Investment in Cancer Risk & Prevention Research, 2005–2010

A special report from the Canadian Cancer Research Alliance's survey of government and voluntary sector investment in cancer research

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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 2013

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Instrumental to the inaugural version of this report were: Drs. Heather Bryant (Canadian Partnership Against Cancer), Roy Cameron (University of Waterloo), Stuart Edmonds (Prostate Cancer Canada), Elizabeth Eisenhauer (Canadian Cancer Research Alliance/Canadian Partnership Against Cancer), Carolyn Gotay (University of British Columbia), Jon Kerner (Primary Prevention Advisory Group, Canadian Partnership Against Cancer), Louise Parker (Dalhousie University), and Jack Siemiatycki (Université de Montréal). Kim Badovinac, who managed this project, prepared this updated report with the invaluable advice and expertise provided by Drs. Robin Harkness (Canadian Cancer Research Alliance/Canadian Partnership Against Cancer), Jon Kerner (Canadian Partnership Against Cancer), Jacques Magnan (Canadian Partnership Against Cancer), Morag Park (Canadian Institutes of Health Research), and Christine Williams (Canadian Cancer Society). This report was designed by Unified Marketing Communications of Toronto.

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EXECUTIVE SUMMARY

This report quantifies the investment in cancer risk and prevention research in Canada for the period 2005 to 2010 and updates our inaugural report on this topic. The data source is the Canadian Cancer Research Survey (CCRS), which includes funding for 40 organizations/programs from the government and voluntary sectors. Projects were classified according to the three-dimensional cancer risk and prevention research "cube" developed specifically for this report, which consists of risk factors, research foci, and research types. The findings were analyzed for two triennia: 2005–2007 and 2008–2010.

The report has some limitations. The CCRS does not include intramural cancer prevention research being conducted by federal, provincial and municipal governments/agencies or by universities, hospitals, cancer centres, schools, and community organizations. It also excludes investments made by industry in etiological research and research on chemoprevention, vaccines, and screening techniques relevant to cancer prevention. Although many of the risk factors for cancer are common to many other chronic diseases, the investment figures reported herein are specific to cancer—the larger investment in research on chronic disease risk and prevention in Canada is not detailed.

Key Findings

- The investment in cancer risk and prevention research increased 39% from 2005–2007 to 2008–2010, surpassing the 30% increase found for cancer research overall.
- Key funders were the Canadian Institutes of Health Research, Canadian Cancer Society, Canadian Partnership Against Cancer, Canada Research Chairs Program, Canada Foundation for Innovation, and Canadian Breast Cancer Foundation, which when combined represented 69% of the cancer risk and prevention research investment over the six-year span.
- The increased investment in 2008–2010 was mainly due to major infrastructure funding designed to support large platforms for epidemiological research.
- The investment in intervention research more than doubled from the first to second triennium.
- Among the 15 risk factors, investments increased substantially from 2005–2007 to 2008–2010 for five risk factors and decreased for four. The remaining six risk factors, which included tobacco, had marginal to moderate increases in investment.
- There was no change in the number of nominated principal investigators funded for cancer risk and prevention research from the first to second period.

- Sixty percent of the nominated principal investigators had funded research projects at some point in both triennia. This group was proportionately more likely to be involved in research that cut across research foci and that involved more than one risk factor.

In summary, the substantial increase in infrastructure funding bodes well for the further development of cancer epidemiological research in Canada. There was evidence that intervention research was on the rise and that a sizeable core, in excess of 200 researchers, was funded for cancer risk and prevention research throughout the 2005 to 2010 period. Further work, outside the scope of the CCRS, is needed to understand the extent to which the nature of the investment may be constrained by the number of researchers and/or their expertise and how best to facilitate the translation of cause-based/discovery research.

1. INTRODUCTION

> *A considerable body of literature now supports two conclusions: cancer can be prevented and many of the most powerful preventive strategies are based on changing lifestyles and modifying risks.*

From "Cancer prevention: major initiatives and looking into the future" by Carolyn Cook Gotay, 2010, *Expert Review of Pharmacoeconomics & Outcomes Research,* 10(2), p. 144.

> *Primary prevention of cancer is the bedrock of cancer control, which if achieved, would abolish the need for early detection and screening, treatment, rehabilitation and palliative care. Although we know enough to prevent 50–60% of cancers, this knowledge has not been adequately applied.*

From "The future of cancer prevention" by Anthony B. Miller, 2012, *Preventive Medicine,* 55(6), p. 554.

1.1 PREVENTING CANCER

Cancer is largely a disease of aging, and Canadian demographics reveal a steadily aging population. Cancer prevention is a key to stemming the anticipated rise in the number of cancer cases in the upcoming decades and it is a vital means to lower both the social and economic costs associated with cancer.

There are two major approaches to preventing cancer:

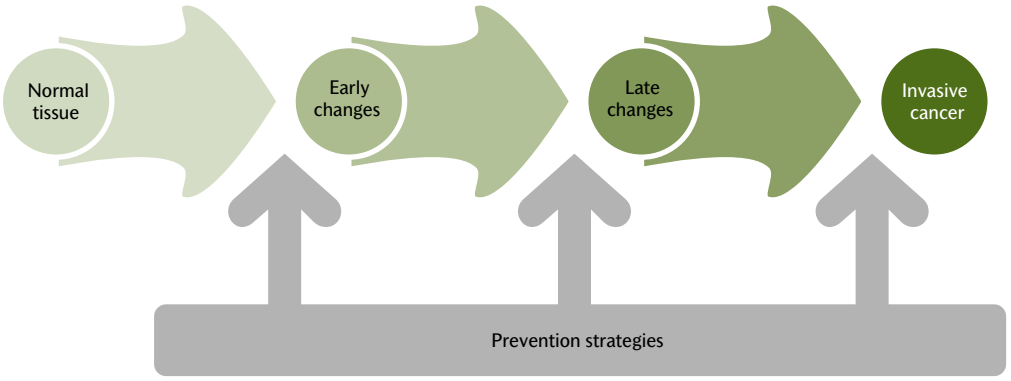
- reduce the risk of developing cancer by modifying lifestyles/behaviours and decreasing environmental exposures known to promote or cause malignancy
- intervene in the progression from premalignant to malignant lesions

Carcinogenesis, the process of how cancers start and progress, typically unfolds over many years and is characterized by progressive genetic changes (mutations), epigenetic changes (changes in the expression of normal genes), and cumulative tissue damage. Cancers or malignant tumours are different from other abnormal tissue growths because they invade surrounding tissues and can spread from one part of the body to another (metastasis). Although there are many different cancers, the basic multistage process of carcinogenesis appears to be similar for many cancers.

Opportunities to intervene and block malignant transformation arise at several stages in carcinogenesis (see Figure 1.1.1). Prevention strategies include individual interventions (e.g., educational, behavioural, pharmacological), interventions aimed at high-risk groups (e.g., surgical, pharmacological), and broad-based interventions (e.g., social marketing campaigns, social and environmental supports, policy/regulatory/legislative change, and population-based screening programs). Research is critical to our understanding of cancer risk and effective cancer prevention strategies. Technological advances have improved our ability to measure carcinogens and identify the molecular components of exposures, lifestyle choices, and outcomes.[1] As research on cancer risk and etiology evolves, so too does our understanding of cancer risk and prevention.

FIGURE 1.1.1

OPPORTUNITIES FOR CANCER PREVENTION THROUGHOUT CARCINOGENESIS



Adapted from "Introduction to Cancer Prevention," by David S. Alberts and Lisa M. Hess, 2008, *Fundamentals of Cancer Prevention*, 2nd ed., Berlin: Springer-Verlag, p. 8.

1. Greenwald, P. & Dunn, B.K. (2009). Landmarks in the history of cancer epidemiology. *Cancer Research*, 69(6):2151–2162.

1.2 ABOUT THIS REPORT

This report quantifies the investment in cancer risk and prevention research in Canada for the period 2005 to 2010 and updates our inaugural report on this topic, which covered the 2005 to 2007 time frame. The classification framework used to describe the investment was developed specifically for the Canadian Cancer Research Survey (CCRS) and is detailed in the following chapter. The framework has sufficient detail to allow users to obtain investment data on different aspects of cancer risk and prevention research. The investment has been carved into specific risk factors, including those with a relatively long history of prevention research (e.g., Tobacco) and those earlier along in their research development (e.g., Ethnicity, Sex & Social Environment).

Although many of the risk factors for cancer are common to many other chronic diseases, **the investment figures reported herein are specific to cancer.** This report does not detail the larger investment in research on chronic disease risk and prevention in Canada.

Given the 2005–2010 time frame, the report does not capture the following more recent initiatives and activities focused on prevention that have been launched, but not yet fully implemented. These include:

- the full investment of the Canadian Partnership for Tomorrow Project by the Canadian Partnership Against Cancer, for which funding commenced in 2008. This large-scale, longitudinal cohort study is made up of five regional studies — the Alberta Tomorrow Project, The Atlantic PATH, the BC Generations Project, the Ontario Health Study, and Quebec's CARTaGENE. A large, high-quality "population laboratory" consisting of data and biospecimens is being created that will support research to better understand the causes and risk factors for cancer and other chronic diseases.
- the full investment of the CCSRI Prevention Initiative by the Canadian Cancer Society (CCS), which began in 2009. The goal of this initiative is to build capacity in prevention research and create a more cohesive and coordinated national risk reduction and prevention research program. New programs focus on career development in prevention, population health intervention research in partnership with the Canadian Institutes of Health Research (CIHR), prevention translation, and multi-sector team grants in prevention research.
- the full investment of the GRePEC Program (Research and prevention group on environment-cancer) by the Cancer Research Society, which began in 2010. The goal of this initiative is to support research on the links between the environment and cancer undertaken by multi-disciplinary teams involving at least two Quebec universities.
- investment of $1.6M for CIHR's Catalyst Grants in Environments, Genes and Chronic Disease launched in December 2012

Prevention research was identified as a priority for investment and was the focus of the first action item identified in the five-year Pan-Canadian Cancer Research Strategy, released in May 2010. Work was undertaken under the leadership of the Canadian Partnership Against Cancer and the CCS to develop a more specific cancer prevention research plan based on input from a broad range of stakeholders. In the resulting report, *Cancer Prevention Research in Canada: A Strategic Framework for Collaborative Action,* released in April 2012, ten priorities for prevention and risk research in Canada were identified. Work involving several CCRA member organizations is currently underway to facilitate capacity building, promote multi-stakeholder/synergistic collaborations, and address significant research gaps. This updated analysis is intended to support this work—ultimately, the goal of increased investment in prevention research is to reduce cancer incidence.

2. METHODOLOGY

2.1 PROJECT IDENTIFICATION

The data source for this study was the CCRS database. This database is composed of peer-reviewed cancer research projects funded by 40 organizations/programs within the federal government, provincial government, and voluntary sectors from January 1, 2005 to December 31, 2010. It includes organizations that fund only cancer research (e.g., CCS) and organizations that fund all types of health (e.g., Michael Smith Foundation for Health Research) and general science (e.g., Natural Sciences & Engineering Research Council) research.

ABBREVIATIONS

CFI	Canada Foundation for Innovation
CCRA	Canadian Cancer Research Alliance
CCRS	Canadian Cancer Research Survey
CCS	Canadian Cancer Society
CIHR	Canadian Institutes of Health Research
CTCRI	Canadian Tobacco Control Research Initiative
CSO	Common Scientific Outline
PI	Principal Investigator

There are 12,629 projects in the database. All projects are coded in terms of the Common Scientific Outline (CSO), cancer site (using International Statistical Classification of Diseases and Related Health Problems, ICD-10), and type of funding mechanism.

The CSO is an international standard for classifying cancer research. It is grouped into seven categories (1-Biology, 2-Etiology, 3-Prevention, 4-Early Detection, Diagnosis, and Prognosis, 5-Treatment, 6-Cancer Control, Survivorship, and Outcomes Research, and 7-Scientific Model Systems), which roll up from 38 codes. (Details about the CSO can be obtained at **https://www.icrpartnership.org/CSO.cfm.**)

All research projects by cancer research organizations are included in the database. Research projects by other health/general science research funders, however, are assessed for their cancer relevance. A project is included only if cancer is specifically mentioned in the available project description (face validity). For example, a project designed to test a dietary-based intervention to prevent diabetes would not be included even though the intervention may also prevent cancer. The same principle applies to research projects focused on cancer-causing infections and viruses.

Research projects on tobacco are the one exception. All tobacco research projects funded by the participating organizations of the CCRS are included unless the project descriptions specifically indicated that the research was focused solely on another disease (e.g., chronic obstructive pulmonary disease, cardiovascular disease). The rationale for this reverse-onus approach is two-fold: (1) the strong causal link between tobacco and lung/other cancers and (2) a large proportion of tobacco research is funded by cancer research funders (applying the rule that similar projects from other health/general science research funders should be included). The budgets for tobacco projects focused on the pharmacokinetics of nicotine and mechanisms

underlying nicotine dependence/addiction were weighted at 33%, the rationale being that if all research funding was partitioned into health/disease categories, these projects would likely find the best home under the mental health/addictions umbrella.

A subset of 4,379 projects was reviewed for possible inclusion in this study. It included all projects coded to the CSO categories of 2-Etiology and 3-Prevention as well as selected codes within 4-Early Detection, Diagnosis, and Prognosis and 6-Cancer Control, Survivorship, and Outcomes Research. Excluded from the analysis were projects focused on:

- cancer biology (research on model systems, however, was included if it directly related to specific cancer risk factors)
- genetic studies where the focus was on diagnostic markers and not disease risk
- preventing cancers in patients who have already had cancer, including studies focused on risks for secondary cancers associated with radiation treatment
- developing or testing lifestyle interventions aimed at improving symptom management or quality of life for cancer survivors
- screening or other tests intended to confirm a cancer diagnosis or determine prognoses in patients with cancer (screening of precursor lesions was, however, included)
- treatment of ductal carcinoma in situ (DCIS) if the intent was to inform breast cancer treatment (projects focused on risk reduction were, however, included)
- providing infrastructure support to research across the full continuum of cancer control – these projects may be relevant to cancer risk and prevention but lack the detail needed to be accurately classified

A total of 2,610 projects were excluded, leaving 1,769 projects in the final sample.

2.2 PROJECT CLASSIFICATION

Projects were classified according to the three-dimensional cancer risk and prevention research "cube" (see Figure 2.2.1). The cube consists of research focus (four categories), risk factor (15 categories), and research type (five categories). Definitions of each category within the three dimensions can be found in Table 2.2.1 as can examples of research projects that typify projects coded to the categories.

FIGURE 2.2.1
CANCER RISK AND PREVENTION CUBE

TABLE 2.2.1

DIMENSIONS AND CATEGORIES OF THE CANCER RISK AND PREVENTION CUBE

RESEARCH FOCUS	Definition	Example
Causes	Research that attempts to identify causes of cancer, factors associated with cancer risks, and possible mechanisms/modulators involved in carcinogenesis.	• *Urinary tract infections and other risk factors for bladder cancer* • *Mechanisms of Kaposi's Sarcoma-associated herpesvirus pathogenesis*
Determinants that Influence Causes	Research on attitudes, behaviours, and genetic and societal factors that may influence adoption and maintenance of behaviours involved in cancer causation and risk reduction.	• *Exploring the psychosocial influences of smoking mothers on daughters' tobacco use*
Determinants that Influence Interventions	Research on factors that may influence the efficacy of risk reduction and cancer prevention strategies.	• *Assessing the longitudinal patterns and determinants of chronic disease prevention capacity in the Canadian public health system*
Interventions	Research that seeks to identify, develop, and test/evaluate interventions that may prevent cancer. Interventions include: • behavioural change approaches (e.g., smoking cessation, obesity control) • social, environmental, and regulatory changes (e.g., mass media campaigns, smoking bylaws) • agents/drugs, nutraceuticals, and vaccines • prophylactic surgery • screening for precursor lesions/causal viruses	• *Molecular mechanisms of drug and dietary interventions for the prevention or reduced progression of prostate cancer* • *Prophylactic salpingo-oophorectomy in women who carry a BRCA1 or BRCA2 mutation* • *The impact of a 100% smoke-free bylaw on exposures to environmental tobacco smoke in non-smoking Toronto bar workers*

RISK FACTOR	Definition	Example
1. Activity Level, Body Composition & Metabolism	Research that focuses on elucidating the role of adiposity, activity level, and metabolism on cancer risk. Research on metabolic syndrome/insulin resistance is incorporated under this factor.	• *Immune mechanisms in physical activity and cancer*
2. Alcohol	Research that undertakes to clarify the role of alcohol consumption on cancer risk. Research on factors that may influence alcohol use and alcohol dependence is also included under this factor.	• *The health effects of patterns of alcohol consumption*
3. Contaminants in the Air, Water & Soil	Research that attempts to identify the cancer risks and mechanisms of carcinogenesis associated with contaminants found in the general environment, such as radiation (ionizing (both natural and man-made sources like cell phones), non-ionizing, and solar radiation). Radiation exposure resulting from the work environment, however, is included in Occupational Exposures and radiation exposure from diagnostic tests in Treatments/Diagnostics. Projects on endocrine disrupters are located under Hormones. In utero exposures and second-hand smoke exposures (non-household) are included under this risk factor.	• *Exposure to air pollutants and the incidence of lung cancer* • *Molecular mechanisms of solar mutagenesis* • *Risk of brain cancer from exposure to radiofrequency fields from wireless telecommunications devices in childhood and adolescence*
4. Diet & Nutrition	Research that explores the relationship between dietary patterns and cancer, the effects of specific dietary nutrients on reducing/increasing cancer incidence, determinants of dietary behaviour, and the relationship between food preparation methods and cancer risk. Also included is research on contaminants in breast milk transmitted to children. This research can be distinguished from Activity Level, Body Composition & Metabolism by its emphasis on food/nutrients.	• *Fruits and vegetables and ovarian cancer risk: a pooled analysis* • *Influences on rural adolescents' eating habits* • *Mechanisms for the anti-cancer effects of docosahexaenoic acid and eicosapentaenoic acid*
5. Ethnicity, Sex & Social Environment	Research that focuses on elucidating the role of demographic, cultural, and socio-economic factors on cancer risk.	• *Health risk behaviours and socio-economic status: explaining the social gradient in health*
6. Gene-environment Interactions	Research that aims to identify what and how genetic factors and lifestyle and/or environmental factors interact to influence cancer risk.	• *Gene-environment interactions in post-menopausal breast cancer: a case-control study*
7. Genetic Susceptibilities	Research whose intent is to define the role of genes (familial and polymorphisms/sporadic mutations) on cancer risk. Research on genetic testing/counselling is also included under this factor.	• *Contribution of known and suspected cancer susceptibility genes in high-risk breast and/or ovarian cancer families of French Canadian descent*
8. Hormones	Research that explores the role of exogenous and endogenous hormones on cancer causation and cancer prevention. Exogenous hormones include hormone replacement therapies, oral contraceptives, phytoestrogens (from dietary sources), and endocrine disrupters from environmental sources. Endogenous hormones refer to a person's own levels of sex steroid hormones and corticosteroid hormones. Research on insulin and the insulin-like growth factor can be found under Activity Level, Body Composition & Metabolism.	• *Reducing breast cancer risk factors by molecular engineering: The redesign of hormonal supplements* • *High androgen/low progesterone exposures and ovarian cancer* • *Endocrine disrupting chemicals (EDCs), pituitary hormones, and estrogen metabolizing enzymes as modifiers of breast cancer susceptibility*
9. Infectious Agents	Research that examines viral and bacterial infections and their role in cancer risk. Research on the prevention and treatment of viruses and infections that cause cancer is also included under this factor.	• *Inuit women's understanding of human papillomavirus: implications for health education and prevention in Nunavik, Québec*

RISK FACTOR	Definition	Example
10. Occupational Exposures	Research that endeavours to identify the cancer risks associated with exposures in the workplace.	• *Occupational histories of breast cancer patients*
11. Physiological Susceptibilities	Research on health conditions or physical attributes that may be associated with cancer risk. Studies on breast density as a risk factor for breast cancer are included here.	• *Does Systemic Lupus Erythematosus increase the risk of malignancy? An international multi-site retrospective cohort study*
12. Precursor Lesions	Research that focuses on premalignancies and precursor stages of invasive cancer (such as polyps, DCIS). Projects on the treatment of DCIS that are intended to inform breast cancer treatment are excluded.	• *Community screening of and intervention in high-risk oral premalignant lesions*
13. Tobacco	Research that examines the carcinogenic effects of tobacco, determinants of tobacco use, pharmacokinetics of nicotine/nicotine dependence, industry strategies, and tobacco reduction/control strategies. Child exposures in the family home or vehicle are included here.	• *The neurobiological substrates of the motivational effects of nicotine in dependent and withdrawn mice* • *Revealing tobacco industry secret science and using it to improve public health*
14. Treatments/ Diagnostics	Research that explores the cancer risk associated with drugs and other medical treatments and diagnostic tests (including tests involving radiation exposure). Research studies on the risks associated with radiation treatment of cancer patients are excluded.	• *Effects of warfarin on the risk of urogenital cancer* • *Cancer risk following radiation exposure from computed tomography in children and adolescents*
15. Multiple/General	Studies that consider a broad range of factors and their relationship to cancer. Also included is research on cancer prevention not aimed at specific risk factors.	• *Measuring cancer prevention knowledge and behaviours in a Nova Scotia university population* • *CIHR Team in microsimulation modeling of the impact of health interventions and policies*

RESEARCH TYPE	Definition	Example
Research Involving Model Systems	Research directed at elucidating mechanisms of known risk factors used to corroborate observational research. It encompasses in vitro studies, animal model research, other laboratory studies, and nutritional science studies. This research is often used as a precursor to interventional studies in humans to provide evidence of biological plausibility.	• *Investigating the genotoxic effects of in utero benzene exposure on bone marrow cells of young mice*
Human Research	Research on humans (in vivo), that includes descriptive research, ecological and migrant studies, case-control and cohort studies, and intervention studies and trials. Human research with a laboratory component that involves analysis of blood, saliva, and/or tissue samples is also included under this research type.	• *Case study observations of consumption of antioxidants and risk of lung cancer among Montrealers* • *Effect of vaginal self-sampling on cervical cancer screening rates: a community-based study*
Methodological/ Measurements Research	Research studies that focus on improving data capture and analysis in future laboratory and human research studies. Included are: • methods development, research on statistical approaches and methods to enhance the measurement of outcomes, endpoints, and variables of interest • exposures measurement, research on the physical measurement of one or more substances/exposures within a specified environment • surveillance, research on identifying the frequency/incidence of risk behaviour(s) in a specified population • economic evaluations, research that examines the costs and health effects of an intervention in order to assess the extent to which it can be regarded as providing value	• *Development and validation of new statistical methods for modelling intermediate events in survival analysis* • *Comparing methods of obtaining exposure data in epidemiological studies involving children and pregnant women* • *The British Columbia Adolescent Substance Use Survey* • *Economic evaluation of population screening for cervical cancer using HPV testing in Canada*
Knowledge Synthesis	Literature reviews, and policy, ethics and legal analyses, and other qualitative research studies that are intended to identify research gaps, inform decision makers, and/or influence the adoption of interventions.	• *A knowledge synthesis of tobacco cessation continuing education programs for dental hygienists*
Infrastructure & Other Support	Funding for: • **equipment/infrastructure** needed to conduct cancer risk and prevention research • **capacity building**—training programs and/or network support, the intent of which is to impart and build on knowledge and skills within a specified area or community • **knowledge dissemination**—support for workshops, conferences, symposia, and travel awards for trainees and researchers to attend these events • **letters of intent,** which offset researchers' time to develop proposals of prospective research projects	• *Infrastructure to support a research program on the early determinants of adult chronic disease* • *Tobacco use in special populations research training program* • *2nd International Francophone Conference on Tobacco Control – Paris, France: "Lessons learned in Canada about health warnings on cigarette packages"* (travel award)

2.3 REPORTING CONVENTIONS

All projects conducted within calendar years 2005 to 2010 were 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 were not adjusted for inflation unless specifically noted. For the purposes of this report, data were aggregated into two triennia: 2005–2007 and 2008–2010.

The budgets of projects that focused on more than cancer prevention were adjusted to reflect the extent of the cancer prevention focus. For instance, the project budget for "A cohort study of nurses' offspring examining adverse reproductive effects and childhood cancers" was weighted at 50% because cancer was assumed to comprise only half the research activities. For projects that were coded to more than one category of the dimensions in the cancer risk and prevention research cube (described above), the project budget was divided evenly among the number of categories. For example, the project budget for "Dietary factors and breast cancer risk among women with BRCA1 and BRAC2 gene mutations" was divided among three risk factors: Diet & Nutrition, Genetic Susceptibilities, and Gene-environment Interactions. Weighted number of projects as reported in section 3.2 reflects this weighting scheme.

Projects investigating more than one cancer site were also weighted. Site determinations were based on project descriptions and other sources of information, when available, from participating organizations (e.g., site checklists). When, however, a project was focused on a specific risk factor, like Tobacco, and cancer sites were not mentioned in the project description, predetermined site allocations based on expert input were used (e.g., for tobacco projects, the site allocations were lung 50%, esophagus 15%, larynx 15%, pharynx 15%, and all sites 5%).

The institutional affiliation of the nominated principal investigator (PI) or project leader is 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 CCS, 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 CCS (i.e., NCIC Clinical Trials Group), each site involved in the trial is treated as a separate project with its own PI and budget (based on per case and site administration funding).

In this report, sector breakdowns have been used to denote the sectors of the organizations that administered and funded the research projects. This means that the investments for projects funded by two or more organizations are 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%). Likewise, funding for projects of the three multi-funded initiatives (i.e., Canadian Breast Cancer Research Alliance, Canadian Prostate Cancer

Research Initiative, and Canadian Tobacco Control Research Initiative) were included under the organizations that were involved in supporting the initiatives.

Detailed investment figures are shown for all aspects of the cube. Capitalization is used when dimensions of the cancer risk and prevention cube are referred. The investment figures shown in the tables and charts are rounded and may not always sum to the totals shown. Readers may find it useful to cluster the results on the basis of thematic similarity, modifiability, or some other dimension of interest.

2.4 LIMITATIONS

The CCRS collects data on projects that are funded on the basis of peer review and often in response to publicly announced research granting competitions. The data does not include intramural cancer prevention research being conducted by federal, provincial and municipal governments/agencies or by universities, hospitals, cancer centres, schools, and community organizations, which may receive funding from other sources. Although the extent of this research activity is unknown, the investment figures reported herein likely under-represent the total cancer prevention research activity taking place in Canada.

As mentioned in the introduction, the investment figures reported herein are specific to cancer. This report does not detail the larger investment in research on chronic disease risk and prevention in Canada. Investment figures for British Columbia may under-represent the cancer prevention investment for the province because the BC Cancer Agency did not contribute data to the CCRS during the reporting period. The investment made by industry in etiological research and research on chemoprevention, vaccines, and screening techniques relevant to cancer prevention was not collected for this report.

Project classification is only as good as the descriptions of the research provided by the funding organizations. Errors may be made when source descriptions are limited, although efforts are made to ensure that coding is as accurate as possible.

3. RESULTS

3.1 OVERVIEW OF INVESTMENT

HIGHLIGHTS

- The cancer risk and prevention research investment grew 39% from 2005–2007 to 2008–2010, surpassing the 30% increase for the overall cancer research investment. Over half of this increase was the result of investment by the Canadian Partnership Against Cancer in the Canadian Partnership for Tomorrow Project.
- The investment in cancer risk and prevention research remained fairly constant from 2005 to 2007, increased sharply in 2008 to a peak investment in 2009 and then dropped in 2010 to a level between that found for the two previous years. The increased investment in the 2008–2010 triennium was mainly due to major infrastructure funding designed to support large platforms for epidemiological research.
- Investment from CIHR accounted for one-third of the six-year investment in cancer risk and prevention research and this investment represented 13% of the organization's overall cancer research investment. The Canadian Partnership Against Cancer emerged as the second top funder in the 2008–2010 period.
- Due to the large influx of infrastructure investment, which was largely non-site specific, the site-specific investment increased a mere 11% from 2005–2007 to 2008–2010. Research focused on breast, colorectal, and lung cancer represented 39% of the overall six-year investment.
- The highest per capita investments in cancer risk and prevention research investment were found in Nova Scotia and Quebec. Infrastructure investment in the 2008–2010 triennium played a significant role in both provinces' investment rates.

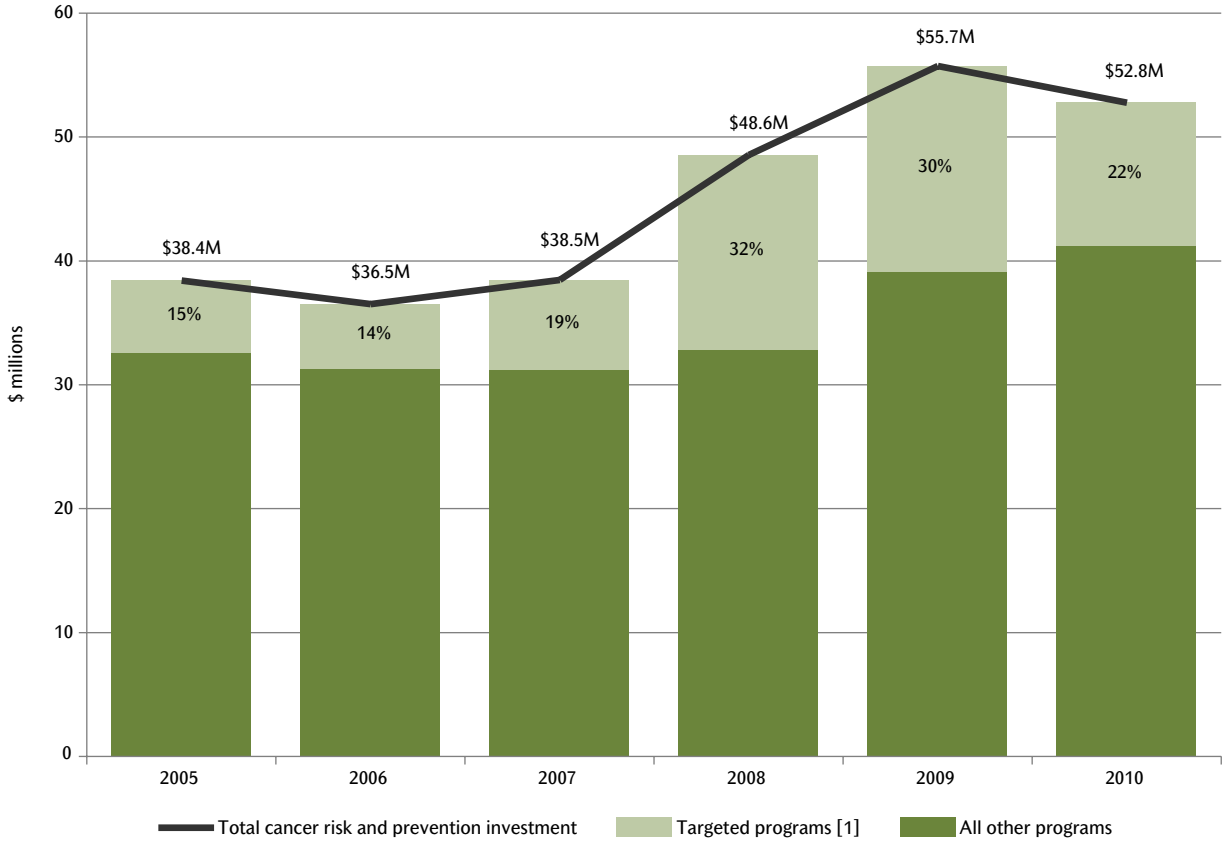
The investment in cancer risk and prevention research for the six-year period of 2005–2010 totalled $270.4M, or 10% of the overall investment in cancer research. The percent change from 2005–2007 to 2008–2010 was 39% (31% when adjusted for inflation), surpassing the 30% (23% when adjusted for inflation) increase for the overall cancer research investment for the same two periods. Per capita investment in cancer risk and prevention research rose from $1.15 per Canadian in 2005 to $1.55 in 2010.

The investment in cancer risk and prevention research was fairly stable from 2005 to 2008, with investment in targeted programs[2] representing between 14 to 19% of the annual investment (Figure 3.1.1). There was a marked increase in investment in 2008 largely due to targeted investments and additional growth in 2009 due to non-targeted investments. The decrease in investment in 2010 follows the pattern found for the overall cancer research investment and was also characterized by a further drop in targeted funding. Of note, over half of this diminished targeted investment was attributable to the ending of the Canadian Tobacco Control Research Initiative. [3]

2. Targeted programs are defined in this report as programs that are specific to cancer risk and prevention research.
3. The Canadian Tobacco Control Research Initiative formally ended on June 30, 2009 although prorated funding for six projects continued beyond this date.

FIGURE 3.1.1

CANCER RISK AND PREVENTION RESEARCH INVESTMENT BY PROGRAM FOCUS, 2005 TO 2010



[1] Funding programs specifically designed for prevention, health promotion, and population health research and/or programs that are targeted to specific risk factors.

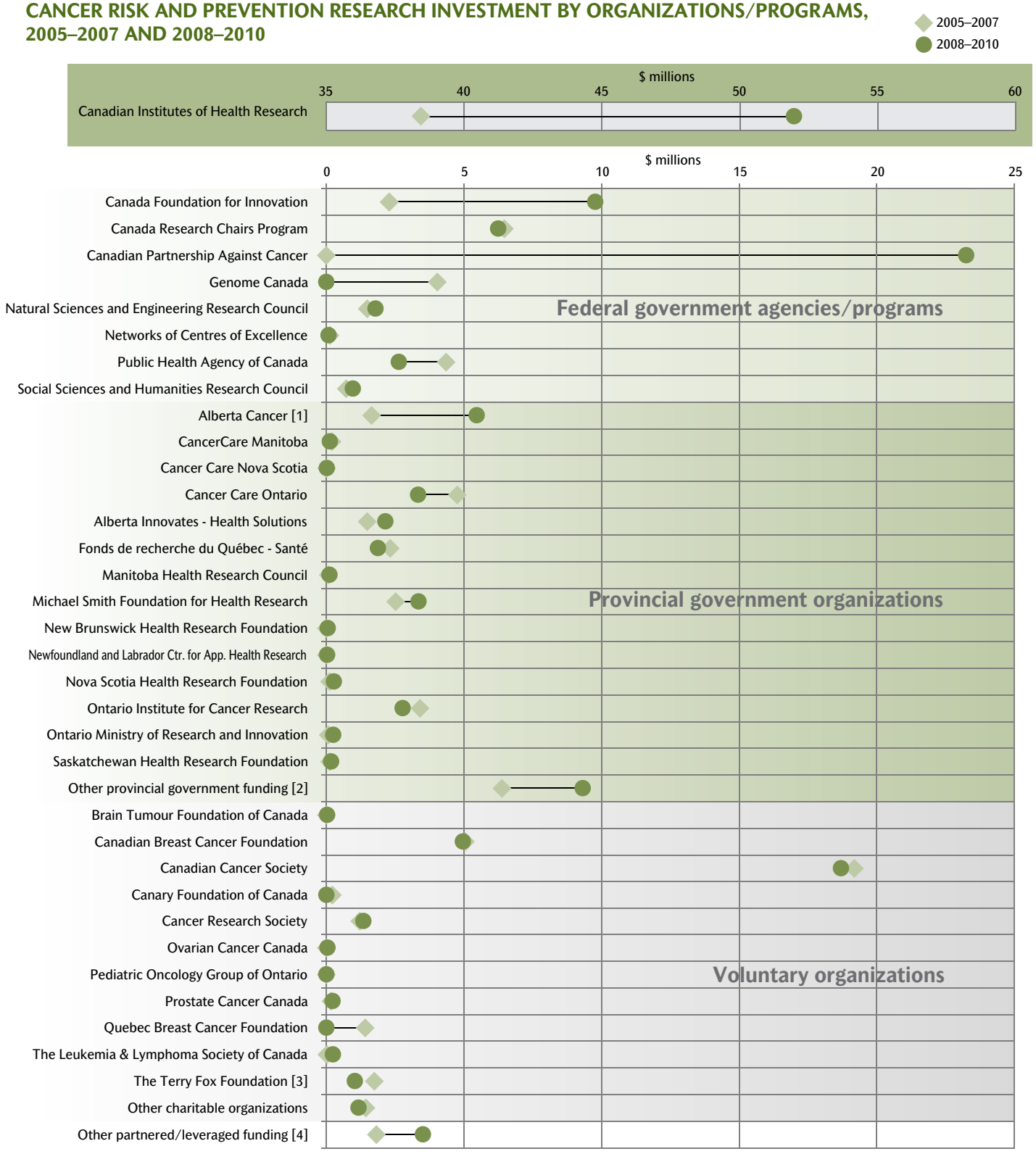
	Targeted programs	All other programs	Total
2005–2007 investment ($M)	18.3	95.1	113.4
2008–2010 investment ($M)	44.0	113.1	157.1
Percent change from 2005–2007 to 2008–2010	140	19	39

Thirty-four of the 40 organizations that participate in the CCRS invested in cancer risk and prevention research during the 2005 to 2010 time frame (29 in 2005–2007; 31 in 2008–2010). Each of the following organizations invested $10M or more in cancer risk and prevention research over the six-year span: CIHR ($90.4M), CCS ($37.9M), Canadian Partnership Against Cancer ($23.2M), Canada Research Chairs ($12.7M), CFI ($12.0M), and Canadian Breast Cancer Foundation ($10.0M). CIHR was the largest funder, accounting for 33% of the cancer risk and prevention research investment. Growth in investment from the first triennium to the second was notable for the Canadian Partnership Against Cancer, CFI, and Alberta Cancer (Figure 3.1.2). The investment by the Canadian Partnership Against Cancer accounted for over half (53%, $23.2M) of the increased investment ($43.7M) from 2005–2007 to 2008–2010.

Investment from federal government sources accounted for a much larger proportion of the investment in 2008–2010 than 2005–2007 (Figure 3.1.3). Detailed investment figures for all organizations for all six years are provided in Appendix A.

FIGURE 3.1.2

CANCER RISK AND PREVENTION RESEARCH INVESTMENT BY ORGANIZATIONS/PROGRAMS, 2005–2007 AND 2008–2010



[1] Alberta Cancer represents an amalgamation of different funding sources over the 2005 to 2010 period, including Alberta Cancer Board, Alberta Cancer Foundation, Alberta Health Services, and the Alberta Cancer Prevention Legacy Fund administered by Alberta Innovates – Health Solutions. For the sake of simplicity, these are grouped under provincial government organizations.

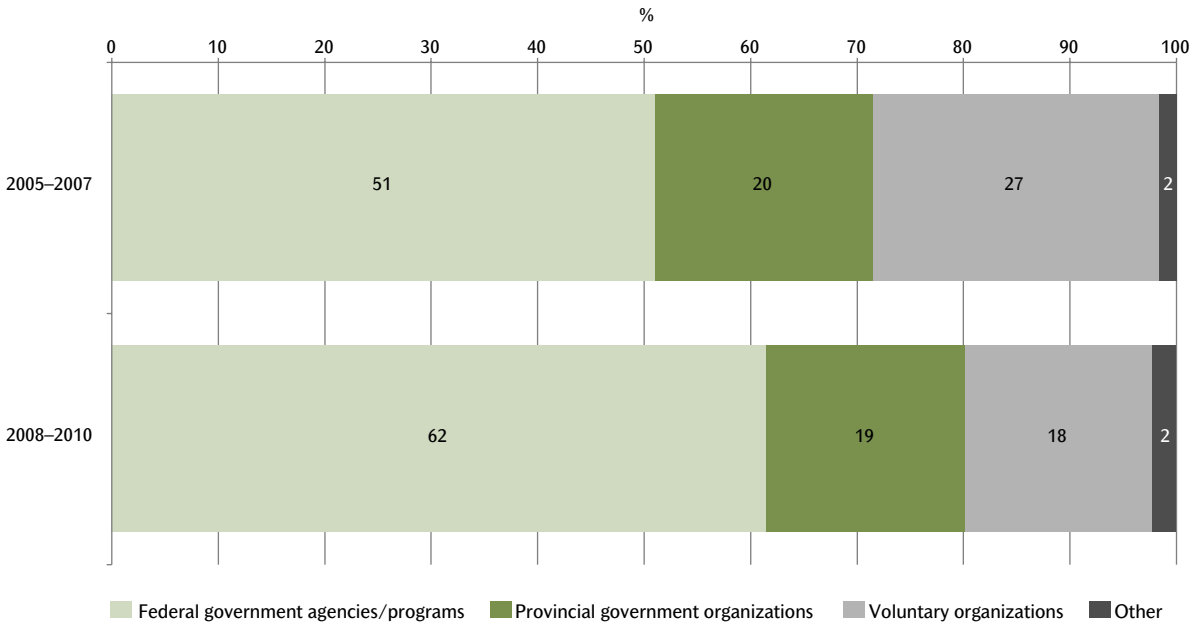
[2] Provincial funding for CFI projects for all provinces is included under 'Other provincial government funding.'

[3] Investment includes projects supported by The Terry Fox Research Institute.

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

FIGURE 3.1.3

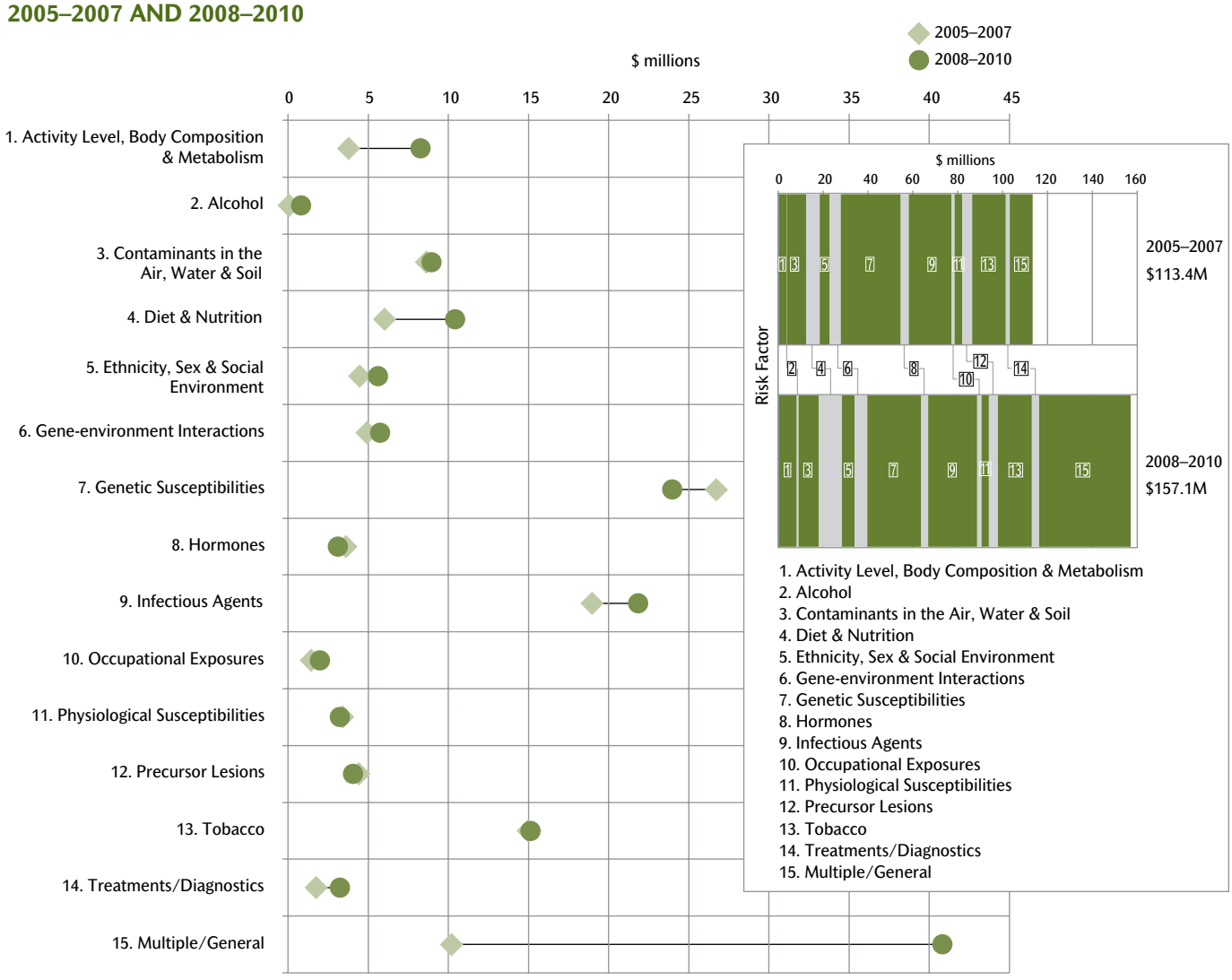
DISTRIBUTION OF CANCER RISK AND PREVENTION RESEARCH INVESTMENT BY FUNDING SECTOR, 2005–2007 AND 2008–2010



The three risk factors with the highest investments in 2005–2007 were Genetic Susceptibilities, Infectious Agents, and Tobacco. When combined, they accounted for 53% of the 2005–2007 investment, but only 39% of the 2008–2010 investment because of the sharp rise in investment in the Multiple/General risk factor category in 2008–2010 largely due to the increased infrastructure investment (Figure 3.1.4). The investments in Activity Level, Body Composition & Metabolism more than doubled between the two periods. Investment for research in Alcohol was the lowest for both periods, although the investment did rise during the 2008–2010 period.

FIGURE 3.1.4

CANCER RISK AND PREVENTION RESEARCH INVESTMENT BY RISK FACTORS, 2005–2007 AND 2008–2010



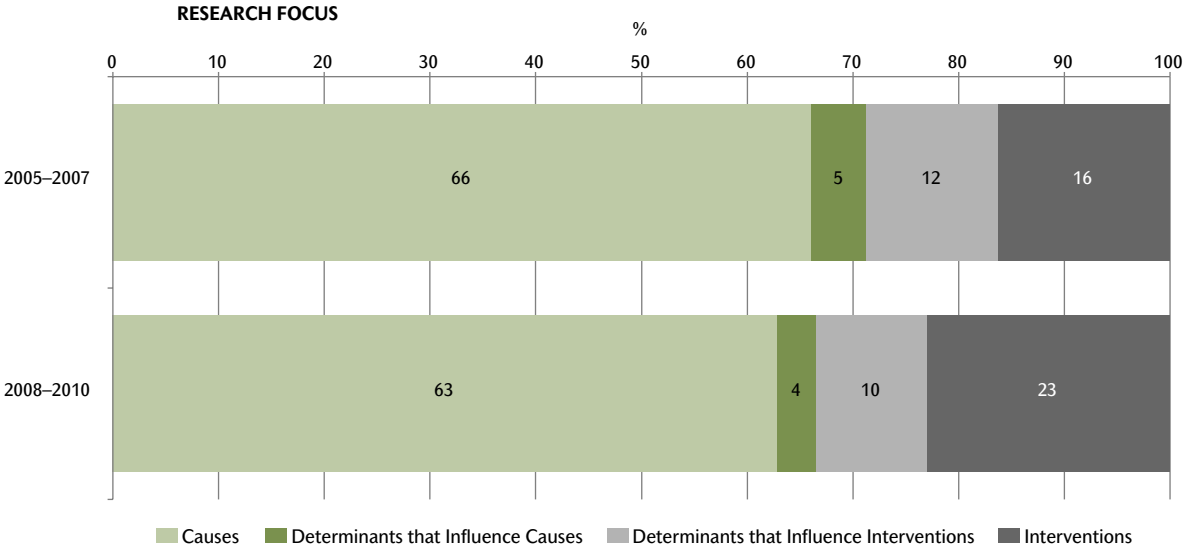
Distributions of the investments for the two periods also changed for the other dimensions of the cube—research focus and research type. In terms of research type, there was a more than doubling of the investment in Infrastructure & Other Support, from $24.0M in 2005–2007 to $63.0M in 2008–2010 (Figure 3.1.5). In terms of research focus, investment in Intervention research rose 96%, from $18.4M in 2005–2007 to $36.0M in 2008–2010.

In terms of the Intervention research investment, there was $10.6M more for Infrastructure & Other Support in 2008–2010 than in 2005–2007 while Human Intervention research doubled from the first to the second triennium (Figure 3.1.6). The following eight organizations invested more than one million dollars over the six-year span in Intervention research: CFI, Canada Research Chairs Program, Canadian Breast Cancer Foundation, CCS, CIHR, Cancer Care Ontario, Michael Smith Foundation for Health Research, and the Public Health Agency of Canada (through the multi-funded initiatives). Collectively, these eight organizations represented 84% of

the total investment in Intervention research in 2005–2007, but only 74% of the total investment in Intervention research in 2008–2010 given increased investment from other organizations. In terms of risk factors, the increased Intervention research investment from 2005–2007 to 2008–2010 for Infrastructure & Other Support was for the Multiple/General category and Diet & Nutrition. For Human Research, the increased investment was mainly for Infectious Agents (projects largely focused on human papillomavirus), Tobacco, and, to a lesser extent, Activity Level, Body Composition & Metabolism.

FIGURE 3.1.5

DISTRIBUTION OF CANCER RISK AND PREVENTION RESEARCH INVESTMENT BY RESEARCH FOCUS AND RESEARCH TYPE, 2005–2007 AND 2008–2010



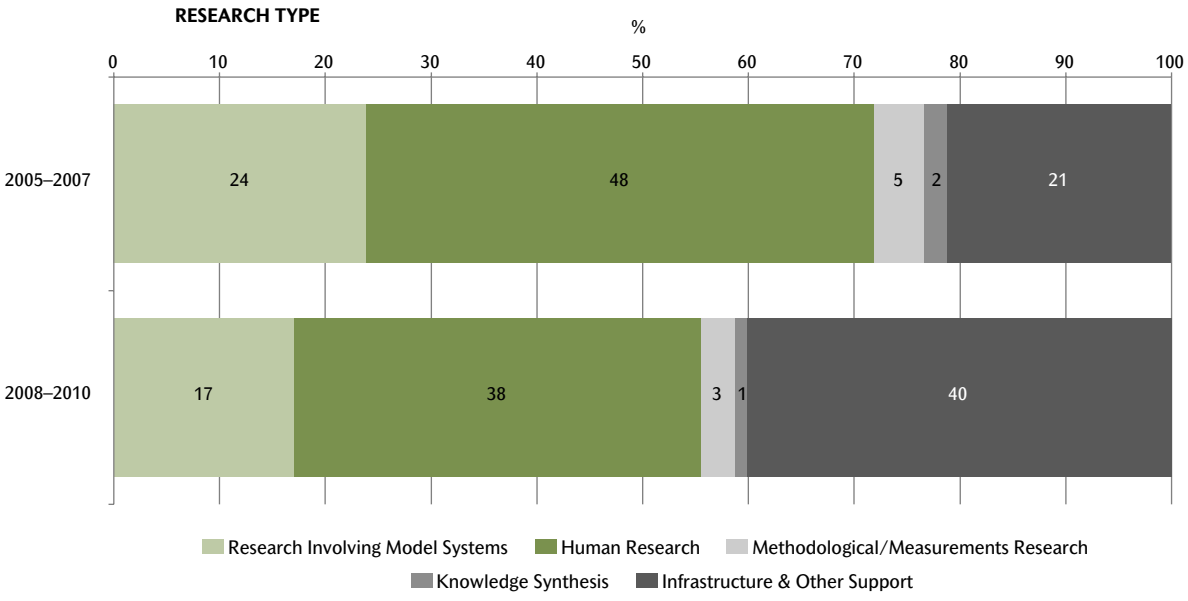
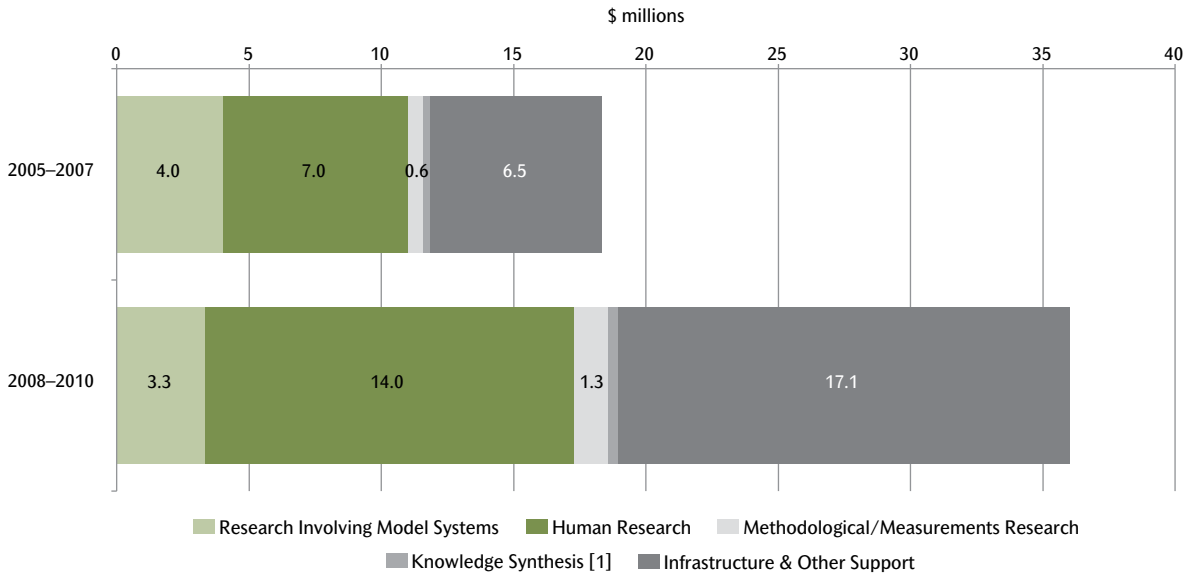


FIGURE 3.1.6

CANCER RISK AND PREVENTION RESEARCH INVESTMENT FOR INTERVENTION RESEARCH BY RESEARCH TYPE, 2005–2007 AND 2008–2010



[1] The investment in Knowledge Synthesis was $0.3M in 2005–2007 and $0.4M in 2008–2010.

When looking at both Research Focus and Research Type, there was nearly a four-fold increase in Infrastructure & Other Support for Causes, from $10.4M in 2005–2007 to $39.4M in 2008–2010 and an increase of 164% in investment in Infrastructure & Other Support for Interventions, from $6.5M in 2005–2007 to $17.1M in 2008–2010 (Figure 3.1.7). In terms of the former, Infrastructure & Other Support for Causes, the increased investment was largely the result of:

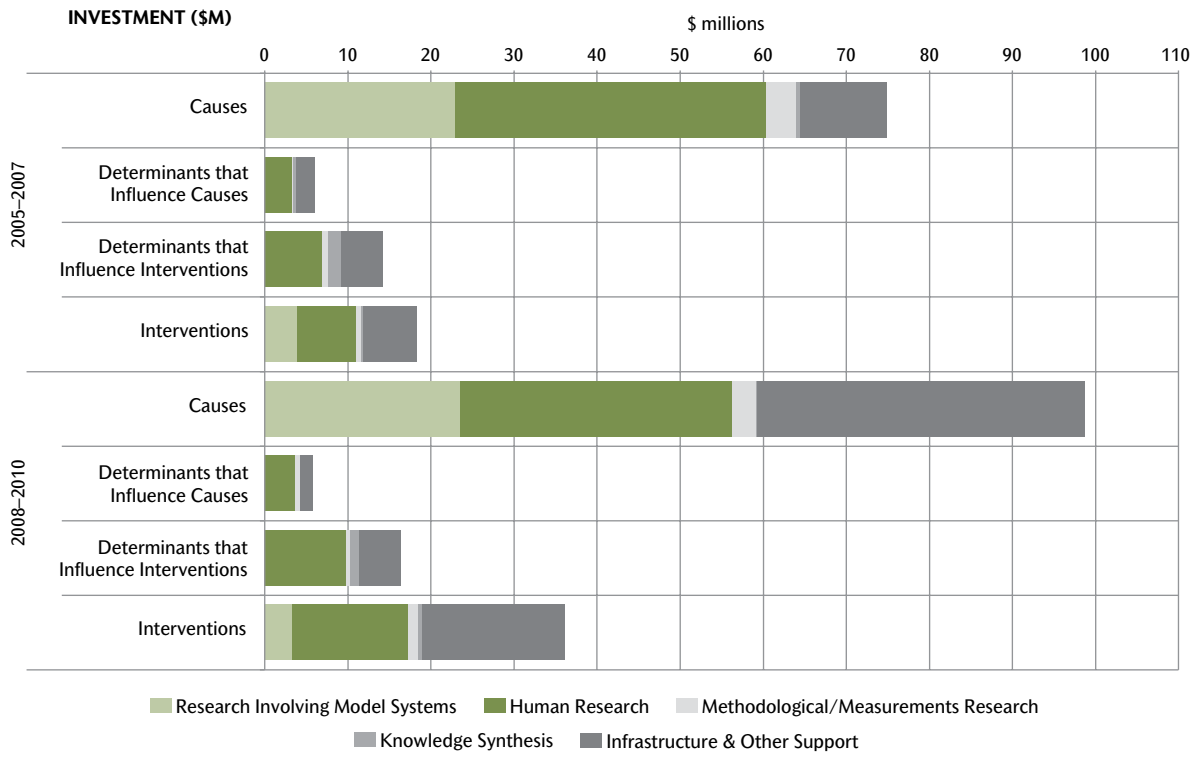
- the Canadian Partnership Against Cancer's support of the Canadian Partnership for Tomorrow Project
- CFI's support of the Canadian Longitudinal Study on Aging[4] (nominated lead at McMaster University) and a major award to McGill University to build and equip the 'Translational Research and Intervention Across the Lifespan' research centre of which prevention research is a component
- equipment/infrastructure to support various cancer epidemiology and prevention platforms provided by Alberta Cancer, which represents investment from the former Alberta Cancer Board, the Alberta Cancer Foundation, and the Alberta Cancer Prevention Legacy Fund

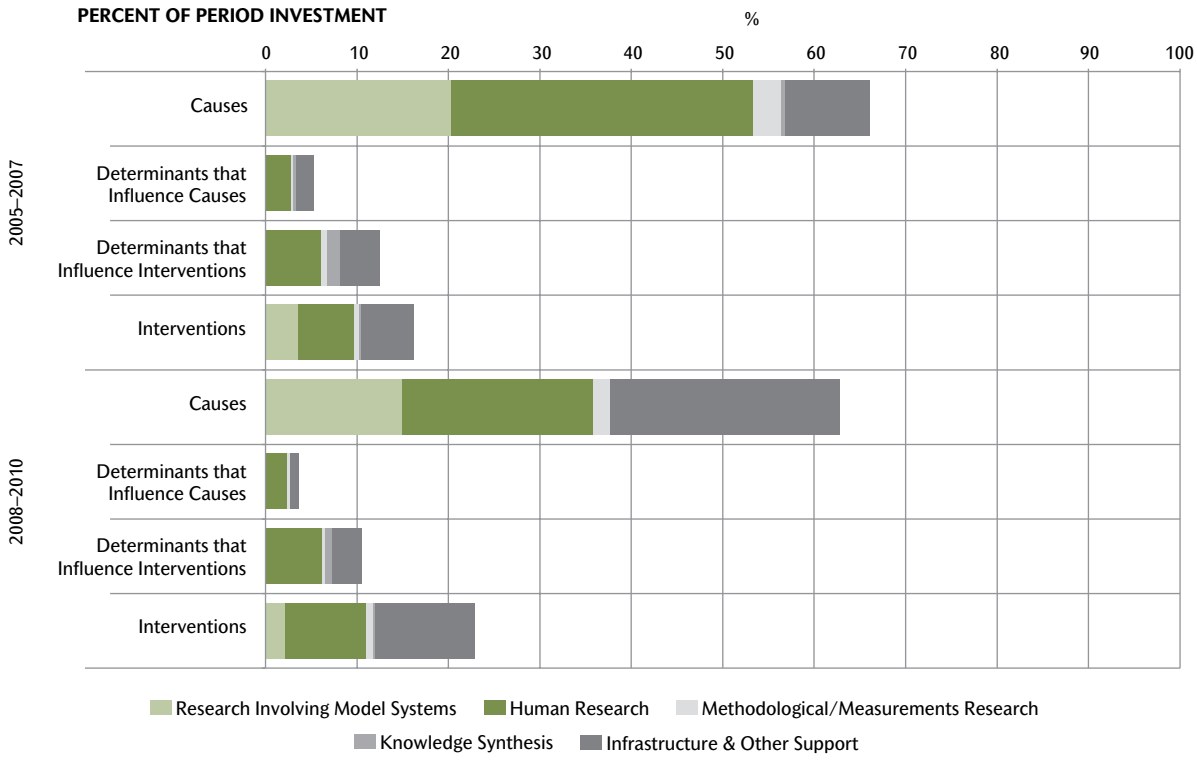
4. CIHR's investment in the Canadian Longitudinal Study on Aging was represented in the Human Research for Causes categories, with the larger portion of the investment in the 2005–2007 triennium.

In addition to this large infrastructure investment, there was a modest increase (11%) in the investment in Human Research. Specifically, the investment doubled for Human Intervention research, from $7.0M in 2005–2007 to $14.0M in 2008–2010 and the investment in Human Research focused on Determinants that Influence Interventions increased 44%, from $6.8M in 2005–2006 to $9.8M in 2009–2010.

FIGURE 3.1.7

CANCER RISK AND PREVENTION RESEARCH INVESTMENT BY RESEARCH FOCUS AND RESEARCH TYPE, 2005–2007 AND 2008–2010

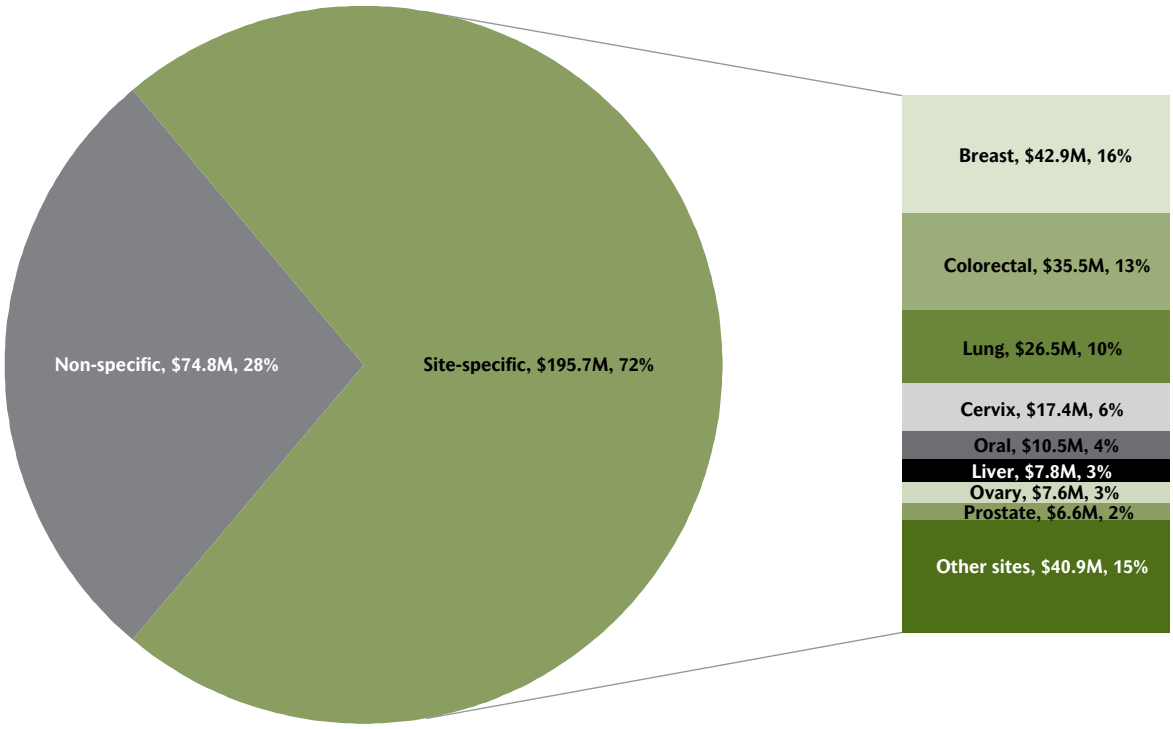




For the 2005–2007 triennium, 82% of the cancer prevention research was directed at specific cancer sites in contrast to the overall cancer research investment for which half was site-specific. Although the site-specific investment in cancer risk and prevention research did not change substantially between 2005–2007 and 2008–2010, the proportion dropped to 65% because of the large increased investment in equipment/infrastructure, which tended to be coded as not site-specific. The largest cancer risk and prevention research investments for the entire six years were for eight sites: breast ($42.9M), colorectal ($35.5M), lung ($26.5M), cervix ($17.4M), oral ($10.5M), liver ($7.8M), ovary ($7.6M), and prostate ($6.6M) (Figure 3.1.8). Percent increases in investment from 2005–2007 and 2008–2010 surpassed the 39% overall cancer risk and prevention research increase for esophageal cancer (58%), prostate cancer (56%), cervical cancer (41%), and lung cancer (40%).

FIGURE 3.1.8

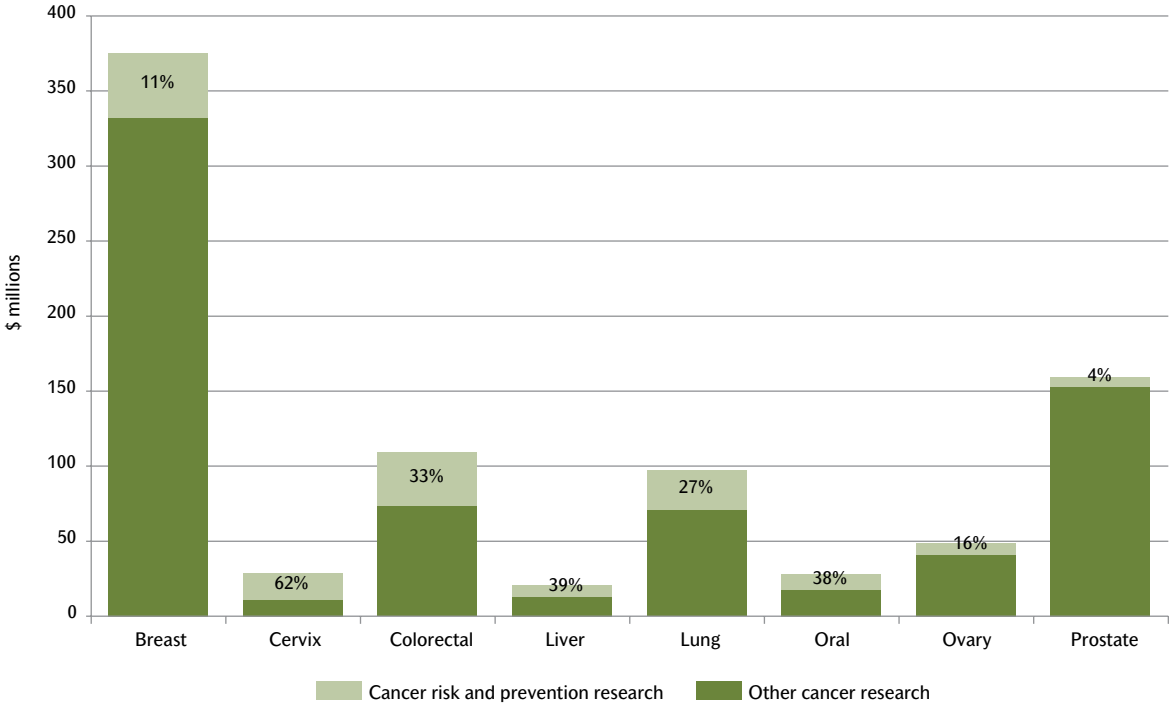
DISTRIBUTION OF CANCER RISK AND PREVENTION RESEARCH INVESTMENT BY CANCER SITE, 2005 TO 2010



A substantial proportion (62%) of the total cervical cancer research investment had a prevention focus, which was quite the opposite for prostate cancer, for which only 4% had a prevention focus (Figure 3.1.9). To a lesser degree, there were also significant proportions of the cancer research investments focused on cancer risk and prevention for liver, oral, colorectal, and lung cancers.

FIGURE 3.1.9

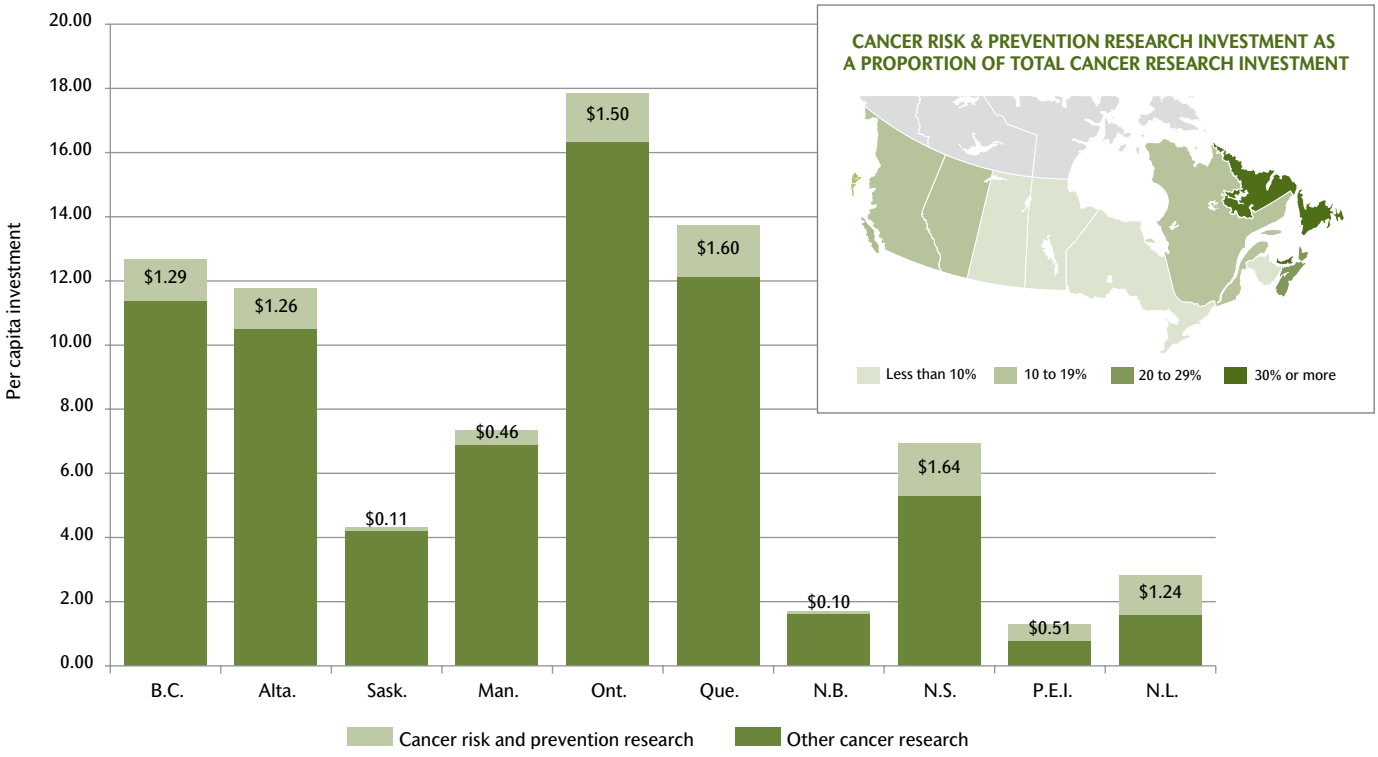
SITE-SPECIFIC CANCER RESEARCH INVESTMENT BY FOCUS, 2005 TO 2010



The investment data were also examined by province of the nominated principal investigator, using provincial populations to normalize the data (Figure 3.1.10). Nova Scotia and Quebec had the highest per capita cancer research investments at $1.64 and $1.60, respectively, while the lowest per capita investments were found for New Brunswick ($0.10) and Saskatchewan ($0.11). Investment by the Canadian Partnership Against Cancer in the Atlantic PATH (Partnership for Tomorrow's Health) cohort study led by PIs in Nova Scotia represented 68% of the overall provincial investment in 2008–2010 and was the reason for the high per capita investment in Nova Scotia. Quebec researchers were recipients of major infrastructure awards from CFI as well as CIHR team grants in the 2008–2010 period and these investments effectively raised the level of the provincial per capita funding. A considerable proportion of the cancer research investment for Newfoundland & Labrador and Prince Edward Island was in the cancer risk and prevention area (see inset map).

FIGURE 3.1.10

PER CAPITA CANCER RISK AND PREVENTION RESEARCH INVESTMENT BY PROVINCE OF NOMINATED PRINCIPAL INVESTIGATOR, 2005 TO 2010



3.2 INVESTMENT BY RISK FACTORS

HIGHLIGHTS

- From 2005–2007 to 2008–2010, investments more than doubled for three risk factors: Alcohol, the Multiple/General risk factor, and Activity Level, Body Composition & Metabolism. The investments in Treatments/Diagnostics and Diet & Nutrition also increased by more than 70%. For four other risk factors—Hormones, Genetic Susceptibilities, Precursor Lesions, and Physiological Susceptibilities—the investments decreased. The remaining six risk factors had marginal to moderate increases.
- The large increase in Infrastructure & Other Support markedly affected the investment distributions from 2005–2007 to 2008–2010 for the risk factors: Activity Level, Body Composition & Metabolism, Diet & Nutrition, Gene-environment Interactions, and the Multiple/General risk factor. The more modest increase in Human Research from 2005–2006 to 2009–2010 affected the investment distributions for Infectious Agents, Precursor Lesions, and Tobacco.
- Given the high level of investment in breast cancer research overall, the breast cancer investment was also high for many risk factors, accounting for over one-third of the investments in Physiological Susceptibilities, Hormones, Treatments/Diagnostics, and Gene-environment Interactions.
- There were provincial areas of strength for particular risk factors, which remained fairly constant over time – i.e., Activity Level, Body Composition & Metabolism – Alberta; Diet & Nutrition, Genetic Susceptibilities, and Tobacco – Ontario; and Infectious Agents – Quebec.

3.2.1 Activity Level, Body Composition & Metabolism

For the Activity Level, Body Composition & Metabolism risk factor, there was a more than doubling of the investment from 2005–2007 to 2009–2010—$3.8M to $8.3M. There was a very large increase in investment for Infrastructure & Other Support focused on Causes, with a much more modest increase in Human Intervention research (Figure 3.2.1).

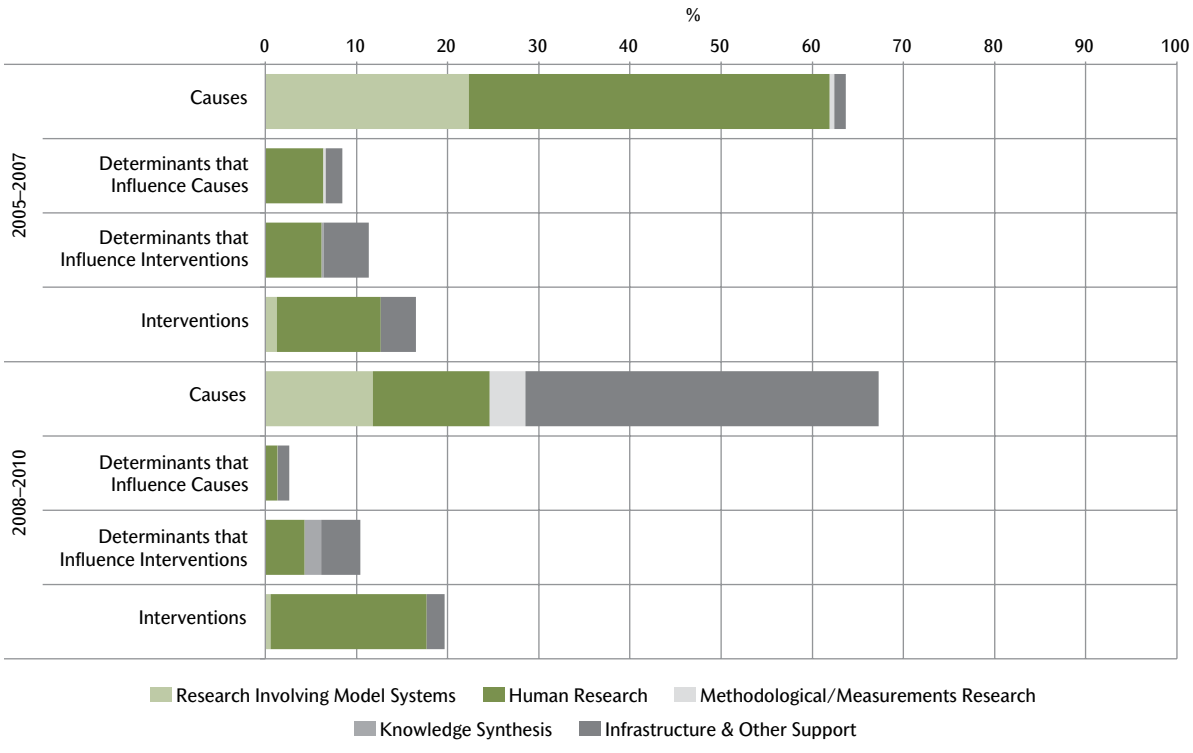
The total weighted number of projects was 64.8 and many projects were co-coded to Diet & Nutrition. Research focused on breast cancer represented 27% of the overall six-year investment.

Twenty organizations had some level of investment in research in the Activity Level, Body Composition & Metabolism risk factor. Growth in investment by Alberta Cancer was nearly four-fold from 2005–2007 to 2008–2010, and it became the second highest funder in 2008–2010, accounting for 15% ($1.3M) of the investment. CCS dropped from the top funder accounting for 24% of the 2005–2007 investment to the third largest funder in 2008–2010, representing 14% of the 2008–2010 investment. CIHR was the top funder in 2008–2010, representing 16% of the investment.

The 2008–2010 investment by province of nominated PI was largely distributed among Quebec (39%), Alberta (26%) and Ontario (20%). There were 43 PIs who were involved in projects focused on Activity Level, Body Composition & Metabolism over the six-year span.

FIGURE 3.2.1

DISTRIBUTION OF RESEARCH INVESTMENT IN ACTIVITY LEVEL, BODY COMPOSITION & METABOLISM, 2005–2007 AND 2008–2010



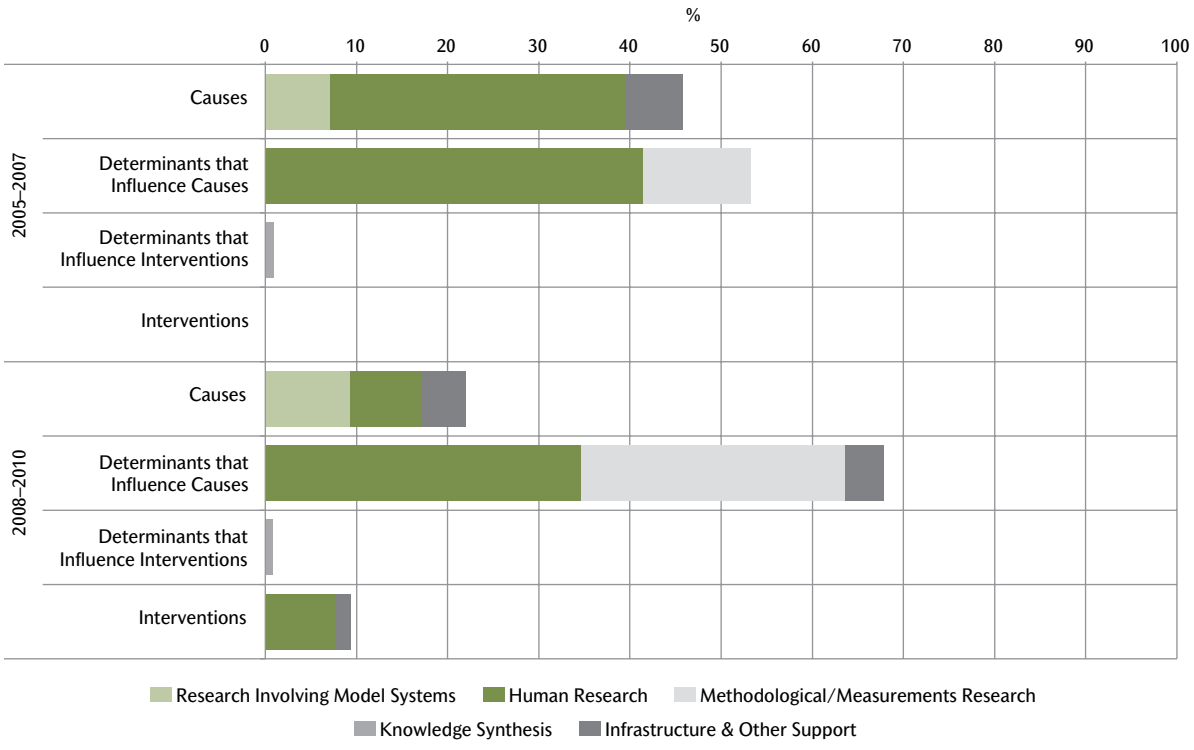
3.2.2 Alcohol

The investment in Alcohol research rose from less than $0.1M in 2005–2007 to $0.8M in 2008–2010, but remained the risk factor with the lowest research investment. Much of the increased investment was attributed to new research focused on Determinants that Influence Causes that involved Human Research and Methodological/Measurements Research (Figure 3.2.2). The weighted number of projects was just 5.3 and almost all projects were co-coded to Tobacco.

Ten organizations had some level of investment in Alcohol. The top funder was CIHR, which accounted for 67% of the investment in 2008–2010. Seven PIs were involved in projects focused on Alcohol over the course of the six years.

FIGURE 3.2.2

DISTRIBUTION OF RESEARCH INVESTMENT IN ALCOHOL, 2005–2007 AND 2008–2010



3.2.3 Contaminants in the Air, Water & Soil

Investment in research focused on Contaminants in the Air, Water & Soil increased marginally—from $8.6M in 2005–2007 to $8.9M in 2008–2010 and was characterized by a shift in increased investment in Infrastructure & Other Support focused on Causes and Human Research on Causes (Figure 3.2.3).

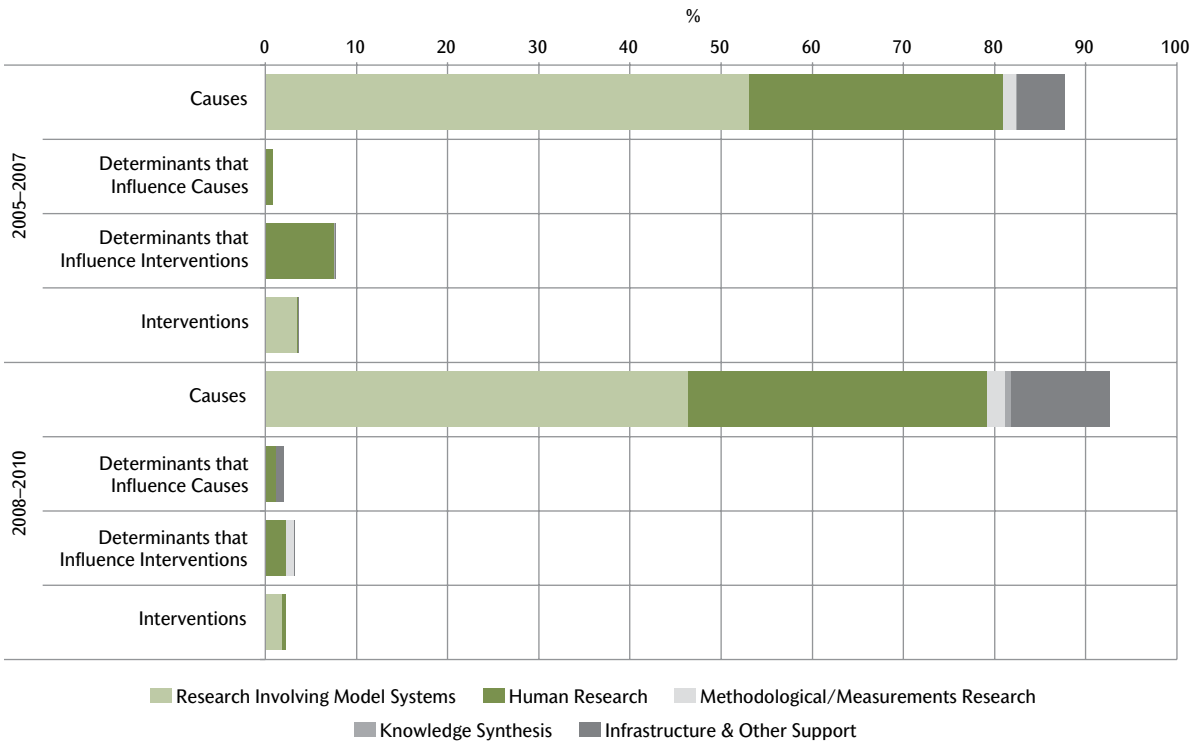
The weighted number of projects was 110.1 and many projects (60%) were not coded to other risk factors. Nearly half of the investment (47%) over the six-year span focused on skin cancer (19%), lung cancer (13%), breast cancer (8%), and leukemia (7%). While only 4% of the cancer risk and prevention investment was focused on bladder cancer, 80% of the bladder cancer risk and prevention research investment was focused on this risk factor alone.

There were 22 organizations that had some level of investment in Contaminants in the Air, Water & Soil research. The top funder was CIHR, which accounted for 49% of the investment in 2008–2010. The investment by CCS dropped by 55% from 2005–2007 to 2008–2010 and represented 9% of the investment in 2008–2010.

The 2008–2010 investment by province of nominated PI was distributed largely among Ontario (31%), Alberta (29%), and Quebec (19%). There were a total of 61 PIs who were involved in projects focused on Contaminants in the Air, Water & Soil over the span of the six years.

FIGURE 3.2.3

DISTRIBUTION OF RESEARCH INVESTMENT IN CONTAMINANTS IN THE AIR, WATER & SOIL, 2005–2007 AND 2008–2010



3.2.4 Diet & Nutrition

Investment in Diet & Nutrition research increased 73%, from $6.0M in 2005–2007 to $10.4M in 2008–2010 and it had the fifth highest investment among all risk factors in 2008–2010. The 2008–2010 period was marked by increased Infrastructure & Other Support for Intervention research and increased Human Research for Causes research (Figure 3.2.4).

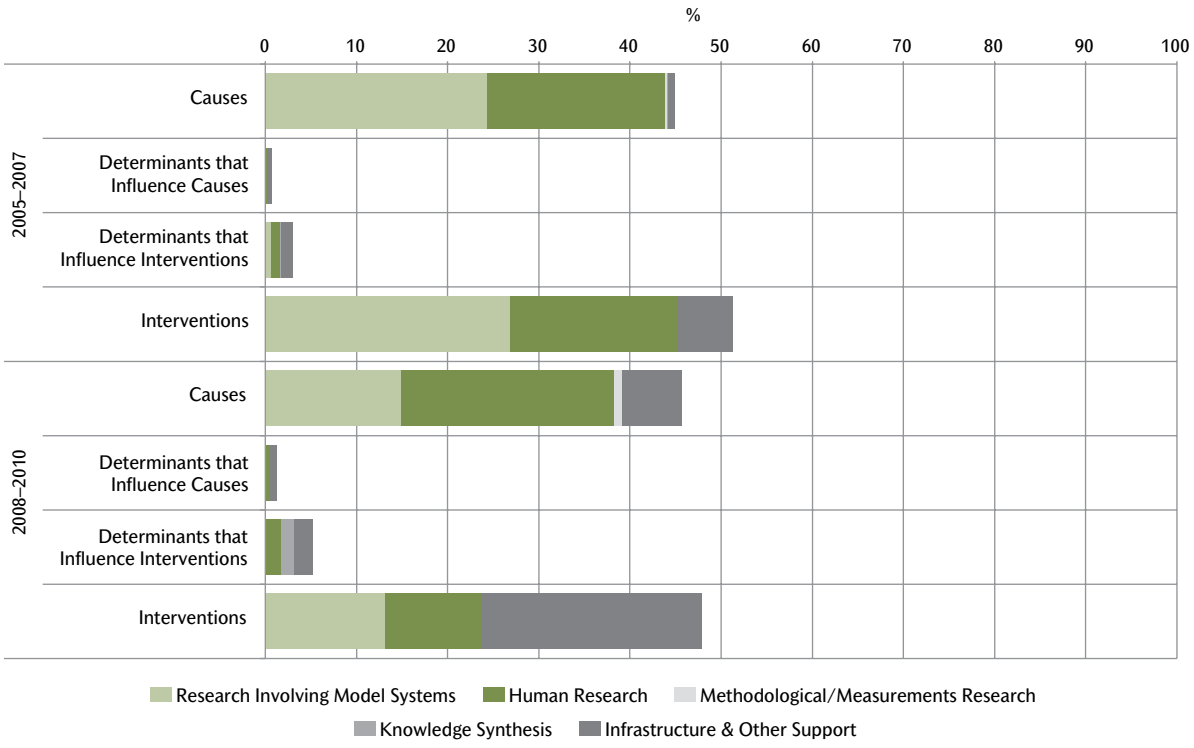
The weighted number of projects was 116.5 and 26% of projects were co-coded to Activity Level, Body Composition & Metabolism. Research focused on breast cancer represented 27% of the overall investment in this risk factor.

Twenty-one organizations had some level of investment in Diet & Nutrition research. The investment by CFI was $1.1M higher in 2008–2010 than in 2005–2007. The CFI investment represented 12% of the total investment in 2008–2010, right behind the investments for CIHR (25%) and CCS (17%).

While much of the investment went to PIs in Ontario in 2008–2010 (55%), an increasing proportion of the investment went to PIs in Quebec and Alberta as the investments in this risk factor more than doubled from 2005–2007 to 2008–2010 for these provinces. Over the six years, there were 68 PIs who were involved in projects focused on Diet & Nutrition.

FIGURE 3.2.4

DISTRIBUTION OF RESEARCH INVESTMENT IN DIET & NUTRITION, 2005–2007 AND 2008–2010



3.2.5 Ethnicity, Sex & Social Environment

A total of $1.2M more was invested in Ethnicity, Sex & Social Environment in 2005–2007 than in 2008–2010 (from $4.4M to $5.6M). The most significant change between the two triennia was in the influx of investment in Human Research focused on Determinants that Influence Interventions and Interventions (Figure 3.2.5).

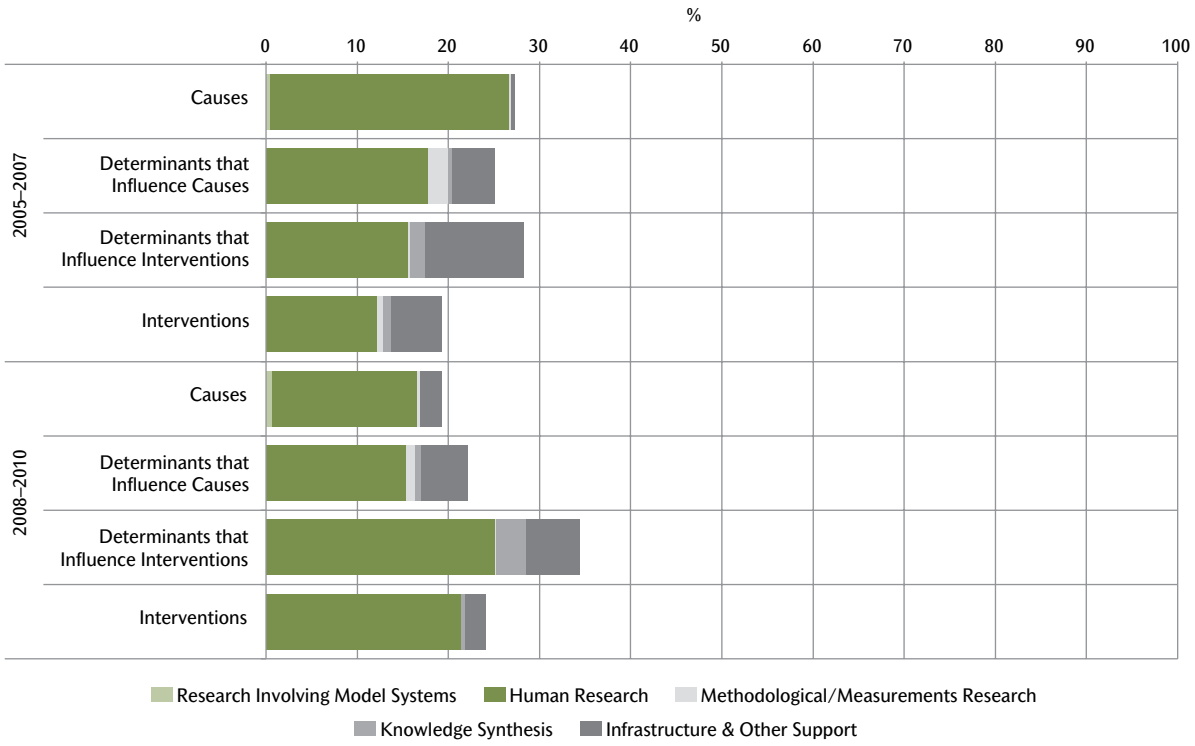
The weighted number of projects was 71.6 and 57% of projects were co-coded to Tobacco. Relatedly, 31% of the investment was focused on lung cancer.

There were 17 organizations that had some level of investment in Ethnicity, Sex & Social Environment. CIHR represented a growing proportion of the investment—from $3.0M (67%) in 2005–2007 to $4.1M (72%) in 2008–2010.

Most of the investment in 2008–2010 went to PIs in Ontario (46%), Quebec (24%), and British Columbia (17%). A total of 45 PIs were involved in projects focused on Ethnicity, Sex & Social Environment over the six-year span.

FIGURE 3.2.5

DISTRIBUTION OF RESEARCH INVESTMENT IN ETHNICITY, SEX & SOCIAL ENVIRONMENT, 2005–2007 AND 2008–2010



3.2.6 Gene-environment Interactions

There was a slight increase (16%) in investment for Gene-environment Interactions—from $4.9M in 2005–2007 to $5.7M in 2008–2010. There was a contraction of Human Research focused on Causes and an influx of investment in Infrastructure & Other Support focused on causes from 2005–2007 to 2008–2010 (Figure 3.2.6).

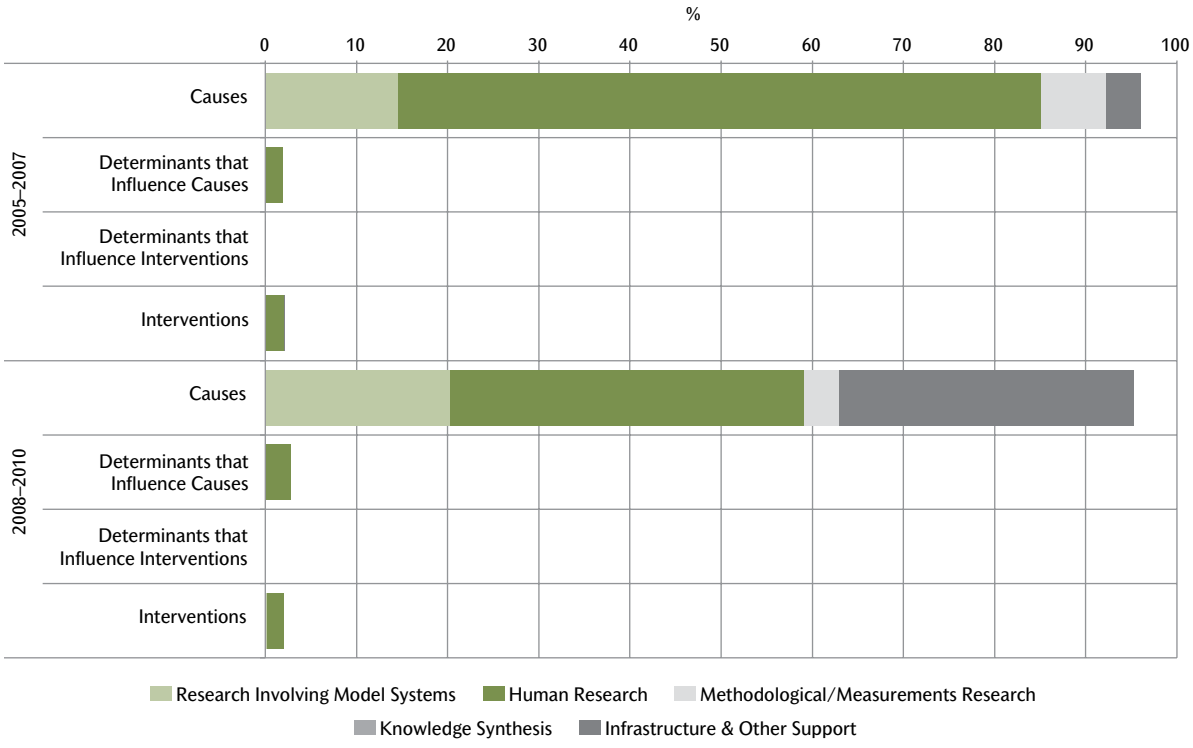
The weighted number of projects was 52.8. Gene-environment Interactions projects were often co-coded, most commonly with Tobacco, Diet & Nutrition, and Contaminants in the Air, Water & Soil. Research on breast cancer represented 37% of this investment.

There were 19 organizations with some level of investment in Gene-environment Interactions. CIHR, CCS, and Alberta Cancer were the top three funders in 2008–2010, representing 32%, 19% and 18% of the investment, respectively.

Most of the investment in Gene-environment Interactions went to PIs in Ontario (34%), Quebec (26%), and Alberta (21%) in 2008–2010. Over the full six years, 88 PIs were involved in projects focused on Gene-environment Interactions.

FIGURE 3.2.6

DISTRIBUTION OF RESEARCH INVESTMENT IN GENE-ENVIRONMENT INTERACTIONS, 2005–2007 AND 2008–2010



3.2.7 Genetic Susceptibilities

There was a slight drop in the investment focused on Genetic Susceptibilities—from $26.7M in 2005–2007 to $24.0M in 2008–2010. In terms of the distribution of the investment, there was a slight contraction in the investment in Human Research and an influx in Infrastructure & Other Support in research focused on Causes (Figure 3.2.7). In 2005–2007, Genetic susceptibilities had the highest level of investment. It was ranked second in 2008–2010 due to the dramatic increase in investment for the Multiple/General risk factor category.

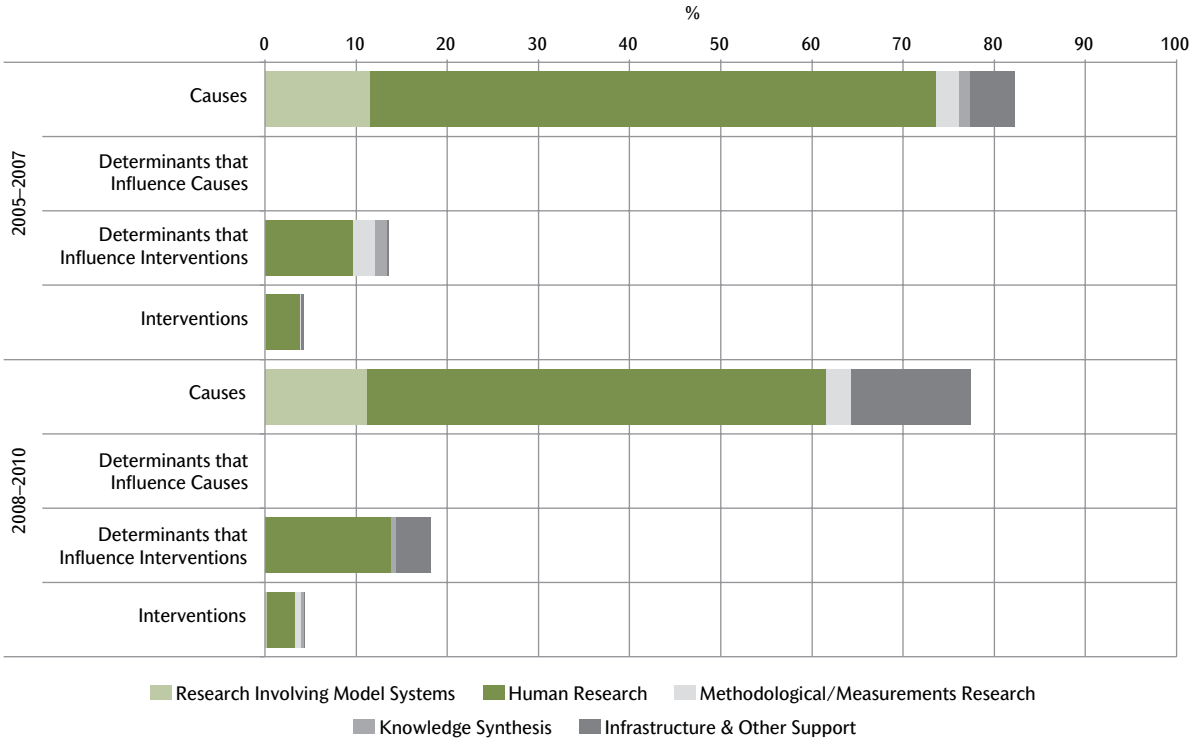
The weighted number of projects was 179.7. The investment in Genetic Susceptibilities was largely dominated by research focused on colorectal and breast cancer, which represented 42% and 31% of the overall six-year investment. Of the overall $7.6M cancer risk and prevention research investment in ovarian cancer, 53% was invested in research focused on Genetic Susceptibilities.

Twenty-four organizations had some level of investment in research focused on Genetic Susceptibilities. CIHR and CCS were the top funders in 2008–2010, representing 40% and 18% of the investment, respectively. The Ontario Institute for Cancer Research and Canadian Breast Cancer Foundation each accounted for 6% of the investment in this risk factor in 2008–2010.

Most of the investment went to PIs in Ontario (49%) and Quebec (29%) in 2008–2010. Investment in Genetic Susceptibilities represented 26% of the total six-year cancer risk and prevention research investment granted to Ontario PIs. There were 88 PIs who were involved in projects focused on Genetic Susceptibilities and 41 were from Ontario.

FIGURE 3.2.7

DISTRIBUTION OF RESEARCH INVESTMENT IN GENETIC SUSCEPTIBILITIES, 2005–2007 AND 2008–2010



3.2.8 Hormones

The cancer risk and prevention research investment focused on Hormones dropped 14%—from $3.6M in 2005–2007 to $3.1M in 2008–2010. The distribution changed with increased investment in research focused on Interventions, particularly Human Research and Research Involving Model Systems for the 2008–2010 period (Figure 3.2.8).

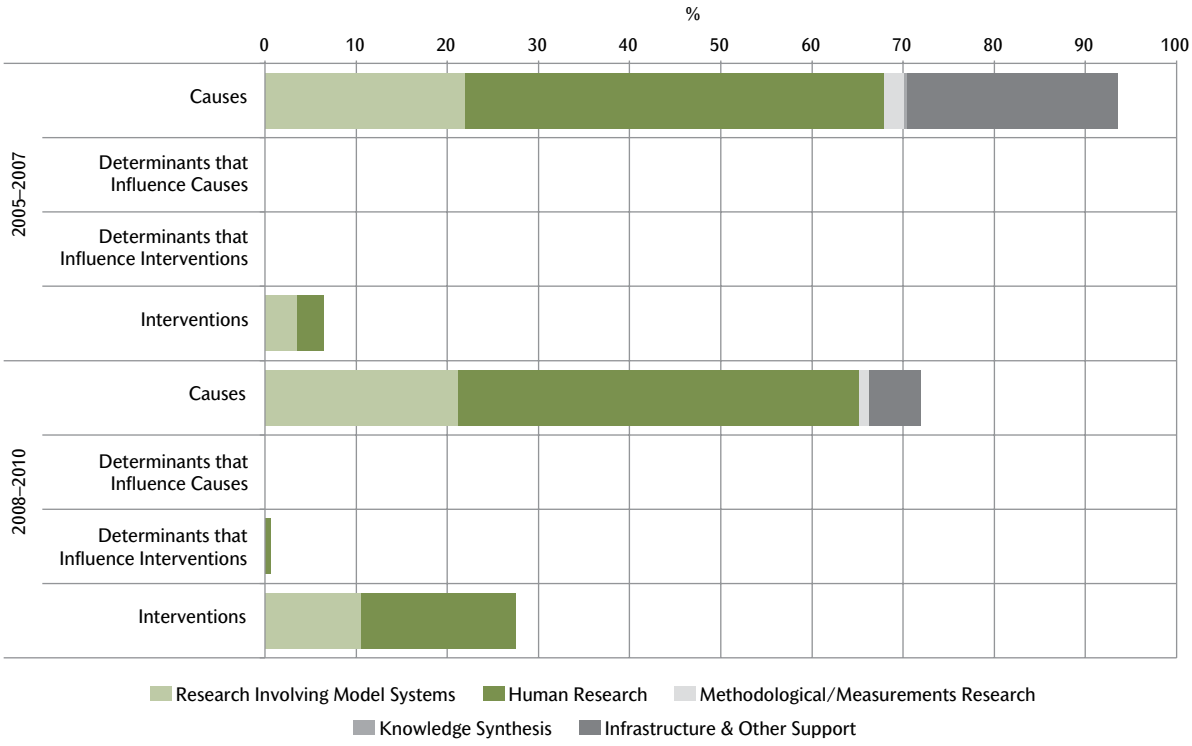
The weighted number of projects was 42.2. One-quarter (25%) of projects were also coded to Genetic Susceptibilities. The research investment in Hormones was dominated by a focus on breast cancer (48%) and, to a lesser extent, ovarian cancer (19%).

There were 12 organizations with some level of investment in research focused on Hormones. CIHR and Canadian Breast Cancer Foundation were the top funders, accounting for 32% and 28% of the 2008–2010 investment, respectively.

Most of the investment 2008–2010 went to PIs in Ontario (64%) and, to a lesser extent, Quebec (19%). There were 27 PIs who were involved in projects focused on Hormones over the six-year span.

FIGURE 3.2.8

DISTRIBUTION OF RESEARCH INVESTMENT IN HORMONES, 2005–2007 AND 2008–2010



3.2.9 Infectious Agents

There was a slight increase (15%) in the research investment on Infectious Agents, from $19.0M in 2005–2007 to $21.8M in 2008–2010. Compared to 2005–2007, there was much more investment in Human Intervention research and Human Research focused on Causes in 2008–2010 (Figure 3.2.9).

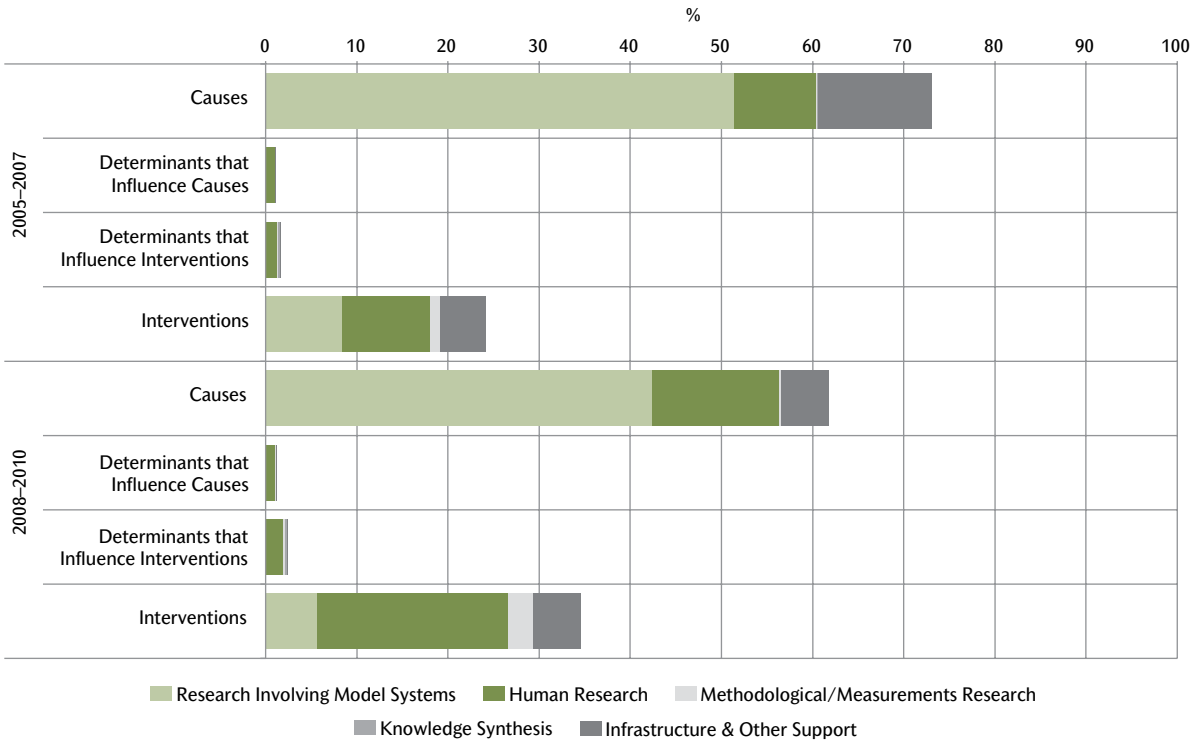
There were 207.2 weighted projects and very few were coded to other risk factors. Research focused on cervical cancer represented 38% of the total six-year investment in Infectious Agents, which translated into 88% of the total cervical cancer risk and prevention research investment. Likewise, research focused on liver cancer represented 14% of the overall investment in Infectious Agents, but 73% of the total liver cancer risk and prevention research investment.

Twenty-three organizations had some level of investment in Infectious Agents. CIHR's investment grew 56%—from $8.3M (44%) in 2005–2007 to $13.0M (59%) in 2008–2010.

Of the investment in 2008–2010, 49% went to PIs in Quebec, 24% to PIs in British Columbia, and 21% to PIs in Ontario. The investment in B.C. more than doubled from 2005–2007 to 2008–2010—from $2.2M to $5.3M. Sixty-three PIs were involved in projects focused on Infectious Agents over the six-year span.

FIGURE 3.2.9

DISTRIBUTION OF RESEARCH INVESTMENT IN INFECTIOUS AGENTS, 2005–2007 AND 2008–2010



3.2.10 Occupational Exposures

Investment in research focused on Occupational Exposures rose by 36%, from $1.5M in 2005–2007 to $2.0M in 2008–2010. Much of this increase was in research focused on Causes, in particular, Infrastructure & Other Support (Figure 3.2.10).

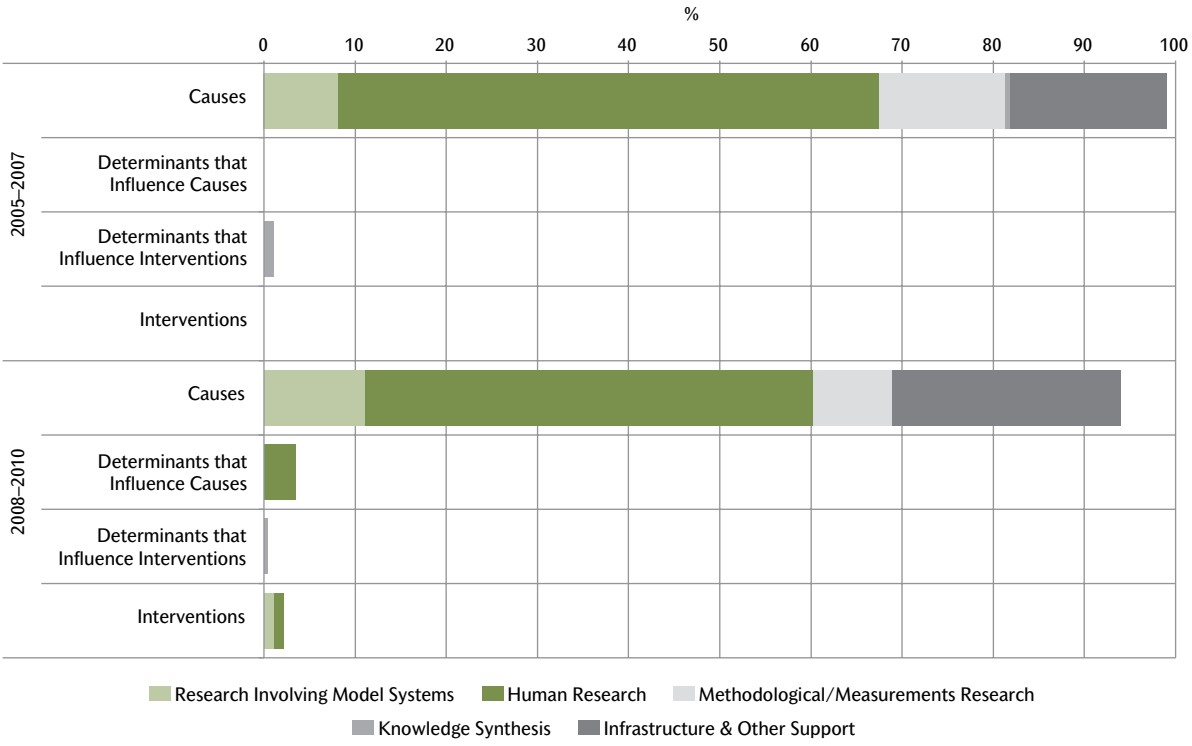
There were 28.4 weighted projects and 29% were co-coded with Contaminants in the Air, Water & Soil. Research focused on lung cancer represented 25% of the overall investment in this risk factor.

There were 11 organizations with some level of investment in Occupational Exposures. CIHR accounted for a dwindling proportion of the investment, from 54% in 2005–2007 to 29% in 2008–2010, while Michael Smith Foundation for Health Research accounted for a growing proportion, from 13% to 18%.

The entire investment in 2008–2010 went to PIs in Ontario (45%), Quebec (31%), and British Columbia (24%). There were 23 PIs who were involved in projects focused on Occupational exposures over the full six years.

FIGURE 3.2.10

DISTRIBUTION OF RESEARCH INVESTMENT IN OCCUPATIONAL EXPOSURES, 2005–2007 AND 2008–2010



3.2.11 Physiological Susceptibilities

The investment in research focused on Physiological Susceptibilities dropped slightly from $3.4M in 2005–2007 to $3.2M in 2008–2010. Much of this reduction was due to a drop in Human Research focused on Causes (Figure 3.2.11).

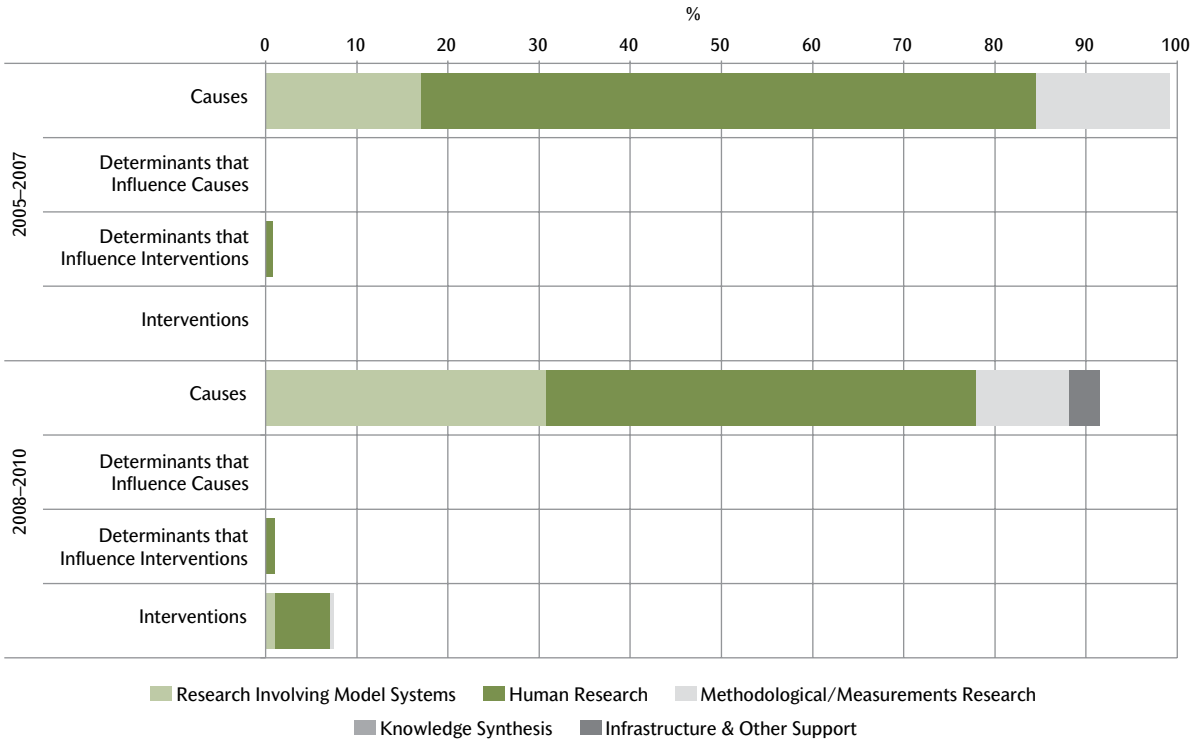
There were 40.5 weighted projects and half of the research projects were co-coded, most commonly with Genetic Susceptibilities and Treatments/Diagnostics. Breast cancer research represented 60% of the overall investment in Physiological Susceptibilities, with mammographic density being a major component of this research.

There were 16 organizations with some level of investment in this risk factor. CIHR was the top funder in 2008–2010 ($1.4M, 42%). Investments in Physiological Susceptibilities from CCS, the Canadian Breast Cancer Foundation, and the Public Health Agency of Canada were largely related to funding programs offered through the former Canadian Breast Cancer Research Alliance.

Much of the investment in 2008–2010 went to PIs in Ontario (34%), Alberta (27%), and Quebec (25%). There were 25 PIs who were involved in projects focused on Physiological Susceptibilities over the six-year span.

FIGURE 3.2.11

DISTRIBUTION OF RESEARCH INVESTMENT IN PHYSIOLOGICAL SUSCEPTIBILITIES, 2005–2007 AND 2008–2010



3.2.12 Precursor Lesions

There was a 9% drop in the research investment for Precursor Lesions—$4.4M in 2005–2007 to $4.0M in 2008–2010. Despite little change in the investment amounts, the distributions of the investments were radically different, with a large reduction in Causes and an increase in research on Determinants that Influence Interventions and, to a lesser extent, Interventions from 2005–2007 to 2008–2010 (Figure 3.2.12).

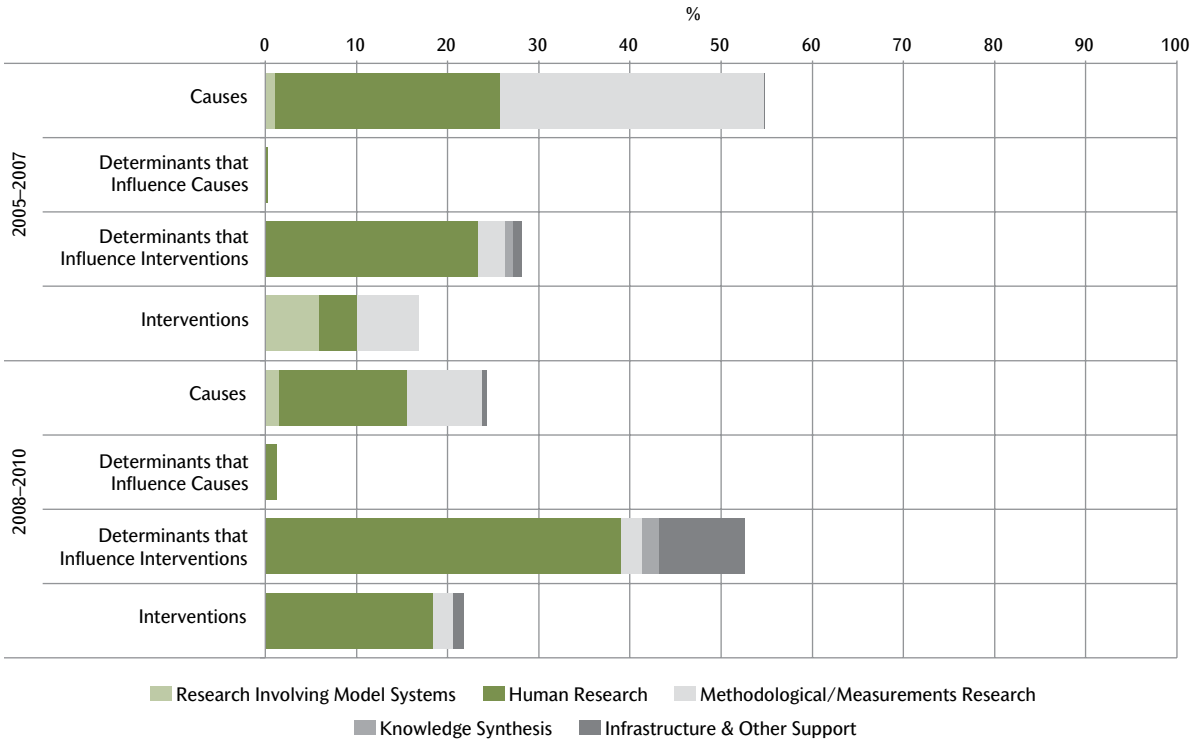
There were 48.9 weighted projects and more than one-third were co-coded, most often to Ethnicity, Sex & Social Environment and Diet & Nutrition. Of the overall $8.5M invested in research on Precursor Lesions over the six years, 45% was for research focused on colorectal cancer and much of this was research focused on screening methods to detect precancerous polyps.

A total of 19 organizations had some level of investment in Precursor Lesions. CIHR was the main funder and accounted for a growing proportion of the investment—from 49% in 2005–2007 to 56% in 2008–2010, while CCS accounted for a shrinking proportion of the investment—from 14% in 2005–2007 to 10% in 2008–2010.

Much of the 2008–2010 investment went to PIs in Ontario (36%) and British Columbia (28%). A total of 42 PIs were involved in projects of focused on Precursor Lesions over the six years.

FIGURE 3.2.12

DISTRIBUTION OF RESEARCH INVESTMENT IN PRECURSOR LESIONS, 2005–2007 AND 2008–2010



3.2.13 Tobacco

Research investment focused on Tobacco increased negligibly, from $15.0M in 2005–2007 to $15.1M in 2008–2010. Relative to 2005–2007, in 2008–2010 there was proportionately more investment in Human Research focused on Interventions, Determinants that Influence Interventions, and Causes and proportionately less investment in Infrastructure & Other Support (Figure 3.2.13). The Canadian Tobacco Control Research Initiative was an important component of the investment in this risk factor, albeit less so when the Infrastructure & Other Support investment was not included (see inset graphs).

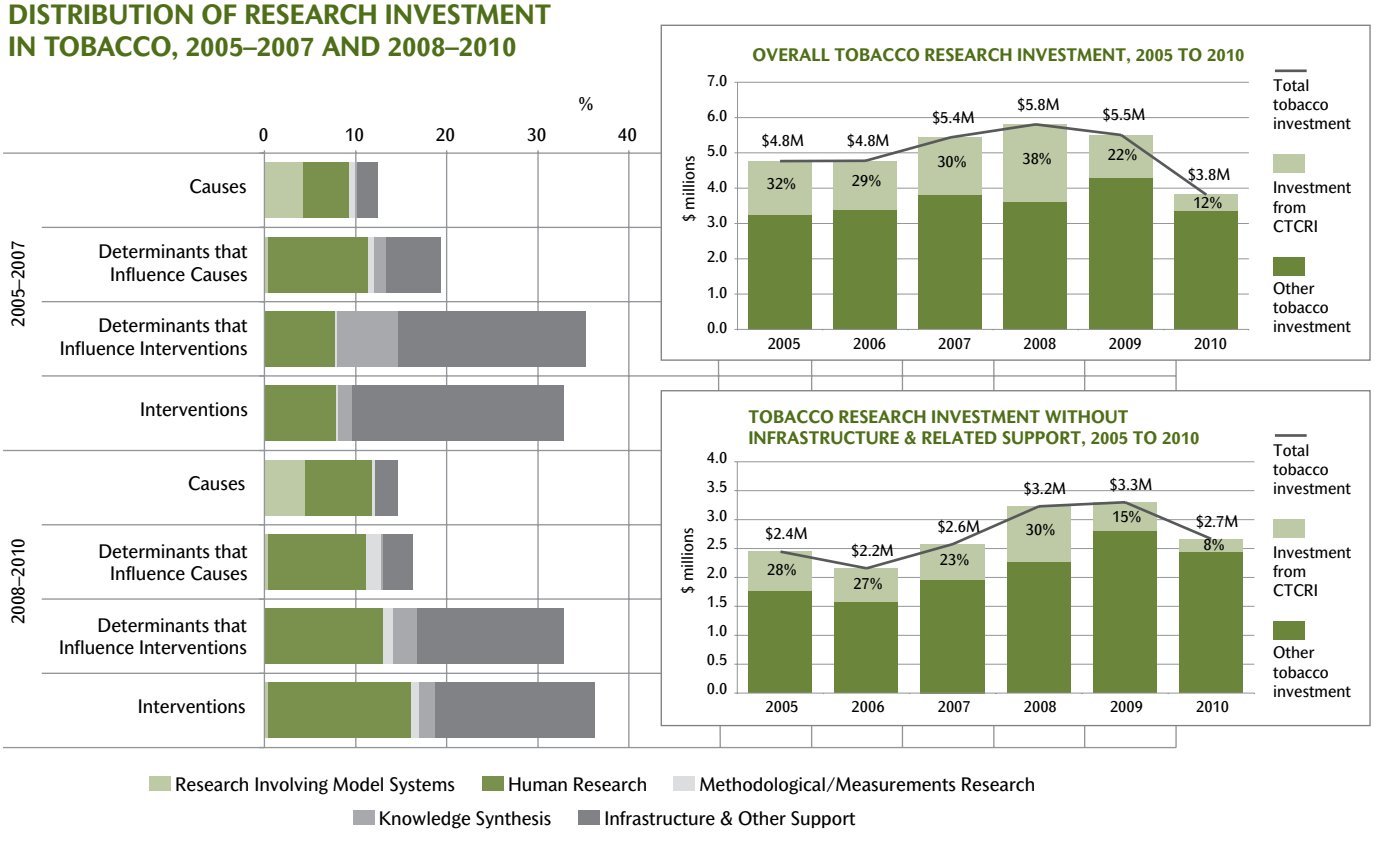
There were 234.8 weighted projects and 24% were co-coded with Ethnicity, Sex & Social Environment. Lung and oral cancers were the focus of this investment.

Fifteen organizations had some level of investment in Tobacco. CIHR became the main funder and accounted for a growing proportion of the investment to the same degree that CCS's investment decreased. That is, CIHR represented 37% of the investment in 2005–2007 and 47% in 2008–2010 while CCS represented 48% in 2005–2007 and 37% in 2008–2010.

A large proportion (65%) of the investment in 2008–2010 went to PIs in Ontario. In fact, Tobacco represented 18% of the total cancer risk and prevention research investment going to Ontario researchers over the six years. There were 69 PIs who were involved in projects of focused on Tobacco and 36 were from Ontario.

FIGURE 3.2.13

DISTRIBUTION OF RESEARCH INVESTMENT IN TOBACCO, 2005–2007 AND 2008–2010



3.2.14 Treatments/Diagnostics

Research investment in Treatments/Diagnostics increased 84% from $1.8M to $3.2M from 2005–2007 to 2008–2010. There was increased investment in Human Research focused on Interventions as well as increased investment in Research Involving Model Systems focused on Causes in 2008–2010 (Figure 3.2.14).

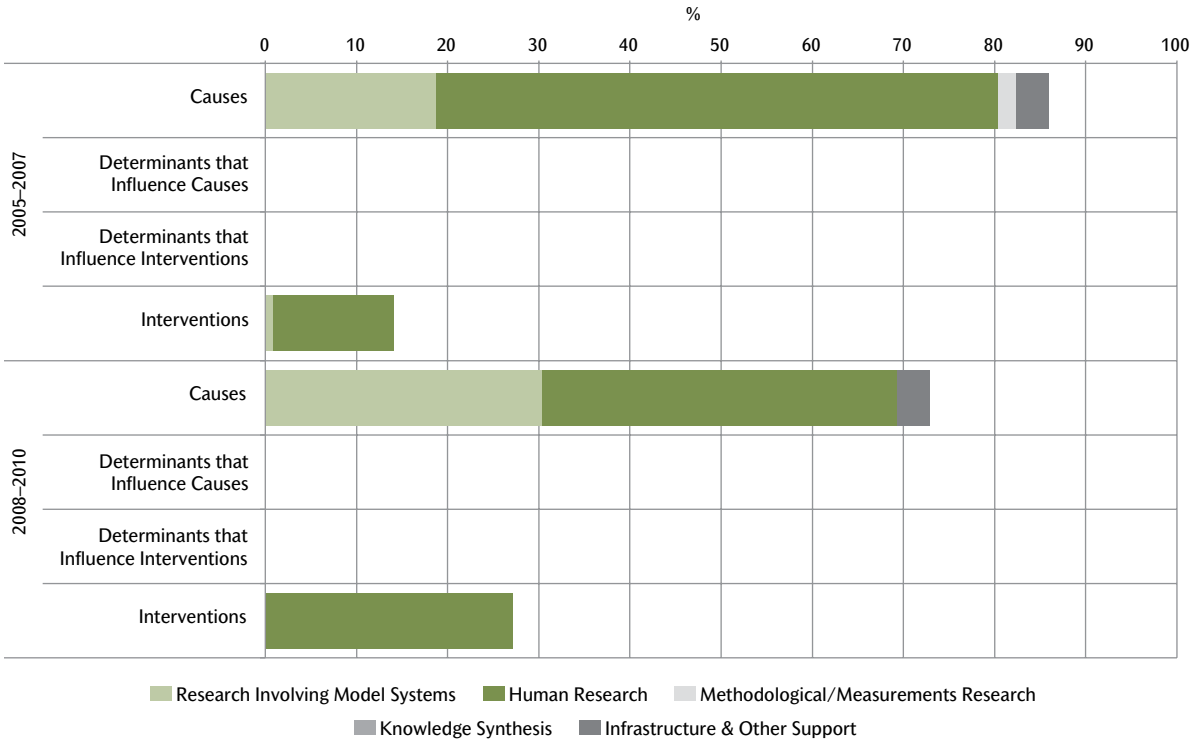
There were 39.9 weighted projects in Treatments/Diagnostics and most (67%) were coded only to this risk factor. Research focused on breast cancer represented 35% of the overall investment in Treatments/Diagnostics.

Twelve organizations had some level of investment in this risk factor. CIHR was the major funder, but accounted for a shrinking share of the investment (from 57% to 42%). The increased investments in 2008–2010 from CCS, the Canadian Breast Cancer Foundation, and the Public Health Agency of Canada were largely due to a major project supported through the former Canadian Breast Cancer Research Alliance.

Nearly all of the investment in 2008–2010 went to PIs in Quebec (32%), Ontario (30%), and Alberta (25%). There were 18 PIs who were involved in projects focused on Treatments/Diagnostics over the six-year span.

FIGURE 3.2.14

DISTRIBUTION OF RESEARCH INVESTMENT IN TREATMENT/DIAGNOSTICS, 2005–2007 AND 2008–2010



3.2.15 Multiple/General

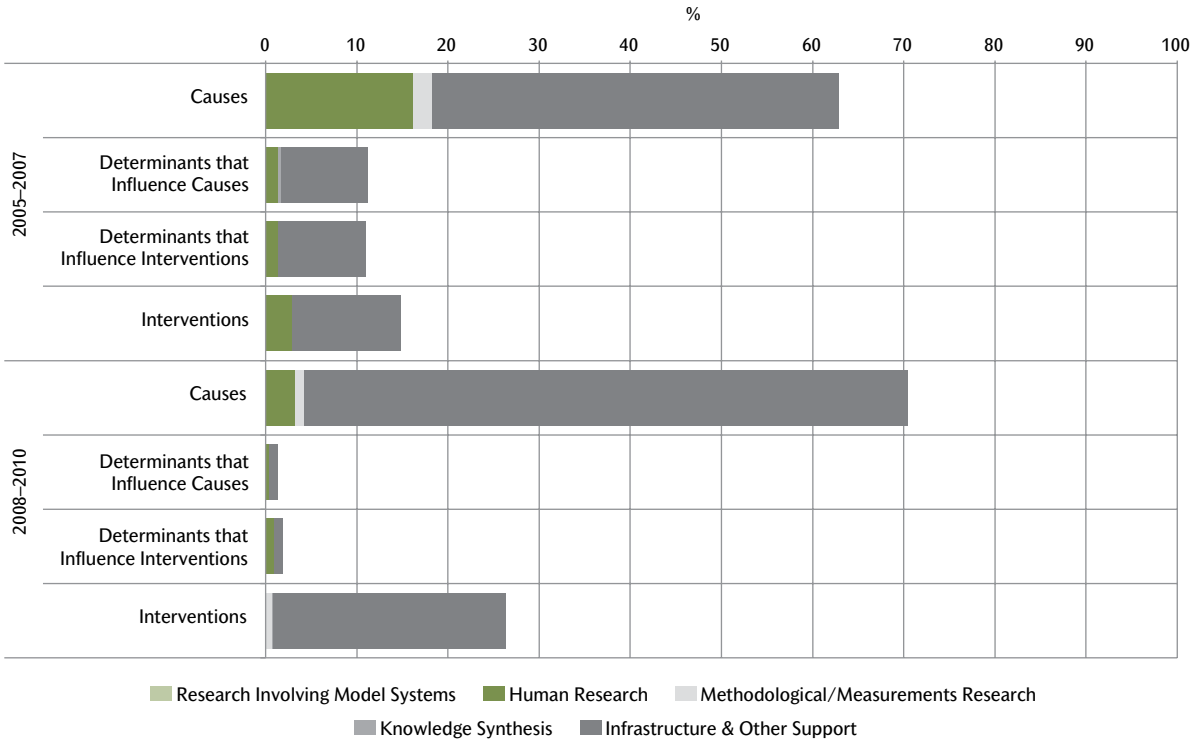
Investment increased four-fold from $10.2M in 2005–2007 to $40.8M 2008–2010 for the multiple/general risk factor category and it became the highest funded risk factor category in 2008–2010 (it was fourth highest in 2005–2007). This large increase was entirely due to increased investment in infrastructure as previously mentioned, particularly in Causes and Interventions (Figure 3.2.15).

This risk factor was represented by 56.3 weighted projects. Seventeen organizations had some level of investment. Key funders were the Canadian Partnership Against Cancer, CFI, and Alberta Cancer.

Much of the 2008–2010 investment went to PIs in Quebec (32%), Ontario (24%), Alberta (16%), and British Columbia (14%). Of the total cancer risk and prevention research investment going to Alberta researchers over the six years, 28% was for the Multiple/General risk factor.

FIGURE 3.2.15

DISTRIBUTION OF RESEARCH INVESTMENT IN MULTIPLE/GENERAL RISK FACTORS, 2005–2007 AND 2008–2010



3.3 RESEARCHERS WORKING IN CANCER PREVENTION

HIGHLIGHTS

- There was no change in the number of nominated PIs funded for cancer risk and prevention research from 2005–2007 to 2008–2010.
- Sixty percent of the nominated PIs had funded research projects at some point in both triennia. This group was proportionately more likely to be involved in research that cut across research foci and that involved more than one risk factor.
- The highest number of nominated PIs worked in Genetic Susceptibilities.
- There was a significant increase in the number of graduate level trainees who received awards from the first to the second triennium.

3.3.1 Independent Researchers

Over the six-year span, there were a total of 402 nominated, non-trainee PIs working in cancer risk and prevention. This refers to researchers who were nominated PIs for at least one operating grant, equipment award, or career award that had a cancer prevention weighting of 50% of higher.

The PIs were divided into three groups based on the funding received:

- those with funding at some point in the 2005–2007 period, but not in the 2008–2010 period (N=82, 20%), denoted as TIME1
- those with funding at some point in the 2008–2010 period, but not in the 2005–2007 period (N=82, 20%), denoted as TIME2
- those with funding during both periods (N=238, 60%), denoted as BOTH

There was no difference in the number of researchers from TIME1 to TIME2. The BOTH group, which represented 60% of the 402 PIs, accounted for 82% of the cancer risk and prevention research investment in 2005–2007 and 67% of the investment in 2008–2010.

When the groups were examined by research focus, the BOTH group was less likely to be engaged in intervention research solely and more likely to be engaged in research across the causes-determinants-intervention continuum (Table 3.3.1). The TIME2 group was least likely to be involved in different types of research—proportionately, there were more TIME2 PIs in the Causes only, Determinants only, and Interventions only groups.

TABLE 3.3.1

DISTRIBUTION OF THREE GROUPS OF PRINCIPAL INVESTIGATORS BY RESEARCH FOCUS

	TIME1		TIME2		BOTH	
Research Focus	N	%	N	%	N	%
Causes	47	57	49	60	127	53
Determinants	10	12	13	16	27	11
Interventions	15	18	18	22	27	11
Causes + Determinants	2	2	0	0	9	4
Causes + Interventions	6	7	2	2	22	9
Determinants + Interventions	2	2	0	0	16	7
Causes + Determinants + Interventions	0	0	0	0	10	4
TOTAL	**82**	**100**	**82**	**100**	**238**	**100**

PIs in the BOTH group were more likely to be working on research that covered two or more risk factors (Table 3.3.2). A detailed breakdown of the three groups and the risk factors is provided in Appendix B.

TABLE 3.3.2

DISTRIBUTION OF THREE GROUPS OF NOMINATED PRINCIPAL INVESTIGATORS BY NUMBER OF RISK FACTORS

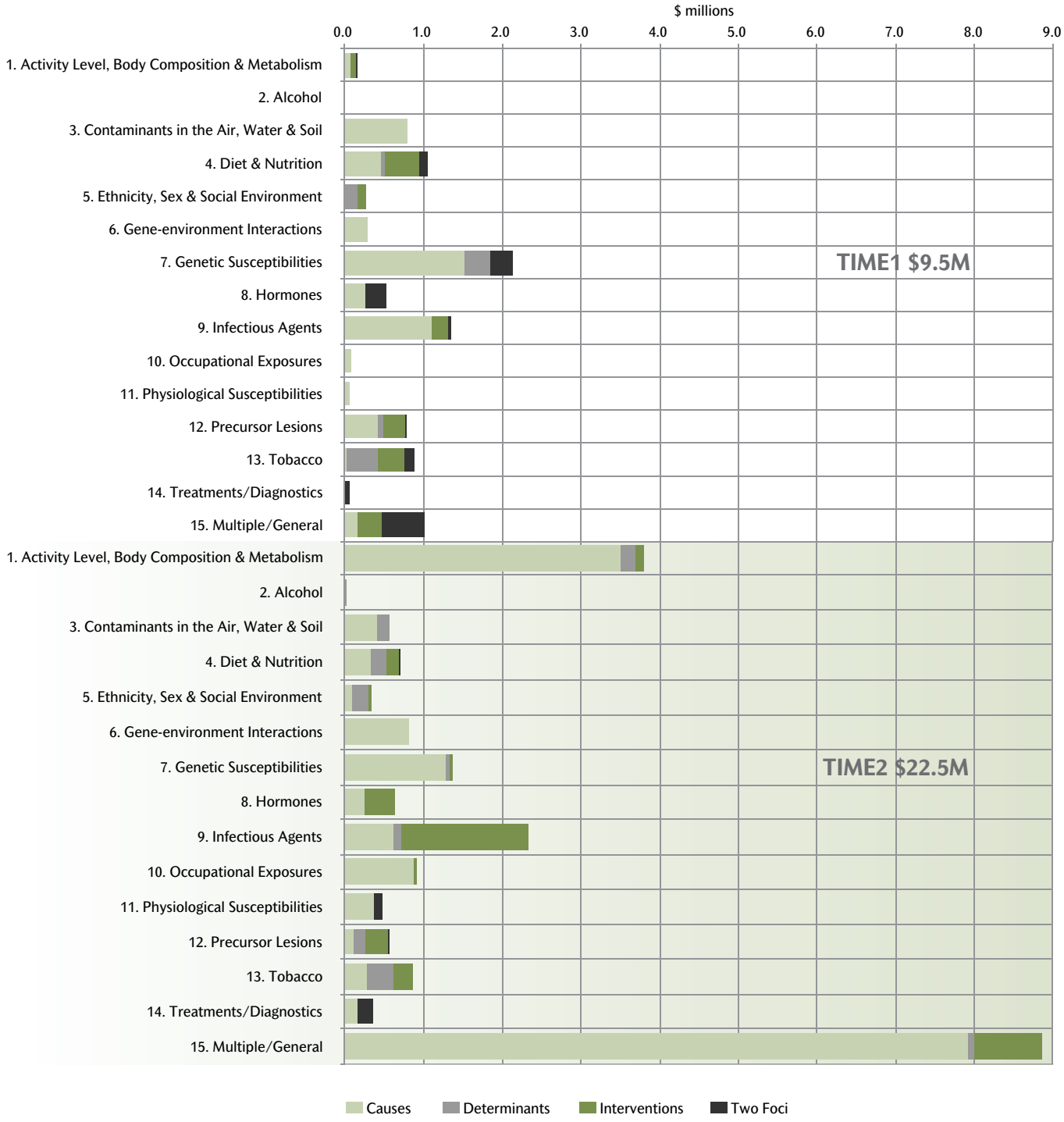
	TIME1		TIME2		BOTH	
Number of Risk Factors	N	%	N	%	N	%
One	59	72	52	63	110	46
Two	16	20	21	26	70	29
Three or More [1]	7	9	9	11	58	24
TOTAL	**82**	**100**	**82**	**100**	**238**	**100**

[1] Included PIs who worked on projects that were coded to the Multiple/General category as well as PIs whose research was coded to three or more specific risk factors.

It is noteworthy that TIME2 PIs represented an adjusted investment of $22.5M, which was substantially higher than TIME1 PIs. There were significant differences in the distribution of the research investments for the PIs from TIME1 and TIME2 in terms of the research foci and risk factors (Figure 3.3.1). Investments for PIs' research in TIME2 was at least a half million dollars more than for PIs from TIME1 in the following areas: Causes for Multiple/General risk factors ($7.7M more); Causes for Activity level, Body composition & Metabolism ($3.4M more); Interventions for Infectious Agents ($1.4M more); Causes for Occupational Exposures ($0.8M more); Interventions for Multiple/General risk factors ($0.5M more); and Causes for Gene-environment Interactions ($0.5M more).

FIGURE 3.3.1

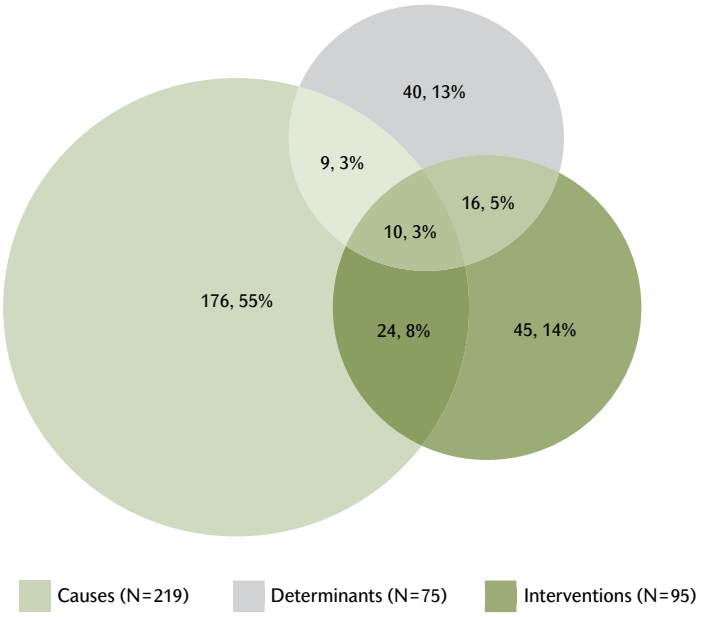
INVESTMENTS FOR NOMINATED PRINCIPAL INVESTIGATORS WORKING IN TIME1 VERSUS TIME2 BY RESEARCH FOCUS AND RISK FACTORS



3.3.2 Current Researcher Capacity

Taken together, groups TIME2 and BOTH provide an indication of the current research capacity in terms of cancer risk and prevention. Causes researchers formed the largest group (Figure 3.3.2). Of note, there were 59 researchers working in more than one research focus (intersection of circles).

FIGURE 3.3.2
NUMBER OF NOMINATED PRINCIPAL INVESTIGATORS BY RESEARCH FOCUS [1]

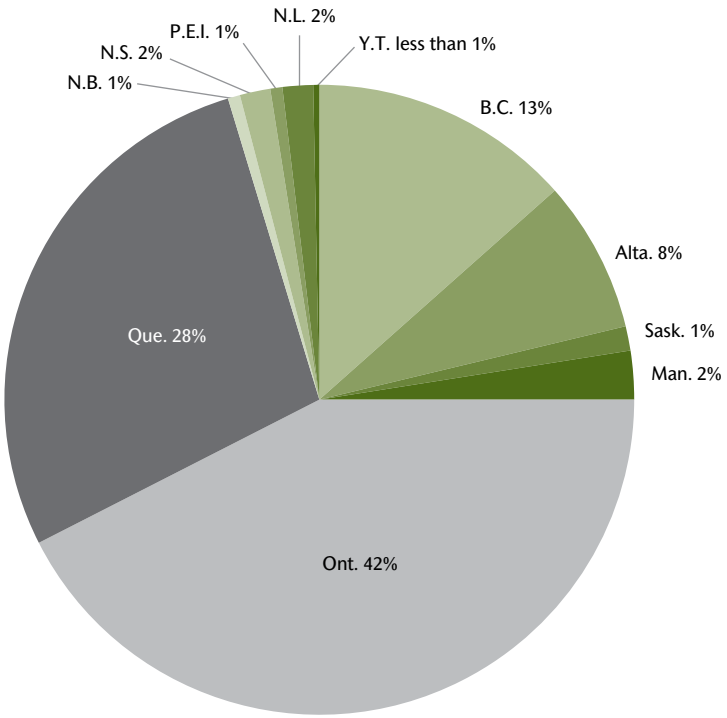


[1] Includes PIs from the TIME2 and BOTH groups (N=320).

The researchers were further stratified by province (Figure 3.3.3) and risk factor (Table 3.3.3). Much of the capacity was in Ontario, Quebec, British Columbia, and Alberta and in these provinces, research was conducted on all risk factors, with one exception (i.e., no Alcohol research investment in Alberta).

FIGURE 3.3.3

DISTRIBUTION OF NOMINATED PRINCIPAL INVESTIGATORS BY REGION [1]



[1] Includes PIs from the TIME2 and BOTH groups (N=320).

TABLE 3.3.3

NOMINATED PRINCIPAL INVESTIGATORS BY RISK FACTOR AND REGION [1]

	PROVINCE/TERRITORY										
Risk Factor	B.C.	Alta.	Sask.	Man.	Ont.	Que.	N.B.	N.S.	P.E.I.	N.L.	Y.T.
1. Activity Level, Body Composition & Metabolism	6	5	1	1	19	7		1			
2. Alcohol	2				2	3					
3. Contaminants in the Air, Water & Soil	7	4	1		22	16		1			
4. Diet & Nutrition	4	4			31	13	1	1	1		
5. Ethnicity, Sex & Social Environment	9	3		3	15	10	1		1		
6. Gene-environment Interactions	6	5	1		17	12					
7. Genetic Susceptibilities	5	4	2	1	37	21				4	
8. Hormones	2	3			14	5					
9. Infectious Agents	8	4			11	27		2		1	
10. Occupational Exposures	4	1			10	5					
11. Physiological Susceptibilities	4	4		1	10	7					
12. Precursor Lesions	5	3	1	1	12	8		1		1	
13. Tobacco	10	2		3	31	9		1	1		
14. Treatments/Diagnostics	2	2			4	9		1			
15. Multiple/General	3	6		1	11	7		1			1
TOTAL [2]	**43**	**25**	**4**	**8**	**136**	**89**	**2**	**5**	**2**	**5**	**1**

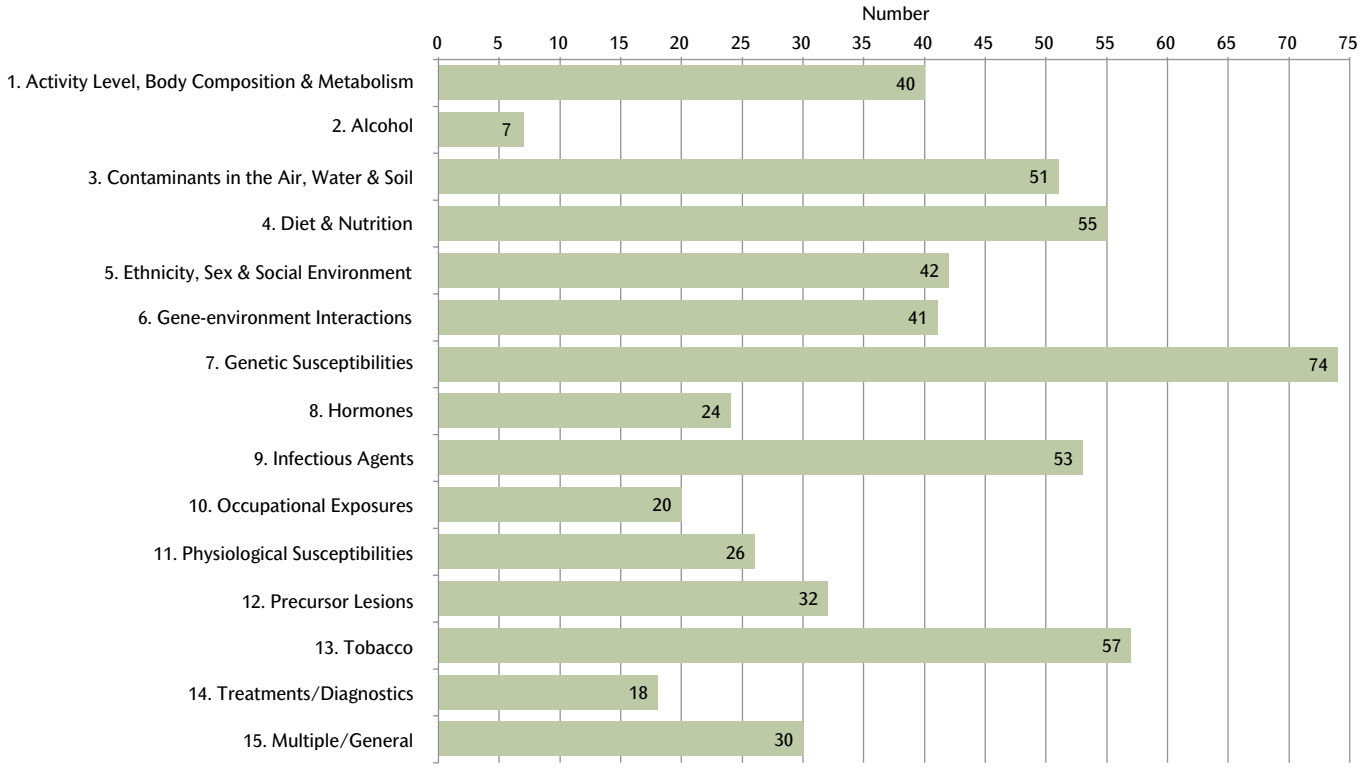
[1] Includes PIs from the TIME2 and BOTH groups. Researchers are counted for each risk factor for which their projects were coded. Sum of risk factors is 570.

[2] Column totals represent the number of PIs per province/territory and not the number of risk factors (N=320).

The highest number of PIs worked in the area of Genetic Susceptibilities (Figure 3.3.4). Tobacco, Diet & Nutrition, Contaminants in the Air, Water & Soil, and Infectious Agents also had 50 or more PIs. There were only seven PIs working in Alcohol.

FIGURE 3.3.4

NUMBER OF NOMINATED PRINCIPAL INVESTIGATORS BY RISK FACTORS [1]



[1] Includes PIs from the TIME2 and BOTH groups (N=320). Total number of risk factors is 570.

3.3.3 Trainees

This section refers only to trainees who competed successfully for awards from the organizations participating in the CCRS. It does not include trainees funded through operating grants or other funding sources, which are assumed to encompass a larger number of trainees.

Over the six-year period, a total of 284 trainees received awards for cancer risk and prevention research projects with a cancer prevention relevance of 50% or higher. Trainees were stratified into the same time periods used for nominated PIs as well as by training level (Table 3.3.4). There was a sizeable increase in the number of graduate level trainees receiving awards, from 52 in 2005–2007 to 102 in 2008–2010. Over half of the graduate level trainees in 2008–2010 (60/102, 59%) received Canada Graduate Scholarships.[5] The number of trainees receiving postdoctoral awards, however, was lower in 2008–2010 than 2005–2007. Many trainees (60%) worked on projects focused solely on Causes.

TABLE 3.3.4

TRAINEES BY GROUP, AWARD LEVEL, AND RESEARCH FOCUS [1, 2]

	TIME1 (N=80)			TIME2 (N=127)			BOTH (N=77)			
Research Focus	Under-graduate	Graduate	Post-doctorate	Under-graduate	Graduate	Post-doctorate	Under-graduate	Graduate	Post-doctorate	TOTAL
Causes	0	29	19	7	65	10	0	25	15	170
Determinants	0	13	4	0	26	0	0	15	2	60
Interventions	0	7	2	0	7	7	0	3	3	29
Causes + Determinants	0	2	0	0	0	1	0	9	0	12
Causes + Interventions	0	1	1	0	2	0	0	1	2	7
Determinants + Interventions	0	0	1	0	2	0	0	2	0	5
Causes + Determinants + Interventions	0	0	1	0	0	0	0	0	0	1
TOTAL	**0**	**52**	**28**	**7**	**102**	**18**	**0**	**55**	**22**	**284**

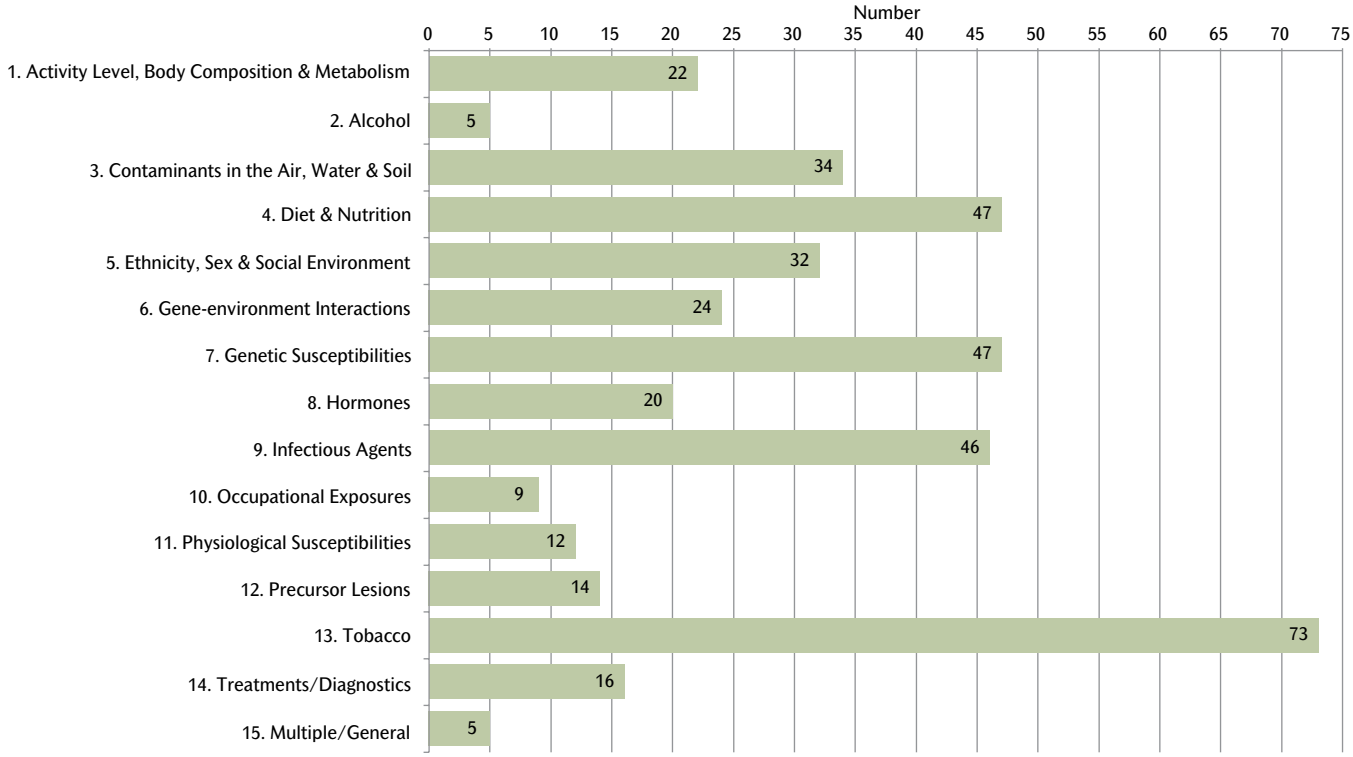
[1] Represents only trainees who received one or more competitive award from one or more of the organizations partipating in the CCRS.
[2] For trainees with awards for two different award levels, the highest level was recorded.

5. Of note, the cancer risk and prevention research investment from the Canada Graduate Scholarships program increased 136%, from $8.4M in 2005–2007 to $19.7M in 2008–2010. Of the total cancer research investment from the Canada Graduate Scholarships program in 2008–2010, 15% was for cancer risk and prevention research.

The highest number of trainees worked in the area of Tobacco (Figure 3.3.5), substantially more than the number of PIs. Diet & Nutrition, Genetic Susceptibilities, and Infectious Agents all had more than 45 trainees. There were only five trainees working in Alcohol.

FIGURE 3.3.5

NUMBER OF TRAINEES BY RISK FACTORS [1]



[1] Includes all 284 trainees. Total number of risk factors is 406.

4. SUMMARY

"Our now clear understanding of the years- to decades-long time frame of tumor development, which often starts early in life, should propel us to think anew about how we can organize and commit resources to markedly reduce the burden of cancer on individuals and society"

From "Applying what we know to accelerate cancer prevention" by Graham A. Colditz, Kathleen Y. Wolin and Sarah Gehlert, 2012, *Science Translational Medicine,* 4(127), p. 5.

This study updated an initial analysis of the investment in cancer risk and prevention research among many of the major funders of cancer research in the government and voluntary sectors in Canada. It compared a period of fairly stagnant investment in cancer risk and prevention research (2005 to 2007) with a period of growth (2008 to 2010).

The tremendous increase in infrastructure funding resulting from strategic funding that occurred from the first to second time periods bodes well for the further development of cancer epidemiological research in Canada. Effectively capitalizing on the important epidemiological platforms arising from these investments will be critical. More specifically, providing funding opportunities to support programs utilizing the dataset and bio-repository of the very important Canadian Partnership for Tomorrow Project is one of the action items from the 2010–2014 pan-Canadian cancer research strategy.

The cancer risk/causation component of the cube accounted for over sixty percent of the investments in both time periods examined, but the highest percent increase in investment from the initial to more recent time period was found for intervention research, for which the investment nearly doubled. Unlike cancer risk/causation, most of the increased investment for intervention research came from funding programs that were not targeted. Consideration of targeted funding programs, however, may be warranted to further build on these gains. As articulated in the strategic framework for cancer prevention research, "CCRA organizations funding this [discovery] research should take advantage of the opportunities for working together to provide strategic funding to explore the translational potential of discovery research to inform new prevention intervention development and testing."[6] This is an important call to action.

6. Canadian Cancer Research Alliance. (2012). *Cancer Prevention Research in Canada: A Strategic Framework for Collaborative Action.* Toronto: CCRA. (p. 44).

Dedicated funding opportunities such as those that were available from the now defunct Canadian Tobacco Control Research Initiative were an important part of the research investment in tobacco. Despite tobacco's importance as a risk factor for lung and other cancers, however, only 15 of the 40 funding organizations involved in the survey invest in tobacco research. Given Canadian leadership in the Framework Convention on Tobacco Control as well as critical infrastructure provided by CCS through the Propel Centre for Population Health Impact, it is important that research investments continue to be directed to advance this field.

In an era of growing awareness and concern about the impact of environmental exposures on human health, the research investments for the environmental and occupational exposures risk factors did not increase at the level of some of the other risk factors. Further investigation is needed to understand why this is the case.

While we provided a detailed analysis of researchers involved in cancer risk and prevention research in this report, our data does not answer several critical questions:

- Are TIME1 investigators no longer in the cancer risk/prevention field? Are they still in the field, but funded from other sources not captured in the CCRS? Are they involved cancer risk/prevention in an unfunded capacity?
- Are TIME2 investigators truly new to the cancer risk/prevention field?
- What is the extent of trainees in the cancer risk/prevention area? Is the number growing? Do trainees go on to become new investigators in the field?

In the CCRA online survey of cancer researchers[7] conducted from December 2011 to January 2012, there were 48 respondents working in the cancer epidemiology and prevention areas. Fewer than 20% of respondents agreed with the statement, 'Canada has adequate/sufficient cancer research capacity at present and is not in any jeopardy in the foreseeable future. No action is needed.' Sixty-three percent felt that there were fewer training opportunities in Canada in the epidemiology and cancer prevention areas when compared to other key countries and 54% reported that they had experienced challenges in recruiting qualified cancer research personnel to their teams/laboratories. More funding opportunities, greater availability of trainee awards/fellowships, and more institutional training programs were the most frequently cited ways that respondents felt insufficient human resources capacity could be addressed. Although a small subset of the cancer risk and prevention researchers, the opinions expressed by these respondents reinforce the importance of capacity building.

7. Canadian Cancer Research Alliance. (2012). *Human Resource Needs and Capacity in Cancer Research in Canada: An Online Survey of Cancer Researchers.* Toronto: CCRA.

In summary, while important gains in the cancer risk and prevention research investment were made during the time frame covered in this report, further investment is critical to ensure that there are sufficient numbers of researchers to undertake the research, that translation of cause-based/discovery research can continue to occur and, ultimately, that future generations will reap the benefits of this research. Primary prevention is a priority and CCRA is committed to supporting the implementation of the cancer prevention research framework and to continued tracking of research investment patterns.

APPENDIX A.

CANCER RISK AND PREVENTION RESEARCH INVESTMENT BY PARTICIPATING ORGANIZATIONS/PROGRAMS, 2005 TO 2010

ORGANIZATION [1]	Current $					
	2005	2006	2007	2008	2009	2010
FEDERAL GOVERNMENT	**19,562,303**	**18,719,112**	**19,636,992**	**31,717,924**	**34,699,634**	**30,206,340**
Canada Foundation for Innovation	809,193	719,663	758,294	1,706,571	3,564,552	4,487,441
Canada Research Chairs Program	2,029,222	2,357,666	2,078,833	2,031,167	2,062,500	2,142,502
Canadian Institutes of Health Research	11,869,397	12,385,472	14,173,086	16,879,622	18,290,153	16,792,599
Canadian Partnership Against Cancer	-	-	-	9,194,808	8,873,389	5,167,186
Genome Canada	2,647,083	950,715	436,175	-	-	-
Natural Sciences and Engineering Research Council	456,595	470,159	565,131	700,001	621,855	455,492
Networks of Centres of Excellence	37,125	49,500	51,975	56,340	15,630	-
Public Health Agency of Canada	1,531,949	1,550,610	1,265,821	873,226	912,344	840,302
Social Sciences and Humanities Research Council	181,739	235,328	307,678	276,190	359,210	320,819
PROVINCIAL GOVERNMENT	**7,511,674**	**6,890,125**	**8,769,950**	**7,279,994**	**10,384,801**	**11,567,080**
PROVINCIAL CANCER AGENCY	1,742,662	2,900,957	1,990,460	1,834,768	3,003,296	4,091,085
Alberta Cancer [2]	459,185	486,739	696,630	995,351	1,761,294	2,704,567
CancerCare Manitoba	44,617	91,085	78,485	37,915	47,103	32,388
Cancer Care Nova Scotia	5,000	-	10,000	5,000	6,500	6,500
Cancer Care Ontario	1,233,861	2,323,132	1,205,345	796,501	1,188,399	1,347,630
PROVINCIAL HEALTH RESEARCH ORGANIZATION	2,213,489	2,526,915	5,416,489	3,827,925	4,027,001	3,140,170
Alberta Innovates - Health Solutions	449,982	548,133	488,190	598,763	812,624	722,915
Fonds de recherche du Québec - Santé	714,939	886,403	728,906	568,969	627,403	667,229
Manitoba Health Research Council	25,817	36,009	14,221	34,992	46,871	34,391
Michael Smith Foundation for Health Research	566,144	715,338	1,242,658	1,479,448	1,327,732	536,903
New Brunswick Health Research Foundation	-	-	-	2,063	24,750	22,688
Newfoundland and Labrador Centre for Applied Health Research	-	-	6,000	18,000	12,000	-
Nova Scotia Health Research Foundation	28,947	35,965	60,426	95,980	105,100	71,464
Ontario Institute for Cancer Research	377,965	250,319	2,783,244	854,910	929,460	983,204
Ontario Ministry of Research and Innovation	9,333	29,400	36,295	76,650	89,460	80,127
Saskatchewan Health Research Foundation	40,362	25,350	56,550	98,150	51,600	21,250
OTHER PROVINCIAL AGENCY [3]	3,555,523	1,462,252	1,363,001	1,617,302	3,354,504	4,335,825
VOLUNTARY ORGANIZATION	**10,696,722**	**10,254,352**	**9,517,005**	**8,967,138**	**9,417,764**	**9,313,088**
Brain Tumour Foundation of Canada	-	-	-	-	25,000	-
Canadian Breast Cancer Foundation	2,428,067	1,491,864	1,131,251	1,370,627	1,700,792	1,886,769
Canadian Cancer Society	6,456,613	6,450,615	6,278,401	6,375,093	6,631,718	5,682,623
Canary Foundation of Canada	-	100,000	116,600	-	-	-
Cancer Research Society	195,333	432,333	589,584	407,417	298,000	631,770
The Leukemia & Lymphoma Society of Canada	-	2,500	25,000	80,000	85,000	70,000
Ovarian Cancer Canada	-	-	-	22,050	9,900	-
Pediatric Oncology Group of Ontario	-	-	-	-	-	3,500
Prostate Cancer Canada	23,674	54,375	95,912	39,151	60,000	120,000
Quebec Breast Cancer Foundation	566,667	566,667	283,333	-	-	-
The Terry Fox Foundation [4]	543,708	683,300	514,099	249,541	197,405	587,559
Other charitable organizations	482,660	472,699	482,826	423,259	409,949	330,866
OTHER [5]	**643,216**	**650,491**	**526,520**	**589,738**	**1,236,542**	**1,683,134**
TOTAL	**38,413,915**	**36,514,079**	**38,450,467**	**48,554,796**	**55,738,740**	**52,769,642**

[1] Organizations are listed alphabetically under the relevant funding sector (sector totals are shown in boldfaced, upper case letters).

[2] Alberta Cancer represents an amalgamation of different funding sources over the 2005 to 2010 period, including Alberta Cancer Board, Alberta Cancer Foundation Alberta Health Services, and the Alberta Cancer Prevention Legacy Fund administered by Alberta Innovates – Health Solutions. For the sake of simplicity, these are grouped under provincial government organizations.

[3] Provincial funding for CFI projects for all provinces is included under 'Other provincial government funding.'

[4] Investment includes projects supported by The Terry Fox Research Institute.

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

APPENDIX B.

NUMBER OF NOMINATED PRINCIPAL INVESTIGATORS FOR EACH TIME PERIOD BY RISK FACTORS [1]

		1. Activity Level, Body Composition & Metabolism	2. Alcohol [2]	3. Contaminants in the Air, Water & Soil	4. Diet & Nutrition	5. Ethnicity, Sex & Social Environment	6. Gene-environment Interactions	7. Genetic Susceptibilities	8. Hormones	9. Infectious Agents	10. Occupational Exposures	11. Physiological Susceptibilities	12. Precursor Lesions	13. Tobacco	14. Treatments/Diagnostics	15. Multiple/General [3]
TIME1 (N=82)	1. Activity Level, Body Composition & Metabolism	2														
	2. Alcohol [2]															
	3. Contaminants in the Air, Water & Soil			9												
	4. Diet & Nutrition				10											
	5. Ethnicity, Sex & Social Environment					1										
	6. Gene-environment Interactions			1			1									
	7. Genetic Susceptibilities				1		2	9								
	8. Hormones								4							
	9. Infectious Agents									8						
	10. Occupational Exposures			1							3					
	11. Physiological Susceptibilities											1				
	12. Precursor Lesions				2	1		2					5			
	13. Tobacco	1				3								6		
	14. Treatments/Diagnostics									1					1	
	15. Multiple/General [3]															7
TIME2 (N=82)	1. Activity Level, Body Composition & Metabolism	4														
	2. Alcohol [2]															
	3. Contaminants in the Air, Water & Soil			6												
	4. Diet & Nutrition	1			6											
	5. Ethnicity, Sex & Social Environment					1										
	6. Gene-environment Interactions	1					1									
	7. Genetic Susceptibilities					1		8								
	8. Hormones			1			1		2							
	9. Infectious Agents					1				8						
	10. Occupational Exposures			1					1		4					
	11. Physiological Susceptibilities											3				
	12. Precursor Lesions				1	1				1			4			
	13. Tobacco	1		1		4	2	1						3		
	14. Treatments/Diagnostics			1								1			1	
	15. Multiple/General [3]															9
BOTH (N=238)	1. Activity Level, Body Composition & Metabolism	3														
	2. Alcohol [2]															
	3. Contaminants in the Air, Water & Soil	1		11												
	4. Diet & Nutrition	2		1	9											
	5. Ethnicity, Sex & Social Environment	1				1										
	6. Gene-environment Interactions			4	2		1									
	7. Genetic Susceptibilities	1		1			4	32								
	8. Hormones	1				1		3	3							
	9. Infectious Agents			1		4		1		28						
	10. Occupational Exposures			2							2					
	11. Physiological Susceptibilities	1			1			4				3				
	12. Precursor Lesions				4	2		3		2			7			
	13. Tobacco			1	1	10				1	1			11		
	14. Treatments/Diagnostics			2								4			2	
	15. Multiple/General [3]															58

[1] Light green boxes denote PIs whose research covered only one risk factor. Grey boxes represent null cells. Footnote 3 describes the PIs denoted by the dark green boxes.

[2] Alcohol research was always coded to at least two other risk factors.

[3] Included PIs who worked on projects that were coded to the Multiple/General category as well as PIs whose research was coded to three or more risk factors.

Our Members

Alberta Cancer Foundation

Alberta Innovates Health Solutions

brain tumour foundation of Canada

BC Cancer Agency Care & Research

Children's Cancer & Blood Disorders

CAPCA

caro acro
Canadian Association of Radiation Oncology
Association canadienne de radio-oncologie

Canadian Breast Cancer Foundation
Fondation canadienne du cancer du sein

Canadian Cancer Society
Société canadienne du cancer

CIHR IRSC
Canadian Institutes of Health Research
Instituts de recherche en santé du Canada

Canadian Partnership Against Cancer
Partenariat canadien contre le cancer

CancerCare Manitoba
ActionCancerManitoba

Cancer Care Nova Scotia

Ontario
Cancer Care Ontario
Action Cancer Ontario

Cancer Research Society
Société de recherche sur le cancer

Fonds de recherche Santé Québec

GenomeCanada

Government of Canada
Gouvernement du Canada

The foundation of kidney care.
Totalement dévouée aux soins du rein.

Leukemia & Lymphoma Society Canada
fighting blood cancers

Manitoba Health Research Council

Michael Smith Foundation for Health Research

NRC-CNRC Canada

NSERC CRSNG

New Nouveau Brunswick

Nova Scotia Health Research Foundation

OICR
Ontario Institute for Cancer Research

Ovarian Cancer Canada
Cancer de l'ovaire Canada

PROCURE
Halte au cancer de la prostate.
The Force Against Prostate Cancer.

Prostate Cancer Canada

Quebec Breast Cancer Foundation

Saskatchewan Cancer Agency

A single dream. A world of hope.
The Terry Fox Foundation

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

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