

INVESTMENT IN EARLY TRANSLATIONAL CANCER RESEARCH, 2005–2014

HIGHLIGHTS

- During the decade of 2005 to 2014, a total of \$1.6 billion was invested in translational cancer research. This represents nearly one-third of the overall investment in cancer research. The investment figures reported herein include the investments made in both non-clinical (i.e., credentialing, creation of modality, and pre-clinical phases) as well as clinical trials (Phases I through III) and investments made in major initiatives. The inclusion and coding criteria differ from what we have previously reported.
- The substantive rise in the investment in 2009 was attributable to the ramp-up of the Ontario Institute for Cancer Research (OICR) as well as increased investment in programs for major initiatives administered by the Canada Foundation for Innovation (CFI). OICR has a translational research mandate and 44% of its total cancer research investment is in this area.
- The \$281.9M growth in investment from 2005–2009 to 2010–2014 was largely the result of increased investment in two modalities—agents (drugs and biologics) and biospecimen-based risk assessment (protocols, reagents, devices/instruments that analyze blood and/or tissue)—although the investment in all modalities was up in the second quinquennial.
- All organizations covered in the CCRS had some investment in translational research, be it research funding or supporting infrastructure such as biorepositories. Thirteen organizations, however, accounted for 74% of the overall investment. While there were a few modality-specific differences, the Canadian Institutes for Health Research, OICR, and CFI were the organizations with the highest investments over the decade. Collectively, however, organizations within the voluntary sector (charities and non-profit associations) showed the greatest positive proportional change in investment from the first to the second quinquennial.
- Along with the increased investment in 2010–2014, there was an increase in the number of researchers and trainees, with 233 researchers in the second quinquennial who had not been funded in the first. The investment in trainee awards rose from the first to the second quinquennial by nearly \$14M, with much of this growth due to increased investment in graduate-level awards.

Cancer exacts a considerable toll. There is increasing emphasis on identifying ways to “translate” research and accelerate the speed at which the public will start to benefit from research advances. Translational research progressively moves laboratory findings and clinical research data into viable modalities that will assess, treat and prevent cancer.

This summary report describes the trend in investment in early translational cancer research in Canada for the decade 2005 to 2014. It updates a previous publication that covered the period 2005 to 2010, although the methodology is slightly different from that report. 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. We estimate that this report captures about 50% of the cancer-related early translational research occurring in the country.

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

PROJECT CLASSIFICATION [1] FOR EARLY TRANSLATIONAL CANCER RESEARCH

PHASE	MODALITY				
	RISK ASSESSMENT (RA) Research intended to characterize the cancer-related health status of an individual		INTERVENTIVE (INT) Research intended to change the cancer-related health status of an individual via prevention or treatment		
CREDENTIALING	I. Biospecimen-based Protocols, reagents, devices/instruments that analyze blood and/or tissue	II. Image-based Devices like MRI, CT, PET, etc. that identify, stage, and monitor cancer and response to treatment	I. Agents Drugs and biologics	II. Immune Response Modifiers Active and passive immunotherapies	III. Interventive Devices Radiation therapy, photodynamic therapy, cryoablation, etc.
CREATION OF MODALITY					
PRECLINICAL DEVELOPMENT					
CLINICAL TRIAL					
MAJOR INITIATIVE	Centres, networks, and platforms that support risk assessment research - e.g., BC Clinical Genomics		Centres, networks, and platforms that support interventional research - e.g., BioCanRx, Canadian Cancer Clinical Trials Network (3CTN)		

[1] Adopted from E.T. Hawk et al. (2009). The Translational Research Working Group Developmental Pathways: Introduction and Overview. *Clinical Cancer Research*,14(18), 5664–5671.

FIGURE 1
EARLY TRANSLATIONAL CANCER RESEARCH INVESTMENT, 2005–2014

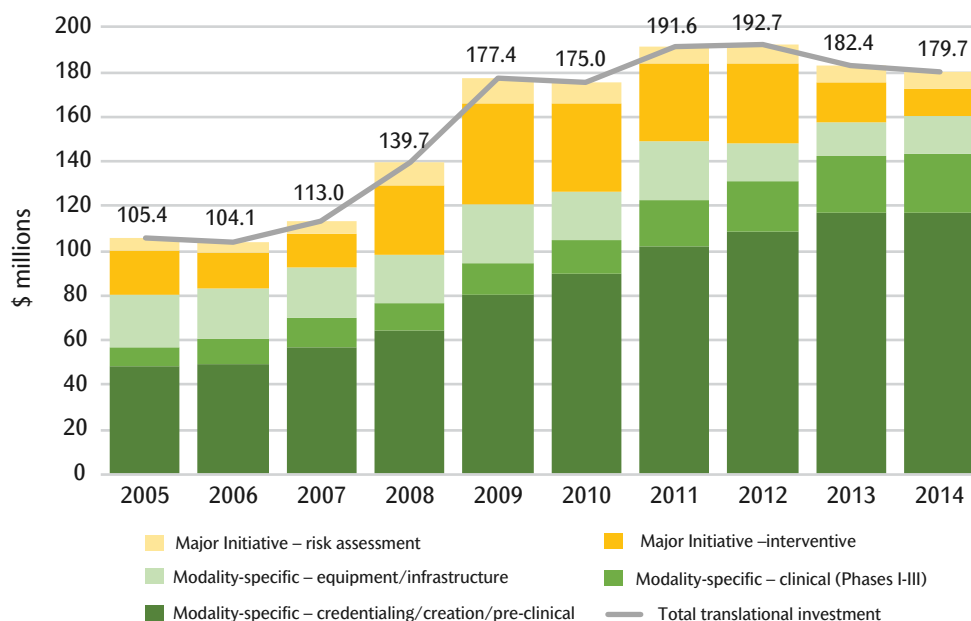
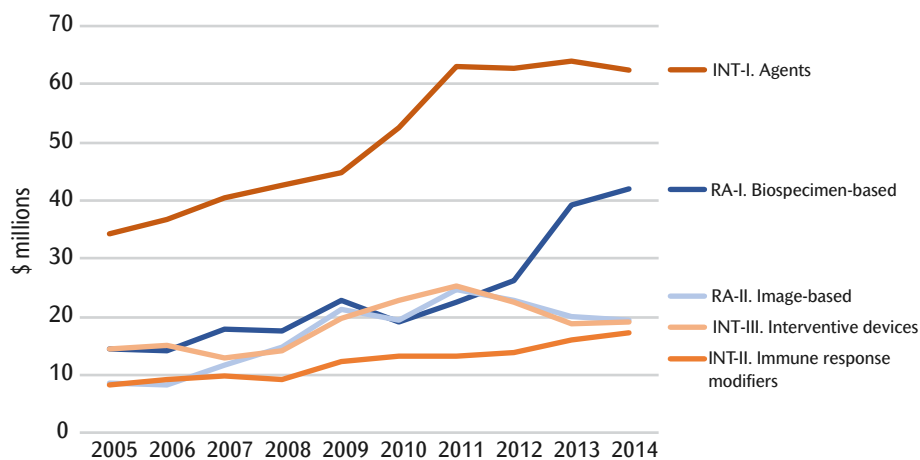


FIGURE 2
EARLY TRANSLATIONAL CANCER RESEARCH INVESTMENT BY MODALITY, 2005–2014 [1]



[1] This graph excludes the investment in major initiatives supporting either risk assessment or interventional modalities.

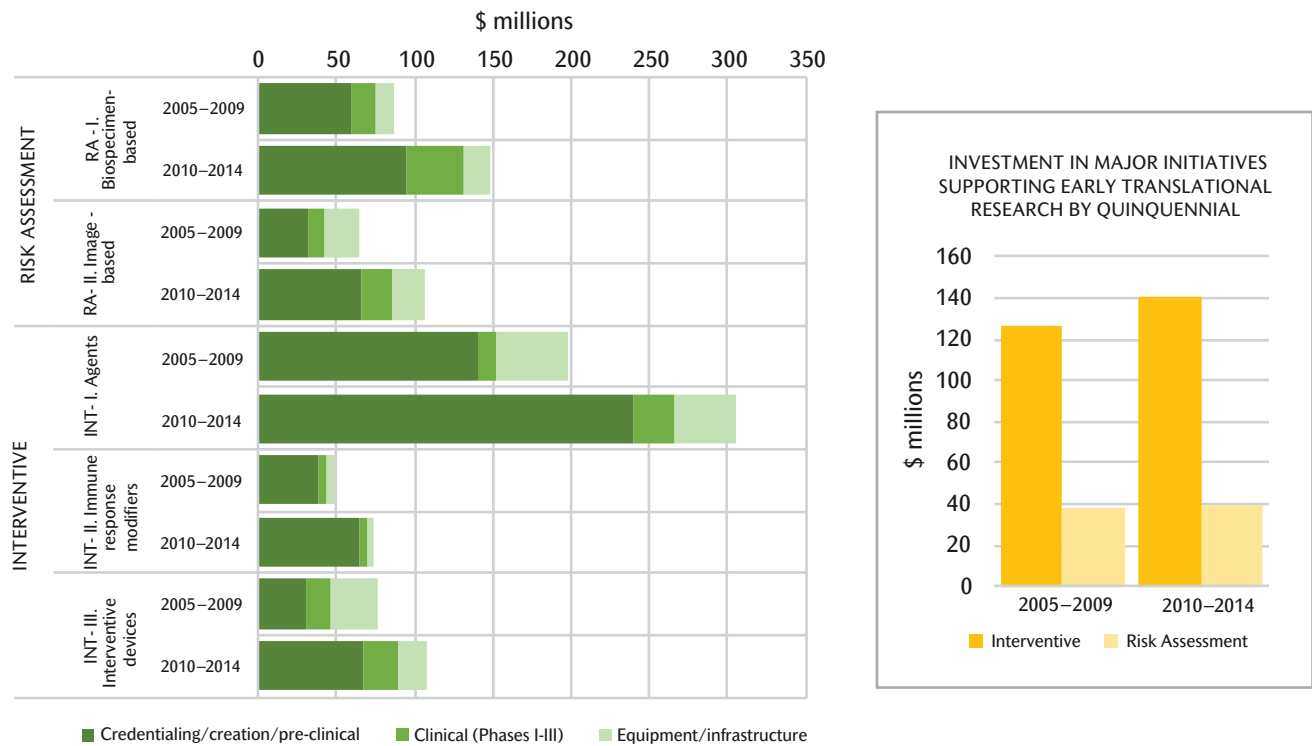
- A total of \$1.6 billion was invested during the decade in translational cancer research, which represents 32% of the overall cancer research investment. This included the investments made in both preclinical and clinical research as well as the investments made in major initiatives. There was an increase from the first to the second quinquennial in the investment, from \$639.5M in 2005–2009 to \$921.5M in 2010–2014. There were 7,522 projects with at least some translational research component.

- The investment trend showed a substantive increase from 2008 to 2009 (Figure 1). This increase was largely due to the ramp-up in investment in this area by the Ontario Institute for Cancer Research (OICR) as well as investments in major initiatives through programs administered by the Canada Foundation for Innovation (CFI). For OICR, 44% of its total cancer research investment is in the translational research area.
- The investment in agents (drugs and biologics) and biospecimen-based risk assessment showed the greatest growth from the start to the end of the decade (Figure 2).

IMPORTANT

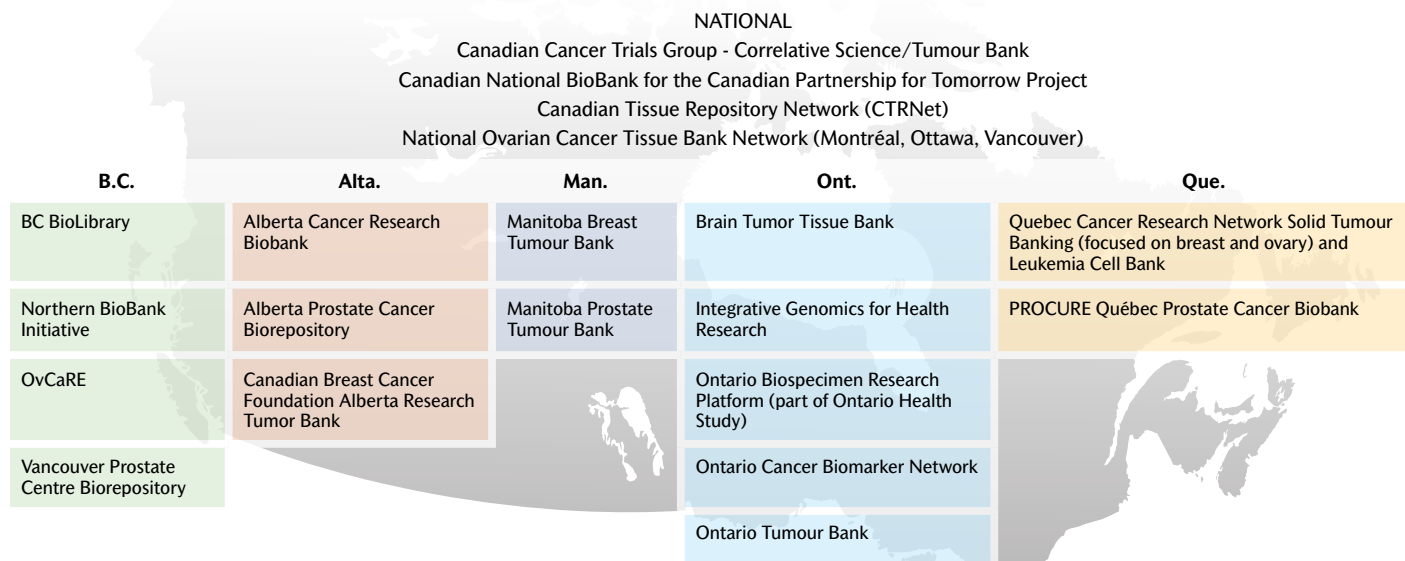
The data reported herein will vary from previously reported data because of differences in the inclusion and coding criteria. Of note, Phase III trials are included in this report, although it is recognized that much of the Phase III trials are funded by industry and industry-funded research is not included in the CCRS. Data from the National Research Council Canada was excluded from this report because new data has not been submitted for years 2011 to 2014 and the investments in the second quinquennial would be affected by this non-reporting.

FIGURE 3
EARLY TRANSLATIONAL CANCER RESEARCH INVESTMENT BY MODALITY AND RESEARCH TYPE, 2005–2009 AND 2010–2014



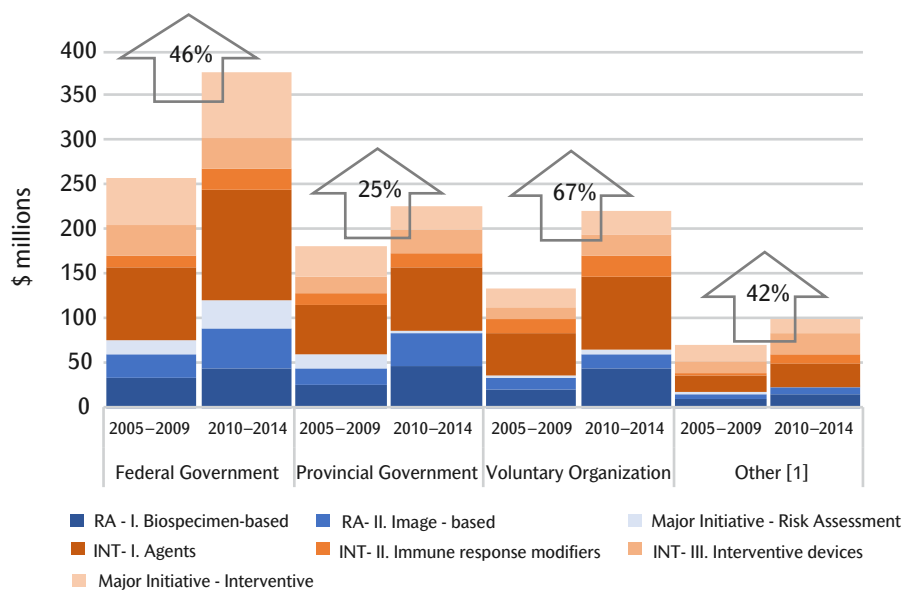
- For all modalities, there were significant increases in the investment from the first to the second quinquennial (Figure 3), with the investment in agents and biospecimen-based risk assessment showing the greatest increases at \$106.5M and \$61.9M, respectively. Across the board, the increase was largely in research focused on the credentialing/creation/pre-clinical phases, although the investment in clinical research was up in 2010–2014 for most modalities.
- The largest investment in terms of major initiatives was for interventional modalities, with much of this investment focused on supporting drug research (Figure 3 inset).
- Biorepositories are not included in the investment data for this report, but are critical to ensuring quality translational research. During the decade, many funders invested in the establishment of biorepositories as well as standard-setting networks such as CTRNet (Figure 4).

FIGURE 4
BIOREPOSITORIES SUPPORTING TRANSLATIONAL RESEARCH FUNDED BY CCRS DATA CONTRIBUTORS [1] DURING THE DECADE, NATIONAL AND PROVINCE-SPECIFIC



[1] This list is not a comprehensive listing of existing biorepositories. Many biorepositories are funded by other sources and/or may not be identifiable within the project descriptions submitted through the CCRS.

FIGURE 5
EARLY TRANSLATIONAL CANCER RESEARCH INVESTMENT BY FUNDING SECTOR AND MODALITY, 2005–2009 AND 2010–2014

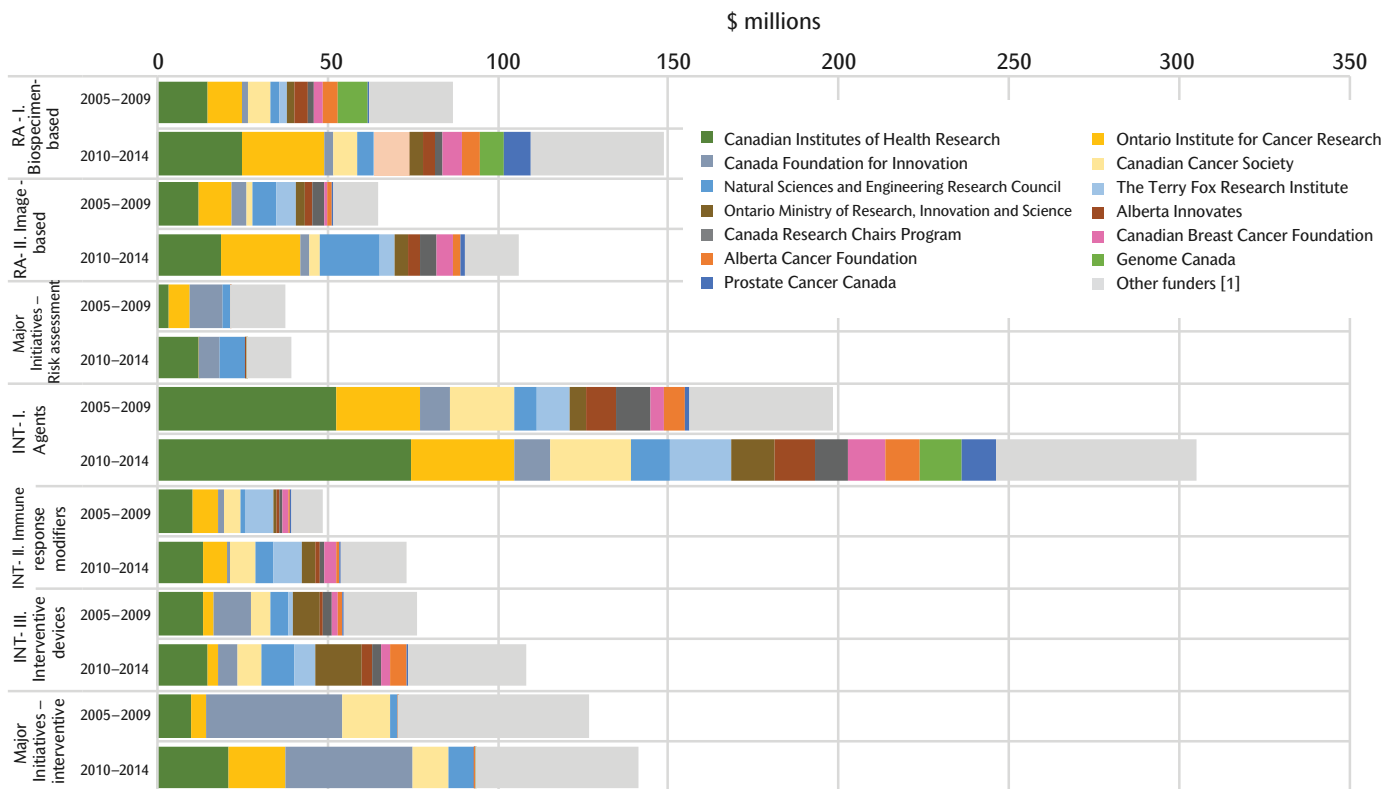


[1] Co-funding of projects supported by CCRS participating organizations by institutional, industry and foreign sources.

- Over 60% of the \$281.9M increase in the overall translational investment from first to the second quinquennial was accounted for by five organization: CIHR, OICR, NSERC, Ontario Ministry of Research, Innovation and Science and TFRI.

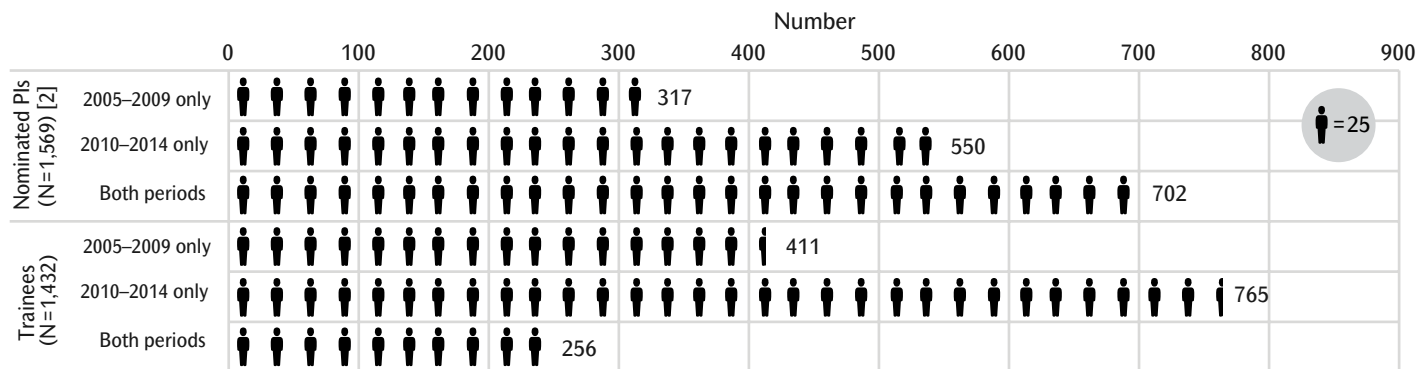
- 41% of the total translational investment came from the Federal government sector. The investment from the voluntary sector (charities and non-profit associations), however, showed the greatest growth from the first to the second period (Figure 5).
- All organizations covered in the CCRS had some investment in translational research, be it research funding or supporting infrastructure such as biorepositories.
- Thirteen organizations represented 74% of the overall investment. Figure 6 shows the investments made by these funders for each specific modality.
- With a few exceptions, the Canadian Institutes for Health Research (CIHR) had the highest investment per modality, accounting for 19% of the overall translational research investment for the decade. CFI accounted for the highest investments for major initiatives. OICR had the second highest investment for agents and risk-based assessment modalities while The Terry Fox Research Institute (TFRI) had the second highest investment for research on immune response modifiers.

FIGURE 6
EARLY TRANSLATIONAL CANCER RESEARCH INVESTMENT BY MODALITY AND FUNDER, 2005–2009 AND 2010–2014



[1] The 13 funders identified by name represented 74% of the overall translational research investment. The other category includes investments made by all other funders.

FIGURE 7
NUMBER OF RECIPIENTS OF GRANTS AND TRAINEE AWARDS [1] BY TIME PERIOD (N=2,896)



[1] Includes trainees or nominated PIs with at least one award/grant with a translational 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.

- There were 1,569 nominated principal investigators with at least one or more operating grant, career award, or equipment grant with a translational research weighting of 80% or more (Figure 7). Of these 45% (702) had funding at some point in both periods. These PIs represented 60% of the translational investment in both 2005–2009 and 2010–2014. There was a net increase of 233 PIs from the first to the second quinquennial.
- 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. The number of trainees funded for translational cancer research projects numbered 1,432 and 105 (7%) of these individuals went on to receive an operating grant, career awards, and/or equipment grant within the decade. There were 354 more trainees with awards in the second quinquennial compared with the first.
- The investment in trainee awards rose from the first to the second quinquennial by \$13.8M, with much of this growth due to increased investment in graduate-level awards (Figure 8).
- A comparison of the distributions of operating grants and trainee awards by modality showed proportionately less investment in biospecimen-based risk assessment research and proportionately more in immune response modifiers (both periods) among trainee awards (Figure 9). The difference in the distributions for agents in 2005–2009 did not remain in 2010–2014.

FIGURE 8
EARLY TRANSLATIONAL CANCER RESEARCH INVESTMENT IN TRAINEE AWARDS BY PROGRAM REACH AND TIME PERIOD

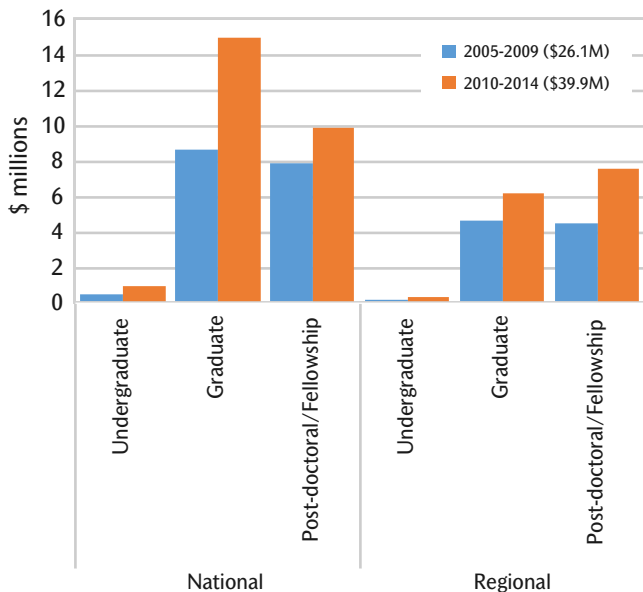
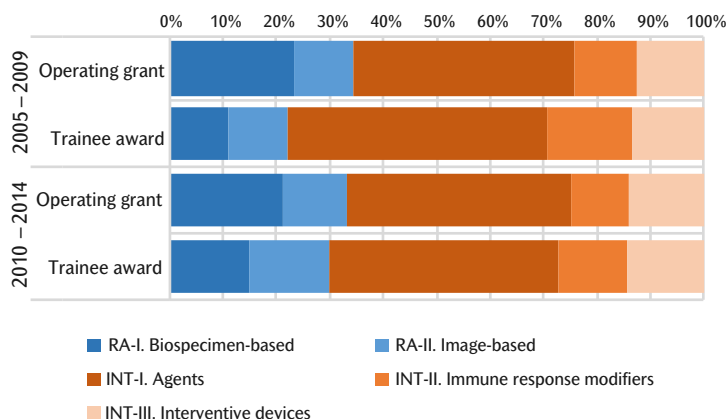


FIGURE 9
DISTRIBUTION OF EARLY TRANSLATIONAL CANCER RESEARCH INVESTMENT BY MODALITY FOR OPERATING GRANTS AND TRAINEE AWARDS, 2005–2009 AND 2010–2014



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, *Investment in Early Translational Cancer Research, 2005–2010*, 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.

ACKNOWLEDGEMENTS

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The impetus for the translational research analysis came from Dr. Victor Ling, founding President and Scientific Director of

The Terry Fox Research Institute, and recognizes the organization's pioneering role in support of translational research in Canada.

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