. For additional copies of this publication, please contact us at info@ccra-acrc.ca. Electronic versions of updates of the research investments made in the areas of childhood and adolescent cancers, cancer risk and prevention, cancer survivorship, palliative and end-of-life care, and early translation are also available on our website.

ACKNOWLEDGEMENTS

We would like to thank the many organizations that participate in the CCRS by contributing their data on an annual basis. Without them, this report would not have been possible. We would also like to acknowledge the expert group who advised us on this report. Members are: Drs. Stuart Edmonds (Prostate Cancer Canada), Elizabeth Eisenhauer (Canadian Partnership Against Cancer/Canadian Cancer Research Alliance), Jim Hudson (Consultant), Stephen Robbins (Canadian Institutes of Health Research and Canadian Cancer Research Alliance), Sara Urowitz (Canadian Partnership Against Cancer/Canadian Cancer Research Alliance), Christine Williams (Ontario Institute for Cancer Research) and Michael Wortzman (Canadian Cancer Society).

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ISSN 1918-0619 (print) / ISSN 1918-0705 (PDF)

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