



UNDERSTANDING THE NOVA SCOTIA HEALTH RESEARCH ENTERPRISE:
REVIEW AND DATA ANALYSIS

Nova Scotia Health Research Foundation (NSHRF)

May 2013

EXECUTIVE SUMMARY

The health research enterprise in Nova Scotia holds significant potential for innovation, for new discoveries, and for meaningful outcomes. It also makes an important contribution to the economy. In fact, over a period of eight fiscal years, the total economic impacts from health research spending were estimated at \$321.2 million in gross domestic product, \$27.3 million in provincial government revenues, and an estimated annual 920 person-years of employment. During that same period, for every dollar the Nova Scotia Health Research Foundation invested in programs, \$7.40 was leveraged from sources external to the province.

Despite these benefits and despite housing talented health care professionals and researchers, despite internationally recognized organizations that fund groundbreaking research and support capacity for more, despite and being known for a robust educational environment, significant challenges exist. Here are the main ones:

- Health-related research funding received by Nova Scotia from national funding bodies (excluding the Canadian Institutes of Health Research) has been decreasing in constant dollar terms over the 2006-07 to 2010-11 timeframe.
- This loss significantly decreases Nova Scotia's ability to fund and support its researchers, graduate students, and institutions dedicated to health research.
- In addition, there is a disjointed funding system that requires matching funds and, as a consequence, places undo pressure on researchers, takes time away from conducting health research, and creates an added – and unnecessary – level of administration.

This report explores the current state of health research in the province and the issues facing the health research enterprise in Nova Scotia.

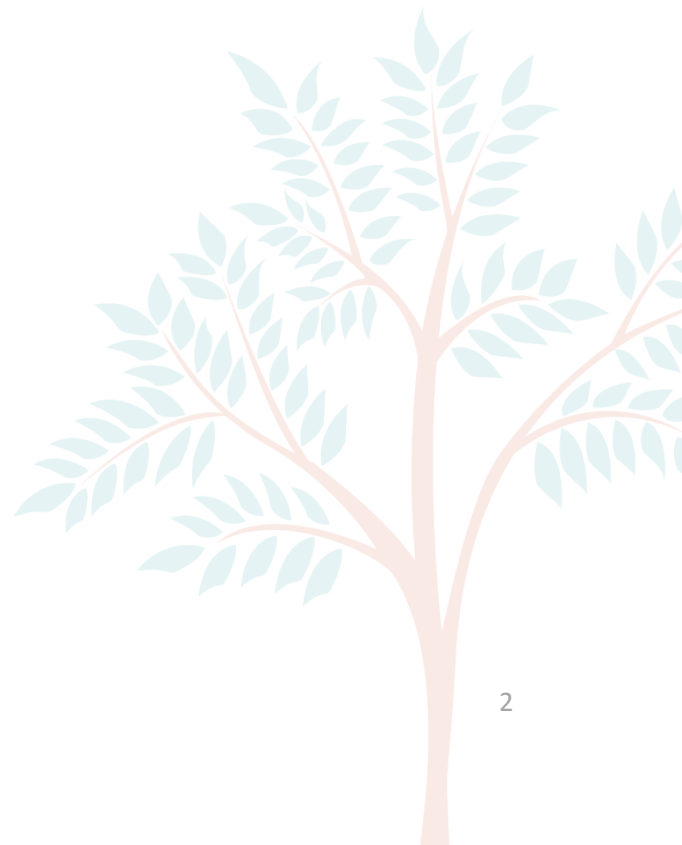
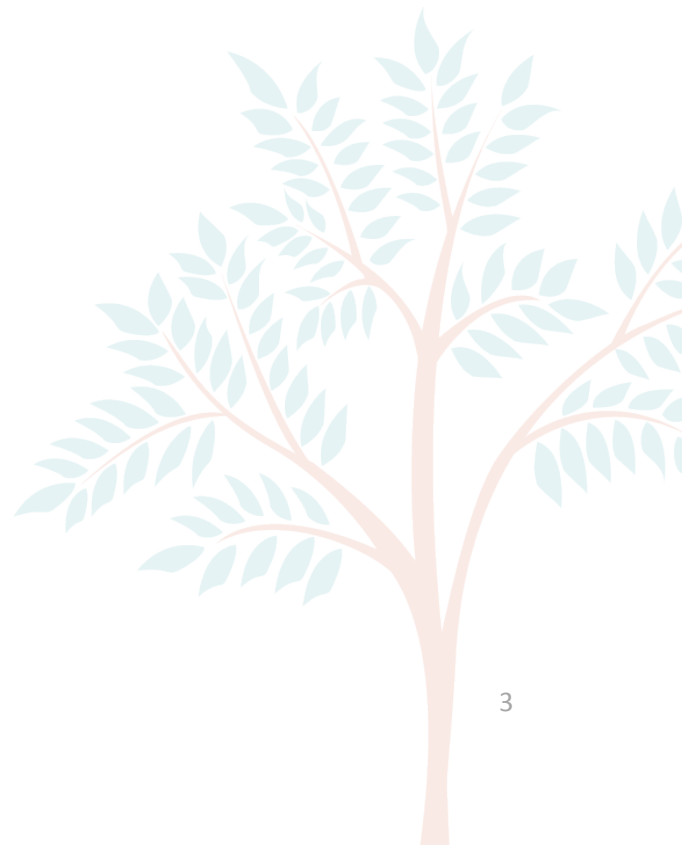


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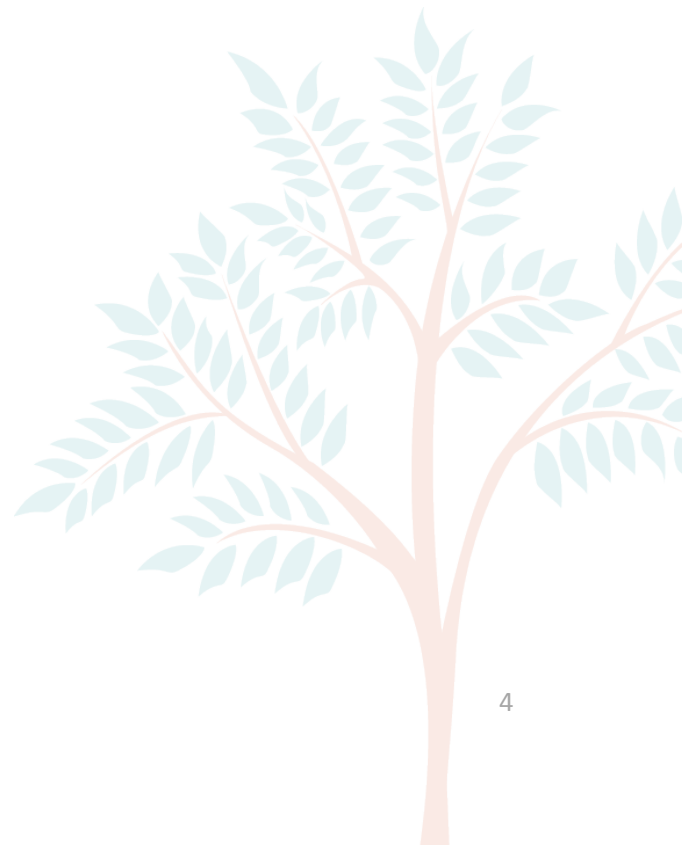
This report was made possible thanks to the support and contribution of many individuals, organizations, and staff.

The Nova Scotia Health Research Foundation appreciates the helpful and informed input and assistance we received throughout the development of this work. Numerous individuals and organizations gave their time and shared their knowledge of the provincial health research enterprise and its intersection with the national research enterprise. The depth of this report is a direct reflection of these insights.

We would also like to thank our team of writers and editors; donalee Moulton, with Quantum Communications, and Clare O'Connor, with Full Picture Public Affairs Inc. They transformed raw data and innumerable facts into a report that is both readable and engaging.

We also want to recognize the invaluable work of the NSHRF staff who provided critical context, fact checking, and editorial assistance in the preparation of this report.

Please note: Data collection, data analysis, and chart preparation was prepared by Gardiner Pinfold Consultants Inc.



Introduction

Any assessment of health research in Nova Scotia leads inevitably to one conclusion: the capacity for innovation, for new discoveries, and for meaningful outcomes is an inherent part of the provincial health research enterprise.

How could it be otherwise? Nova Scotia continues to support and attract talented health care professionals and researchers, house internationally recognized organizations funding and supporting research across the province, and offers a robust educational environment that promotes a thirst for new knowledge and innovation.

On this landscape, however, rests another reality: the Nova Scotia health research enterprise faces significant challenges. Recent trends at the national level have potentially important consequences for provincial researchers. In particular, funding changes implemented at the federal level have a direct impact on the ability of Nova Scotia's researchers to do what they do best.

This paper looks at the issues facing the health research enterprise in Nova Scotia and the current state of the health research landscape.

Scope

This report uses complementary investigative approaches to illustrate the Nova Scotia health research enterprise. It provides a high-level overview of health research funding in the province, with a particular emphasis on health research over the five-year period from 2006-2011. It also identifies important themes for discussion as highlighted through analysis and discussion with experts in related fields.

What the paper cannot do is be all encompassing. Instead, it draws a broad picture of the landscape that shapes the provincial health research enterprise and seeks to understand current challenges affecting that landscape.

Definitions

For the purpose of this report, the following definitions are used:

Health: The word "health" is defined according to the Ottawa Charter for Health Promotion as "a complete state of physical, mental, social and emotional well-being [a] resource for living that enables people of all ages to realize their hopes and needs and to change or cope with the environments around them." The determinants of health as identified by the World Health Organization are encompassed within how we define factors that influence health.

Health Research: Health research is defined as a systematic investigation to establish facts, principles, or generalizable knowledge in the areas of biomedical research, health outcomes research, health policy research, and health services research.

Nova Scotia's Health Research Enterprise: The health research enterprise is defined as a community that is an integral part of the health system and includes not only researchers and research institutions but also those who use research to develop policy, deliver care, and maintain the health system.

Methodology

A suite of complementary approaches, both quantitative and qualitative, was used to detail Nova Scotia's research enterprise. This included:

- A review and analysis of health research funding data obtained from numerous sources such as the Canadian Institutes of Health Research (CIHR), the Social Sciences and Humanities Research Council of Canada (SSHRC), the Natural Sciences and Engineering Research Council of Canada (NSERC), the Canada Foundation for Innovation (CFI), Genome Canada, the National Research Council (NRC), the Nova Scotia Health Research Foundation (NSHRF), the health charities sector, the district health authorities, and the Dalhousie Medical School
- Website searches
- Key informant interviews via telephone and in person with researchers and senior executives of health research organizations, hospitals, universities, government, and foundations across Nova Scotia

Limitations of this report

Data were not uniformly available. There were limitations in both the availability and comparability of information. Data from CIHR, for example, were available up to 2011-12, but data from SSHRC, NSERC, and CFI were available only up to fiscal year 2010-2011. In addition, the bibliometric data were only available up to fiscal year 2006-07.

Data were not necessarily distinct. A clear distinction did not always exist between health and non-health-related research. Where possible, health-specific coding indicators were used to separate health-related research funding from broader funding pools.

Data were not always available. In some cases, it was difficult to obtain complete data particularly for the non-profit sector and health charities.

Data collection and interpretation was not performed by the same person. The qualitative data were analyzed by individuals who were not present during collection. This has created the potential for uncertainties regarding interpretation. This limitation was addressed by having two coders analyze all raw data and then discuss any noted inconsistencies or uncertainties.

The Provincial Landscape

A previous study has estimated the economic impact of health research activities in Nova Scotia (Collins Management Consulting, 2009). Over a period of eight fiscal years (2001–2002 to 2008–2009), the total economic impacts from health research spending were estimated at \$321.2 million in gross domestic product, \$27.3 million in provincial government revenues, and an estimated annual 920 person-years of employment. In addition, over the same period, for every dollar the Nova Scotia Health Research Foundation invested in programs, \$7.40 had been leveraged from sources external to the province.

These benefits are substantial.

However, the benefits to Nova Scotia go well beyond the dollars. While gains in wealth and employment in the province created from expenditures on health research are significant, they are just one aspect of the full picture of the health research enterprise.

The other aspects include:

- Recruitment or retention of exceptional scientists in Nova Scotia
- World-class excellence in knowledge creation and training
- The commercialization of Nova Scotia research findings
- The attraction of international health-related industries to locate in Nova Scotia with the attendant health-related and economic impacts (employment, wealth creation, etc.)
- Serving as an international model for setting appropriate health research priorities, establishing effective research partnerships, and demonstrating research capability

A key finding in the literature is that the benefits of health research largely reside in the jurisdiction where the research takes place (Clarke, 2011). In fact, provinces not engaged in health research are unlikely to reap the full rewards of health research conducted elsewhere in the country.

Studies have also shown a positive relationship between institutions and clinicians participating in health research and improved patient care and patient outcomes (Majumdar, 2008). Research-active institutions attract higher-quality employees, and the high-quality research program itself acts as a magnet for skilled employees and researchers. These institutions also have a greater potential to both attract and retain high-calibre clinical staff (Scott, 1999). Hospitals actively engaged in research and clinical trials implement mechanisms to ensure greater adherence to guidelines, more structured care, and consistent access to approved interventions and procedures. The result: improved health outcomes.

Understanding the benefits is critical to understanding the current significance – and ultimate potential – of the health research enterprise in Nova Scotia. Equally significant to this understanding is an exploration of the full context of events and external forces that are helping to shape this vital sector. Three key factors are discussed here:

- Nova Scotia context
- Infrastructure
- Resources

Nova Scotia Context

Like most provinces, Nova Scotia has an aging population. It is estimated that by 2036, more than 27% of the population will be over 65 years of age (Table 1).

The province’s population is also decreasing. Over the next 15 years, population size is projected to be less than it was in 2000 and substantially less than 2011.

Combined, these two factors impact the health research enterprise in the following ways:

- The projected decrease in Nova Scotia’s population will mean an increase in health care services with greater prevalence of later-life diseases such as Alzheimer’s, cancer, and other chronic diseases.
- For researchers, the implication of this pending reality is that there is a growing need for research in this area.

As Nova Scotia’s population ages, so too do its health care providers, which puts even more pressure on the province’s health system. Nova Scotia, for example, has a higher proportion of registered nurses (RNs) and licensed practical nurses (LPNs) aged 45 years and older relative to Canada as a whole. The province also has a corresponding smaller proportion of younger RNs and LPNs, those 40 years and younger. As more health professionals retire and fewer enter the workforce to take their place, research capacity declines.

Table 1: Percentage distribution of projected population, Nova Scotia, 2010 to 2036

Age group	Percent of total population by year		
	2010	2015	2036
0-19 years	22.21%	20.53%	18.11%
20-64 years	63.22%	62.18%	54.87%
65-74 years	8.69%	10.83%	13.28%
75-84 years	4.50%	4.95%	10.25%
85+ years	1.38%	1.50%	3.49%
Total	100.0%	100.0%	100.0%

Source: Estimates of Population, CANSIM 051-0001

In trying to understand the health research enterprise in Atlantic Canada's most populous province, it is critical to understand that the numbers do not necessarily add up in a linear fashion. The total population of the Atlantic region is currently about 2.4 million people, roughly 2.5 times the population of Nova Scotia. The following points highlight the central role Nova Scotia plays in the Atlantic region:

- Nova Scotia is a place of origin in terms of services shared with the rest of the Atlantic provinces. Many of its hospitals and health centres serve as a diagnosis and treatment hub for the region. Nova Scotia's health research enterprise has a large reach.
- Nova Scotia has the only schools of dentistry, occupational therapy, and physiotherapy in the Atlantic region and the only school of pharmacy in the Maritimes. The Dalhousie Medical School has campuses in Halifax and Saint John. In addition, Dalhousie's School of Human Communication Disorders offers the only degree program in audiology.
- Two state-of-the-art research hospitals, the IWK Health Centre and the QEII Health Sciences Centre, reside here.
- The IWK, affiliated with Dalhousie University, serves as a primary clinical resource for pediatric and obstetric teaching and provides world-class research into disorders and diseases affecting children and women. Specialists from the IWK take their expertise to Maritime communities in the form of traveling clinics, particularly in the areas of pediatric neurology, orthopedics, cardiology, and respiratory medicine. In addition, the IWK provides specialized care to Maritime families using computer-based videoconferencing technology through the Children's TeleHealth Network.
- The QEII Health Sciences Centre's close affiliation with Dalhousie University Medical School ensures strong basic research support and maximum crossover from laboratory to clinical application. The Capital District Health Authority, which oversees the QEII, employs more than 280 experienced principal investigators, physicians, and other health care professionals including many nationally and internationally recognized experts in a wide range of fields. It also has more than 300 dedicated research personnel including over 150 professional coordinators all externally funded for research projects.
- Nova Scotia is home to advanced technology networks including telemedicine networks that enable researchers to include patients in remote areas.
- The Sanofi Pasteur Vaccine Challenge Unit is a 10-bed inpatient unit with isolation rooms at the IWK. It is the first of its kind in Canada and one of a very few such facilities worldwide.
- The Skills Centre for Health Sciences, a 4,000-square-foot facility, offers a range of services, equipment, models, and unique materials that health care professionals use to rehearse medical procedures.

Lastly, it is important to understand that Nova Scotia is Canada's university capital. It is home to 10 universities, the most per capita of anywhere in the country. As a result, Nova Scotia has many highly qualified researchers; it ranks third in Canada in terms of the number of PhDs as a percentage of total provincial population. This provides a strong foundation for developing and conducting research.

While it is not possible to determine the proportion of the PhDs shown in Table 2 that are in the health-related fields across the province, given the number of PhD programs in health sciences relative to other fields, a large proportion of the advanced degrees would logically be in this area.

Table 2: Number of PhDs per 100,000 people and percentage of provincial population, by province, 2006

	2006	% Provincial Population (Per 1,000)
British Columbia	26,815	6.1
Ontario	73,785	5.7
Nova Scotia	4,995	5.3
Quebec	40,360	5.2
Alberta	16,935	4.7
Manitoba	5,220	4.3
Saskatchewan	3,895	3.8
New Brunswick	2,690	3.6
Prince Edward Island	455	3.3
Newfoundland and Labrador	1,560	3.1

Source: Statistics Canada, Census 1991-2006, 97-560-XCB2006007 & 97F0012XCB01041

What this means for Nova Scotia’s health research enterprise:

1. Fluid geography and regional commitment have a marked impact according to experts in the field. Nova Scotia serves as a hub of research expertise and enterprise. Here research teams are formed and extend to other provinces in the region. Collaboration is a cornerstone. Of course, the research pool is smaller than in many other provinces, and this poses distinct challenges for researchers, at times limiting opportunities for funding.
2. Nova Scotia is in a unique position: there is greater demand on the health research enterprise, and there is greater expertise here regionally. Collectively, this combines to present both opportunities and challenges. Key informant interview findings identified increased competition for funding dollars as a barrier for health research. Funds are continually declining, and this downward momentum places enormous pressures on researchers. Researchers and research administrators are also spending more time on securing funding and subsequently time available for doing research is diminished. Increased application pressure combined with fewer funds at all levels is generally seen to be an issue that will have a multi-layered effect and ultimately result in negative outcomes for the Nova Scotia health research enterprise, outcomes that are mirrored on the national stage.

Provincial Sources of Funding: A Synopsis

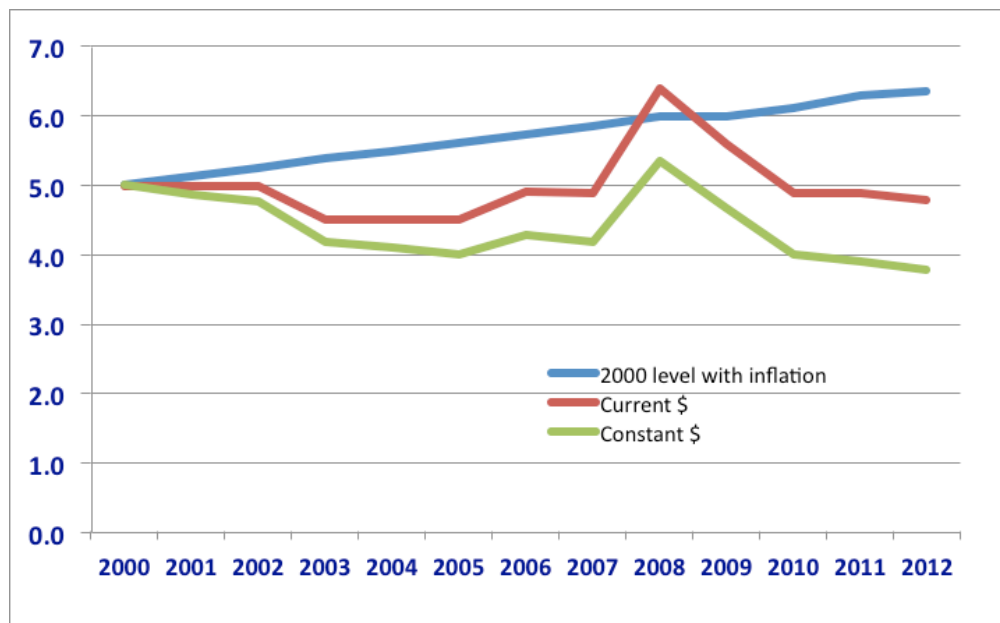
Although not intended as an exhaustive list, this section highlights a diversity of provincial funding sources that contribute to the provincial health research infrastructure. They are not identified in order of importance or impact but are included here due to their role in contributing to a thriving enterprise. They support the enterprise in a multitude of ways including funding, collaborative and peer networking, and educational opportunities.

1. Nova Scotia Health Research Foundation

The Nova Scotia Health Research Foundation, created in 2000 with a mandate to improve the health of Nova Scotians through health research, runs three programs that directly support the province's health research enterprise. They are: research enterprise development initiatives, research programs, and the knowledge program.

Funding to support NSHRF's mandate has decreased over time, a fact that is demonstrated in Figure 1 below.

Figure 1: Inflation impacts on NSHRF annual grant, 2000 to 2012, \$millions



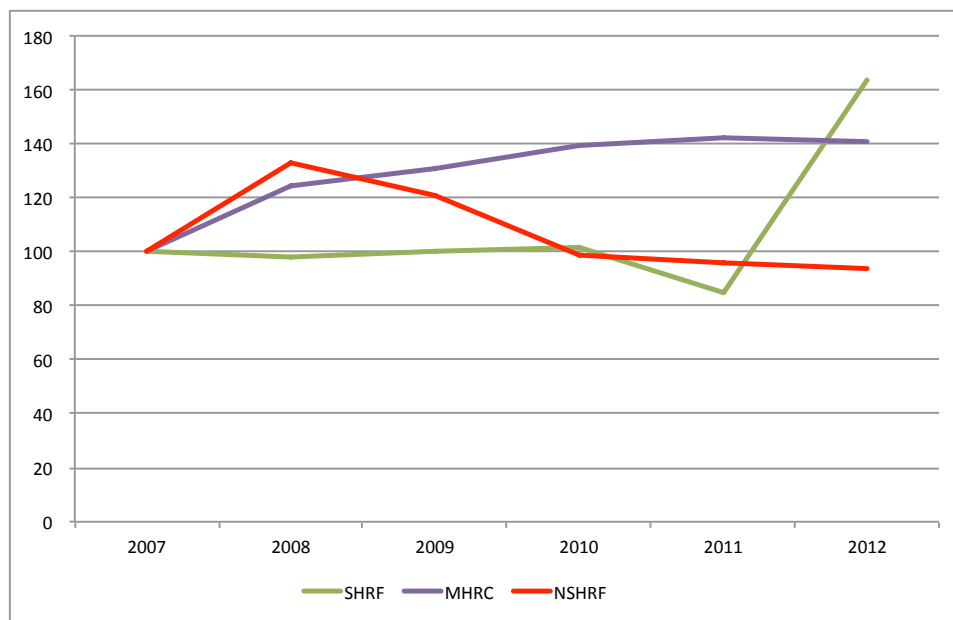
Source: Calculated by Gardner Pinfold Inc. from NSHRF, Statistics Canada: Cansim Table 326-0021

In its first three years of operation, the grant to NSHRF was \$5 million a year. This dropped to \$4.5 million in 2003-04. During this timeframe, NSHRF received year-end funding from the government in 2008 and 2009. This provided a slight increase in funds for these two years only as depicted above. These funds were earmarked for specific initiatives, and year-end funding has not occurred since.

NSHRF’s annual grant from the provincial government has decreased to its lowest levels. When examined in real dollar terms (adjusted for inflation), the funding level for 2012 was only \$3.8 million.

Using annual budget figures in constant dollar terms, an analysis was also conducted comparing NSHRF’s funding levels with two comparable health research organizations: the Manitoba Health Research Council (MHRC) and the Saskatchewan Health Research Foundation (SHRF) (Figure 2). As can be seen in Figure 2, Nova Scotia is the only one of these provinces to have its funding steadily decrease.

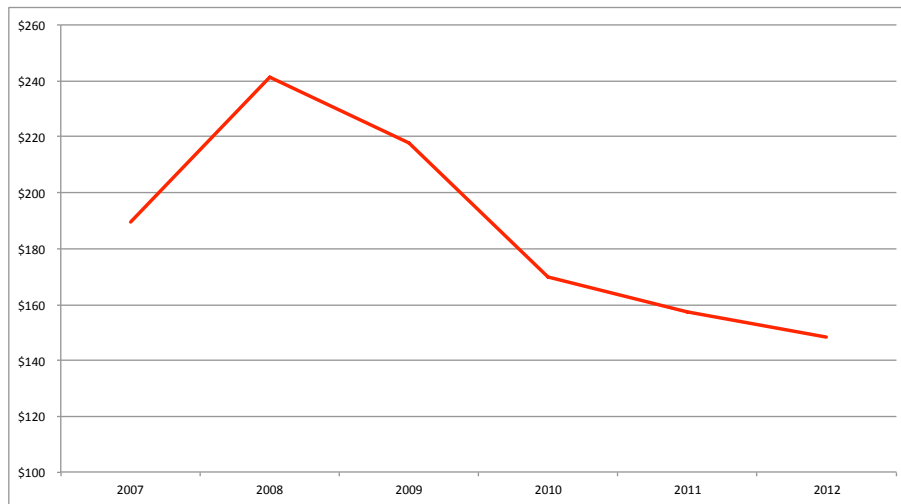
Figure 2: Percent change in annual budgets (in constant \$2011 dollars) for selected provincial health research foundations, 2006-07 to 2011-12



Source: Calculated by Gardner Pinfold Inc. from NSHRF, Statistics Canada: Cansim Table 326-0021

An examination of NSHRF’s annual budget since 2007 on a per-million dollars of gross domestic product (GDP) shows a consistent downward trend. Figure 3 shows that NSHRF’s annual funding per million dollars of GDP has fallen substantially over the past six years from \$240 per million dollars in 2008 to less than \$150 per million in 2012.

Figure 3: NSHRF's annual budget per million in provincial gross domestic product, (constant \$2011 dollars), 2006-07 to 2011-12



Source: Calculated by Gardner Pinfold Inc. based on NSHRF's annual reports

2. *Dalhousie Medical Research Foundation*

The Dalhousie Medical Research Foundation is an independent, external funding agency established for the sole purpose of funding excellence in medical research at Dalhousie Medical School and its affiliated research institutions. The Foundation focuses its support on the Faculty of Medicine's four identified areas of research emphasis: neuroscience; cancer; cardiovascular research; and immunity, inflammation, and infectious diseases.

As outlined in Figure 4, the Foundation provides approximately \$2 million annually in funding for research, equipment and infrastructure, training, and senior research chairs. It is also the largest non-government funding agency supporting local cancer research providing roughly \$600,000 to the Beatrice Hunter Cancer Research Institute each year.

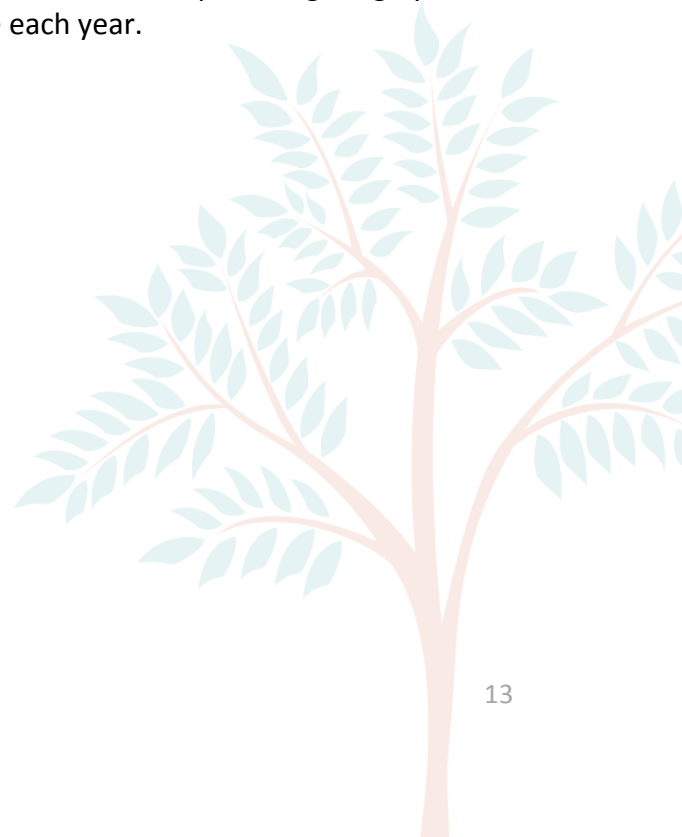
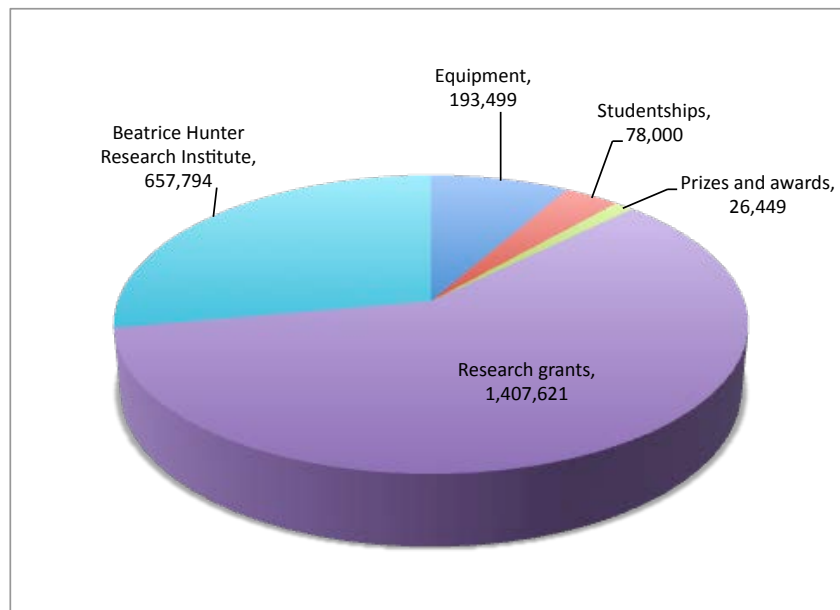


Figure 4: Distribution of Dalhousie Medical Research Foundation expenditures (dollars spent) on research activity, 2011-12



Source: Dalhousie Medical Research Foundation annual report: <http://www.dmr.ca/en/home/aboutdmrf/default.aspx>

The Foundation receives no government funding and is supported entirely through public donations. Its contributions are often used as matching grants to leverage support from national granting agencies.

In 2011-12, the total amount of research funding distributed was \$2.3 million: \$1.4 million in research grants, \$193,000 for equipment, and \$658,000 to support the Beatrice Hunter Cancer Research Institute.

3. Universities

Nova Scotia's universities offer internal awards of varying amounts. Funding levels vary by institution, department, and faculty. This information was not collected for the purposes of this report.

4. Capital District Health Authority

In Nova Scotia, there are nine district health authorities (DHAs) and the IWK Health Centre, with the largest DHA being the Capital District Health Authority (CDHA). The majority of health research undertaken by the DHAs in Nova Scotia is conducted by the CDHA or in collaboration with the CDHA.

5. *IWK Health Centre*

The IWK Health Centre, the largest children's hospital in the region, invested \$1.4 million in research in 2010-11 from its own internal sources (IWK Foundation), including infrastructure support and \$870,000 in funding to research programs. These funds foster research capacity by investing in people, equipment, and projects.

6. *QEII Health Sciences Centre Foundation*

The QEII Health Sciences Centre Foundation, part of the CDHA, disbursed \$5.85 million for health research over the last five fiscal years. This amount increased from less than \$200,000 in 2006-07 to \$1.6 million in 2008-09. The total amount disbursed in 2012 (largely as research scholarships) was \$1.25 million.

7. *Nova Scotia Research and Innovation Trust*

The Nova Scotia Research and Innovation Trust (NSRIT) was established by the province of Nova Scotia in 2001 to provide matching funds for approved infrastructure projects. NSRIT matches CFI's approved funding by providing an additional 40% of a project's eligible infrastructure cost. The remaining 20% of funding is secured through the research institution, industry partners, or other government partners. NSRIT matching funds benefit researchers in health and life sciences, ocean technology, clean technology, and information and communications technology.

Since 2001, NSRIT has awarded over \$66 million for 356 projects at Nova Scotia institutions. The average amount awarded for all infrastructure support between 2001 and 2012 was slightly less than \$5.5 million per year. National data indicate that of this approximately 40% of the funding would have been allocated for health-related research.

A breakdown of the level of CFI support for health-related infrastructure for Nova Scotia and Canada as a whole in constant 2011 dollar terms and as a percent of total CFI infrastructure funding shows that CFI funding for Nova Scotia decreased from 12.6% in 2006-07 to 4.7% in 2010-11.

The symbiotic relationship between CFI and NSRIT highlights the importance of understanding precisely how decision-making at the national level impacts provincial health research. Although this funding relationship offers substantial leveraging opportunities for innovation and direct economic benefits to Nova Scotia, it also adds another layer of complexity for researchers who need to apply for and win multiple grants to conduct their research.

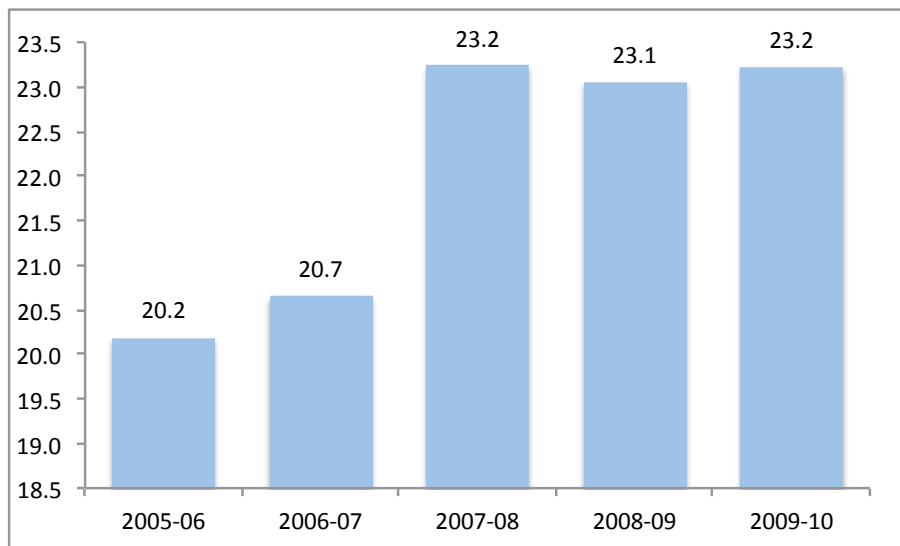
8. *Health Charities*

Nova Scotia's health research is also supported by organizations outside the public domain. These include private for-profit corporations, private not-for-profit organizations, and foreign organizations. An analysis of health research funding made available from the not-for-

profit sector provides a summary of expenditures on research and development in health-related fields in Nova Scotia.

Health research funding by the not-for-profit sector in Nova Scotia has grown in recent years. Figure 5 provides a summary of the total gross expenditures on research and development by the not-for-profit funding sector in the health fields in Nova Scotia. Total expenditures on research and development in health fields by this sector in Nova Scotia increased from \$20 million in 2006-07 to \$23 million in 2007-08 and have remained steady at \$23.2 million in 2011-12.

Figure 5: Not-for-profit funding sector, gross domestic expenditures on R&D (GERD) in the health fields, Nova Scotia 2011-12, \$ millions



Source: StatCan Cat. 88-001-X: Gross domestic expenditures on research and development in the health field in Canada (Non-profit funding sector)

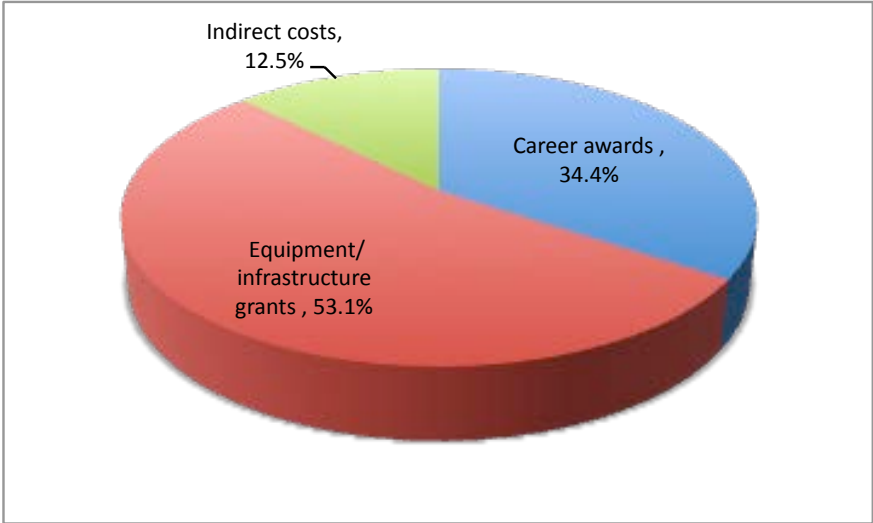
This analysis is not meant to be an exhaustive examination of health research funding by all health charities in Nova Scotia, but rather an overview of health-related research activities of the not-for-profit sector. Specifically, an analysis of two larger health charities, the Heart and Stroke Foundation of Nova Scotia and the Canadian Cancer Society, are included as examples of health research activities of charities in Nova Scotia. The information provided is based on publicly available data.

a. Canadian Cancer Society

An important contributor to health research in Nova Scotia and Canada in general is the Canadian Cancer Society. The Society grants its fundraised research dollars through its sister organization, the National Cancer Institute of Canada (NCIC). In 2009, the NCIC contributed \$542.2 million for cancer research in Canada as a whole and \$7.7 million in Nova Scotia.

Over half of the Canadian Cancer Society investment in cancer research in Nova Scotia in 2009 was for equipment and infrastructure (53%), 34.4% for career research awards, and the remainder (12.5%) for indirect costs (Figure 6).

Figure 6: Distribution of Canadian Cancer Society research investment, Nova Scotia, 2009



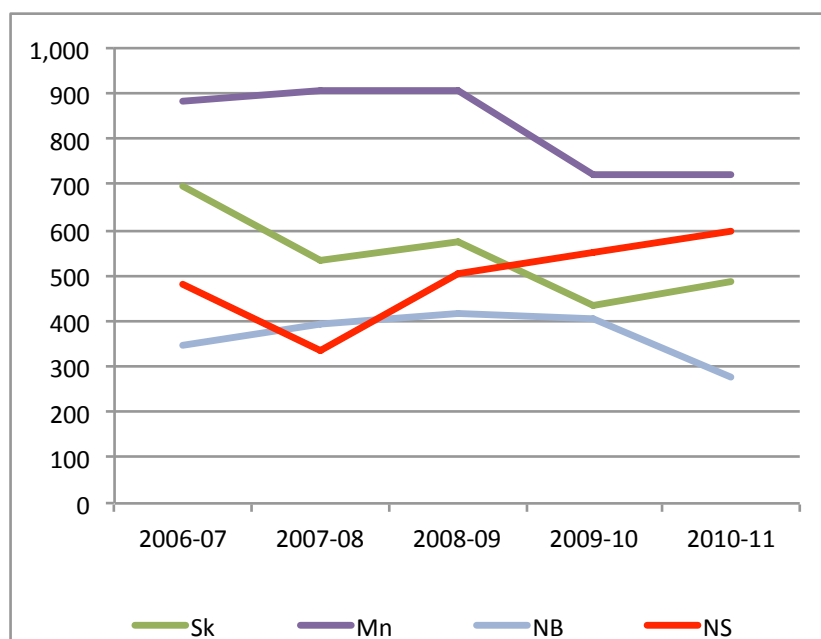
Source: National Cancer Institute of Canada (NCIC)

On a per-capita basis, Nova Scotia ranked fifth among the Canadian provinces in terms of total per-capita cancer research (\$8.18). Per-capita cancer research is highest in Ontario (\$22.22), followed by Quebec (\$15.15), BC (\$14.03), and Alberta (\$12.85).

b. Heart and Stroke Foundation of Nova Scotia

Since its inception, the Heart and Stroke Foundation of Nova Scotia has supported the health research enterprise in the province and invested approximately \$19 million in life-saving cardiovascular research in 2010-11. The Foundation’s investments over the past 50 years have contributed to new innovations and new opportunities in treatments for people living with heart disease and stroke. In addition, the Heart and Stroke Foundation provides funding for research grants, research chairs, and fellowships. In 2010-11, the Heart and Stroke Foundation of Nova Scotia awarded a total of \$.6 million in research funding, almost double the amount in 2007-08 (Figure 7).

**Figure 7: Heart and Stroke Foundation research spending by selected provinces
2006-07 to 2010-11**



Source: Heart and Stroke Foundation Annual Reports, 2006-07 to 2010-11.

9. Genome Atlantic

Genome Atlantic manages large-scale gene-discovery projects throughout Atlantic Canada and receives a significant portion of its funding through Genome Canada, a not-for-profit organization with a mandate by the Government of Canada to implement a national strategy for supporting large-scale genomics and proteomics research projects.

Although Genome Canada invests in and manages large-scale research projects in areas such as agriculture, environment, fisheries, forestry, health, and new technology development, Genome Atlantic focuses research on genes that will help to find better ways to diagnose and treat illnesses, genes that identify healthy fish for aquaculture, and genes in organisms that can produce “green” fuel. Genome Atlantic recruits research teams to work on genomics research projects, and it helps research teams raise funds for required research and development. Industry Canada is a major funder for almost all projects undertaken with Genome Canada providing up to 50% of project funding.

Genome Atlantic also pursues projects outside of Genome Canada, funding competitions by working with local governments and other funding organizations to make sure that important regional research receives the financial investment it needs. Provincial governments, funding bodies like the Atlantic Canada Opportunities Agency (ACOA), and others have been extremely important in making sure these projects happen.

To date, with its partners, Genome Atlantic has generated over \$70 million in large-scale gene research in the Atlantic region.¹

What this means for the health research enterprise:

1. NSHRF funding levels have eroded since the organization was established more than a decade ago. Now there is \$2.6 million fewer funds in constant dollars available for health research, for health researchers, and for NSHRF to meet its mandate.
2. Funding cuts to provincial universities over the past three years represent a total loss of over \$100 million. As well, a 3% cap on tuition has been implemented, restricting universities' ability to increase revenues directly. As a result, Nova Scotia's universities have had limited ability to build research capacity.
3. Many university departments have also had a freeze on hiring full-time faculty, placing greater responsibility on existing faculty and researchers and adversely affecting their ability to apply for grants and conduct research. In addition, university departments have fewer funds to support faculty research through course relief, assistance with proposal writing, or research assistance. Because many health researchers hold both teaching positions as university or hospital faculty and positions in hospitals as researchers or practitioners, hospital-based research capacity is also stretched.
4. Representatives from provincial health research organizations recognize that it is becoming increasingly important for jurisdictions to be strategic in developing a coordinated approach to health research to build capacity and to attract and retain highly qualified health researchers and practitioners. Some provinces are in the process of implementing a health research strategy and are developing a very focused and strategic approach to building health research capacity.
5. While interviewees noted that it is increasingly important for jurisdictions to be strategic in funding health research, to develop a coordinated approach to health research, and to attract and retain highly qualified health researchers and practitioners, they identified that there is often a timing gap between infrastructure funding approval obtained through CFI and the operating grants obtained through other funders resulting in a lag in the award of the operating grant. In addition, the infrastructure grant is sometimes contingent on the operating grant being in place.
6. Times are tough – and getting tougher. As resources decline or disappear, at both the national and provincial level, researchers are left struggling to continue ongoing investigations and launch new ones. The significance of this struggle was put into context by the experts interviewed for this report who noted that access to funding at national, regional, provincial, and institutional levels is becoming increasingly difficult to secure. Investment in health research, they noted, has been decreasing

¹ *About Genome Atlantic*, "About us" web page, retrieved November 8, 2012, <http://www.genomeatlantic.ca/aboutus>

at all levels and commitment to national health research in general was questioned. Informants believed that national changes to programming will further deplete access to funds, more so for some types of research than others and in general, early-career researchers currently being funded or new to the research enterprise will be the first to suffer the consequences.

The National Landscape

There are numerous agencies responsible for supporting health research throughout Canada. One of the more significant funders is the Canadian Institutes of Health Research. It is, in fact, the primary funding agency in health research. As a result of its prominence in the field of health and due to its impact in Nova Scotia, it is described first.

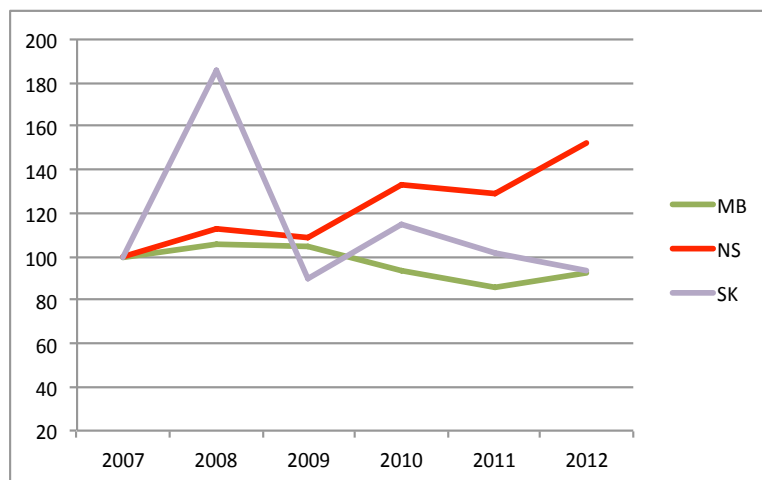
Canadian Institutes of Health Research

Nova Scotia's share of total CIHR funding in 1999-2000 was roughly 2.3%, and its share fell slightly over the period from 2000-01 to 2009-09, but rose in 2009-10 to 2.9%. Total CIHR funding in Nova Scotia in 2011-12 was \$28 million, representing roughly 3% of total CIHR funding in Canada.

This analysis also examines the growth rate in CIHR funding among provinces. This has not been linear over time or uniform among provinces. In the two years following 2000, overall growth in total CIHR funding averaged 24.9% per year.

Figure 8 compares the rates of growth in the value of CIHR grants and awards among selected provinces over the 2000-2012 timeframe, inclusive.

Figure 8: Growth in CIHR grants and awards, selected provinces, 2000 to 2012



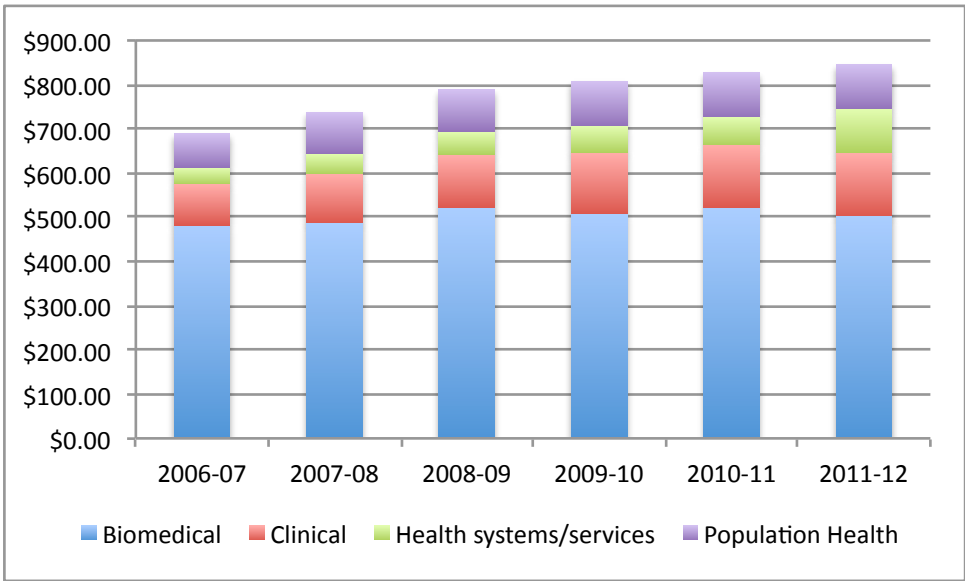
Source: CIHR

Grants and Awards by CIHR Research Themes

The analysis examined CIHR funding to health researchers in Nova Scotia based on the four themes used by CIHR to categorize its grants and awards: biomedical research, clinical research, health services research, and population health research. This analysis was conducted over the 2006-07 to 2011-12 fiscal years.

The variability in the funding by research themes as shown in Figure 9 below may reflect modest levels of research capacity in these areas in Nova Scotia. The amount of funds for health services, clinical, and population health research is quite small in comparison to funding for biomedical research.

Figure 9: Distribution of CIHR funding by CIHR research theme, Canada, 2006-07 to 2011-12 \$millions



Source: CIHR funding database, <http://www.cihr-irsc.gc.ca/e/826.html>

Note: Totals do not include grants and awards that are unassigned or not classified according to research themes.

The funding index highlighted in Figures 10 and 11 and Table 3 measures the relationship between funding levels and population. In the case of CIHR expenditures, this index is the ratio of a province’s actual share of CIHR expenditures² in a given year to the province’s share of the national population.

While outlined in more detail later, a few important results of the analysis of Nova Scotia’s CIHR funding index by research theme over the 2007-2012 timeframe are highlighted. They include:

- The biomedical research theme has steadily trended downward over this time period to a funding index value of .67 in 2012 indicating considerable opportunity exists for additional funding for this theme in Nova Scotia.
- CIHR-funded research projects in biomedical research represent the highest proportional amount of funding relative to other research themes in both Nova

² Including expenditures in Canada and outside Canada.

Scotia and Canada as a whole. Overall, close to 65% of the total funding awarded in Canada over the last six years has been in this area.

- While biomedical research represents the largest share of CIHR-funded research projects for Nova Scotia, the share of biomedical research funding in Nova Scotia (49%) is less than the share for Canada as a whole (65%).
- CIHR-funded research projects in clinical research represent the second largest proportion of funding relative to other research themes in both Nova Scotia and Canada as a whole. On average, 16% of the total CIHR funding awarded in Canada over the last six years has been in this area.

Table 3: Funding index for CIHR research themes, Nova Scotia, 2006-07 to 2011-12

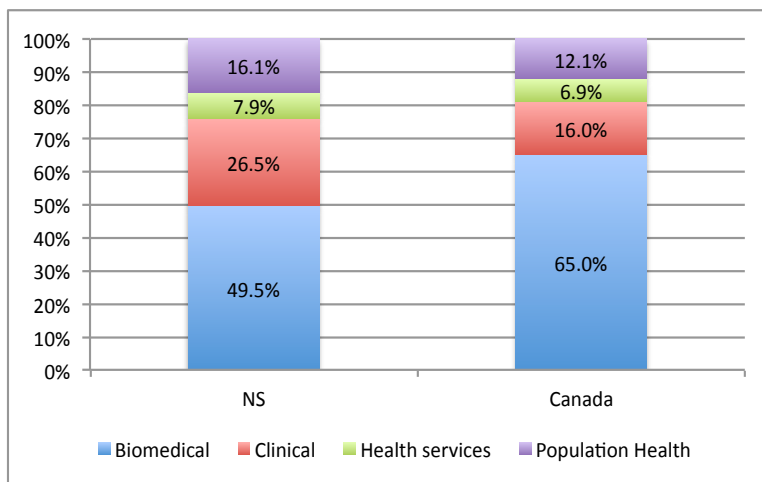
	2007	2008	2009	2010	2011	2012
Biomedical	.80	.80	.69	.71	.66	.67
Clinical	.82	.97	.82	2.55	2.00	1.90
Health services	1.00	1.06	1.12	1.21	.98	1.14
Population Health	1.45	1.46	1.49	1.35	.98	.91

Source: CIHR funding database, <http://www.cihr-irsc.gc.ca/e/826.html>

- The funding index for CIHR was broken down by research themes for the six-year period and provides several useful insights into Nova Scotia’s health research enterprise.
 - Nova Scotia’s share of biomedical research lies below its share of the Canadian population over the entire six-year period.
 - Nova Scotia’s CIHR funding index for clinical research was close to the 1.0 value in 2008-09 with a value of .97 but rose significantly in 2010 with a value of 2.55, reflecting the large increase in CIHR clinical research funding in 2009-10.
 - Nova Scotia’s CIHR funding index for health services research was above the funding index value of 1.0 and rose over the period from 2006-07 to 2009-10 to a value of 1.21. This index fell slightly in 2010-11 to .98 but rose above 1.0 in 2011-12 to a value of 1.14. Nova Scotia’s average CIHR funding index for health services over this period was 1.09, indicating that Nova Scotia’s share of health services research lies above its share of the Canadian population.
 - Nova Scotia’s average funding index for population health research was above the funding index value of 1.0 and rose over the period from 2006-07 to 2009-10. It fell slightly in 2010-11 and was .91 in 2012. Nova Scotia’s average CIHR funding index for population health research over this period was 1.27, indicating that its share of population health research lies well above its share of the Canadian population.

- It is also significant that the average index for the population health, clinical, and health services themes have been greater than 1.0 for the past six years, indicating that Nova Scotia health researchers have been successful in attracting funding for these research areas. Moreover, the index for clinical research increased sharply above 1.0 in 2009-10 and has remained greater than 1.0 for the past three years.

Figure 10: Shares of CIHR funding in Nova Scotia by CIHR research theme, 6 year average, 2006-07 to 2011-12



Source: CIHR funding database, <http://www.cihr-irsc.gc.ca/e/826.html>

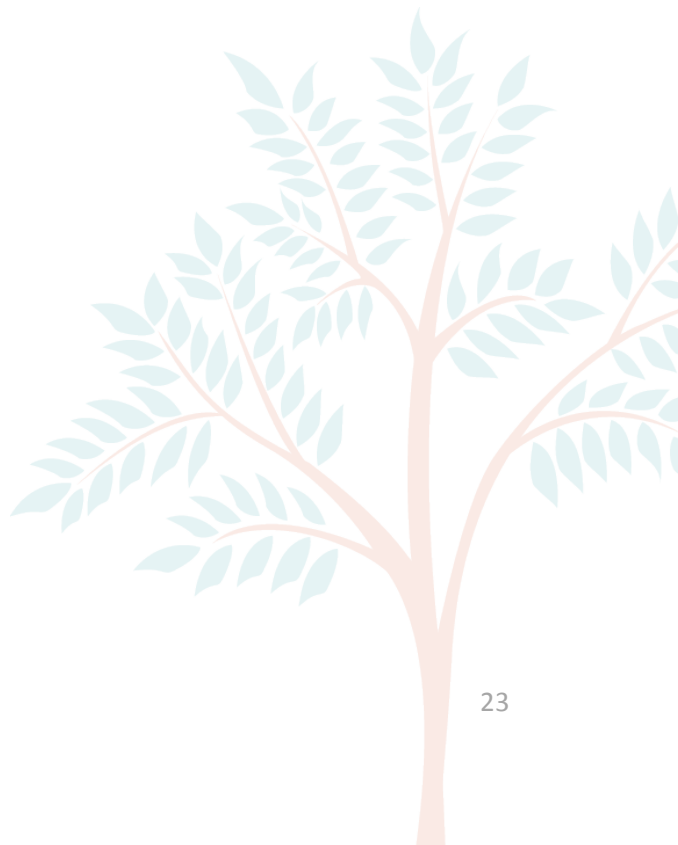
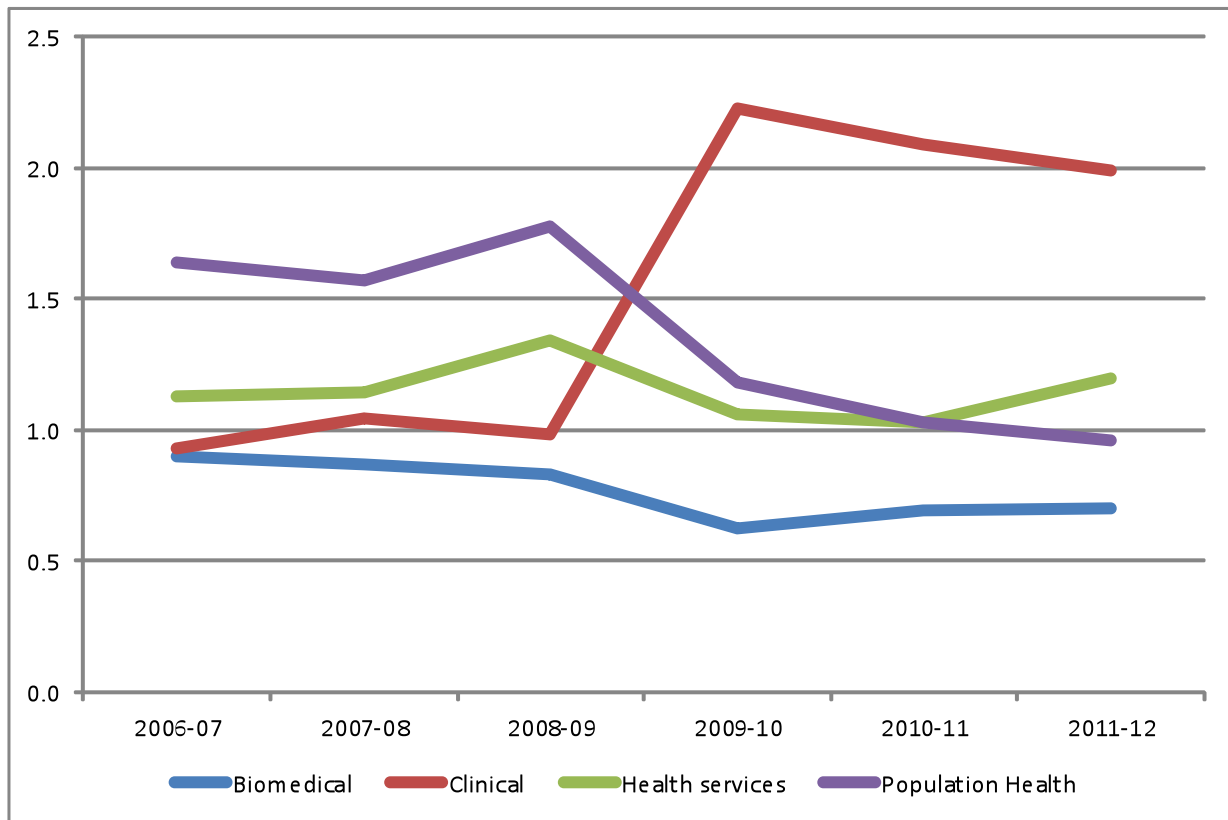


Figure 11: Funding index for CIHR research themes, Nova Scotia, 2006-07 to 2011-12



Source: CIHR funding database, <http://www.cihr-irsc.gc.ca/e/826.html>

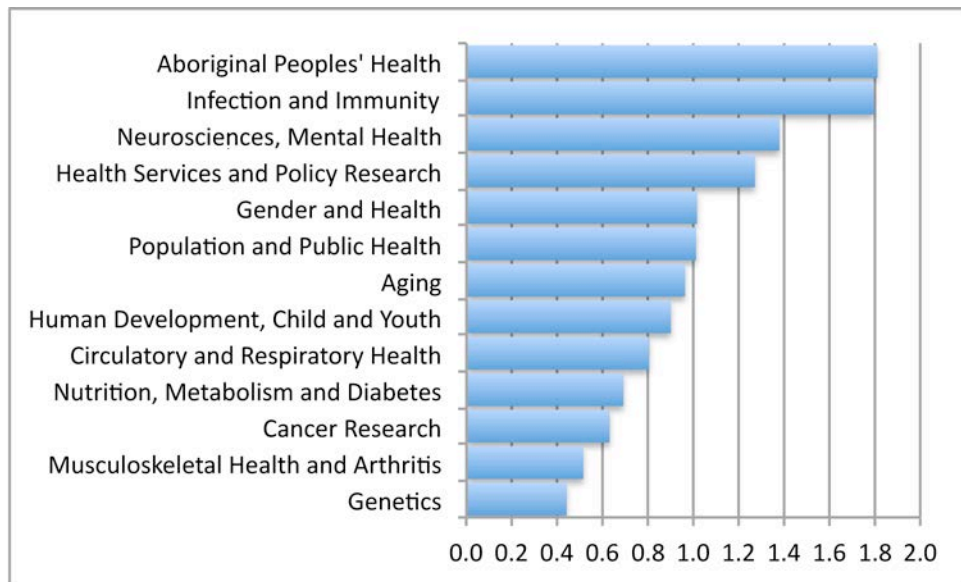
The funding context is critical and multi-faceted. For example, provincial comparisons of health research funding are calculated on a provincial per-capita basis, and for a province like Nova Scotia, which serves a regional base, do not reflect the broader population served by the health research enterprise here.

Grants and Awards by CIHR Institute

The following analysis examines Nova Scotia's CIHR grants in terms of the research institutes they are aligned with.

Given there are 13 research institutes, presenting an analysis of the CIHR grants by institutes over each of the past six fiscal years beginning in 2006-07 becomes challenging. Funding indices are calculated as averages of the funding for each of the research institutes over the 2007-2012 timeframe and are presented in Figure 12.

Figure 12: Average funding index for CIHR institutes, Nova Scotia, 2007-2012



Source: CIHR funding database, <http://www.cihr-irsc.gc.ca/e/826.html>

The results indicate that Nova Scotia researchers have attracted research funding above 1.0 in four CIHR institutes, and another two institutes have funding indices at or close to 1.0. The six-year-average funding indices for Aboriginal Peoples' Health is 1.8 and for Infection and Immunity, 1.78, exceeding the other indices by a substantial amount. The average funding index for Neurosciences, Mental Health and Addiction is 1.37, and Health Services and Policy Research, at 1.26, were also well above the 1.0 value.

These findings indicate that Nova Scotia health researchers have been able to attract CIHR funding to the province.

Over the same period, researchers were less successful in attracting funding in three institute areas, particularly in genetics and cancer research where the six-year-average funding indices were 0.44 and 0.63, respectively, well below the national average of 1.0. It is also worthwhile to note that the funding index for cancer research has been increasing over the past several years, with the average index for 2007-08 being 0.44, which has now increased to a value of 0.63.³

Other Federal Health Research Funding

Although CIHR is the primary funding agency in health research, other federal and provincial government agencies provide funding for health research. This section provides an analysis of the financial contribution by these organizations and examines trends in these expenditures. Figure 13 provides a summary of the distribution of Nova Scotia's percentage share of total health-related research funding by the major national funding agencies including CIHR, NSERC,

³ The National Cancer Institute of Canada (NCIC) also funds cancer research. NCIC funding is examined in the section below.

NIH, CFI, and SSHRC. The results are based on the total level of funding awarded by each of the health research by the Tri-Council over six fiscal years.

In the case of NSERC funding, only the portion designated as health-related funding is included. This encompasses NSERC funding for biomedical engineering, human health, human pharmaceuticals, medical and health sciences, and medical equipment and apparatus. The distribution of NSERC funding in each of these areas for Nova Scotia over this time period is presented below. The data for SSHRC research funding includes only the portion of funding designated as health-related (including mental health). CFI funding include only that portion categorized by CFI as the health sciences sector is included in the analysis.

The most striking feature of Figure 13 is the large proportionate share of CIHR of total health-related research funding for Nova Scotia. This is not surprising given that CIHR is the major source of health research funding for not only Nova Scotia but for Canada as a whole. The other feature illustrated by Figure 13 is that the increase in total health research funding in Nova Scotia in constant dollar terms is being driven by increases in CIHR funding in the past two years, beginning in 2009-10.

Figure 13: Nova Scotia's share of total health related research funding 2006-07 to 2010-11

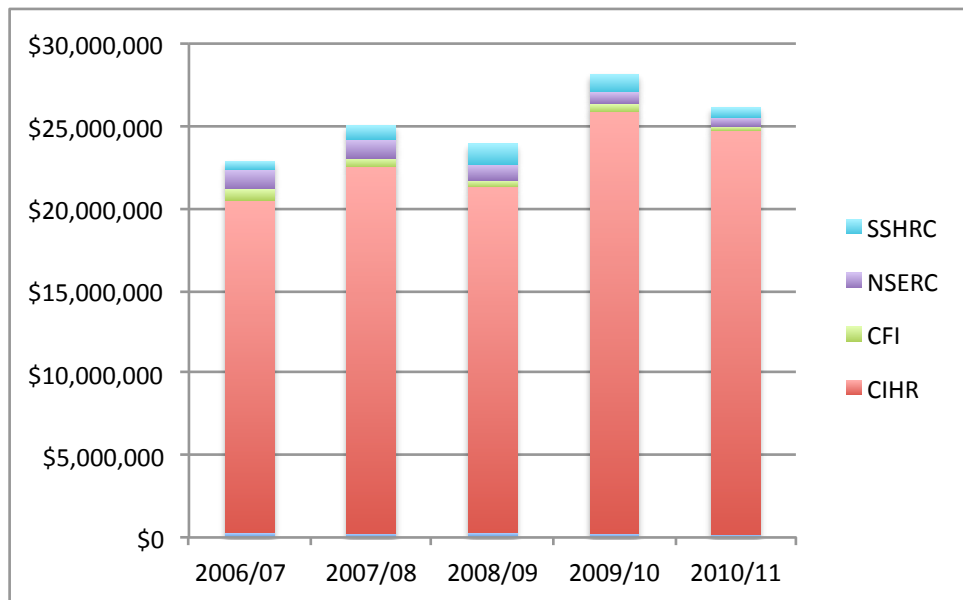


Figure 13 does not reveal the changes in health-related research funding in Nova Scotia from other sources.

A summary of total health-related funding for Nova Scotia from other national sources (excluding CIHR) can be located in Table 4. This table also reveals that health-related research funding received by Nova Scotia from other national funding bodies (excluding

CIHR) has been decreasing in constant dollar terms over the 2006-07 to 2010-11 timeframe.

Table 4: Nova Scotia share of total health research funding by national funding agency, 2006-07 to 2010-11, constant 2011 dollars

	2006-07	2007-08	2008-09	2009-10	2010-11
CFI	\$691,323	\$521,852	\$388,857	\$485,268	\$257,162
NSERC	\$1,151,265	\$1,119,505	\$951,619	\$702,334	\$521,180
SSHRC	\$524,563	\$848,210	\$1,246,177	\$1,054,949	\$598,326
Grand Total	\$2,655,906	\$2,743,919	\$2,884,117	\$2,494,705	\$1,583,041
NS Shares	2006-07	2007-08	2008-09	2009-10	2010-11
Total Shares	2.1%	2.1%	1.5%	2.5%	2.6%
CFI	0.6%	2.2%	0.1%	0.3%	1.6%
NSERC	2.7%	2.5%	2.1%	1.7%	1.5%
SSHRC	2.4%	1.8%	5.6%	4.6%	3.7%

Source: CIHR, CFI, NSERC, and SSHRC online databases and NSHRF

When the distribution of Nova Scotia’s health-related research funding from national funding sources other than CIHR (Figure 14), is examined, a steady decrease in total NSERC health-related funding over this period is evident. There is also a marked decrease in CFI’s health sciences sector funding and SSHRC’s health-related funding. This decrease in SSHRC health-related funding is not surprising given that health-related research funding moved out of the SSHRC portfolio in 2009 and only previously committed health-related research funds remain.

Figure 14: Nova Scotia’s share of total research funding awarded by national funding agencies, 2006-07 to 2010-11



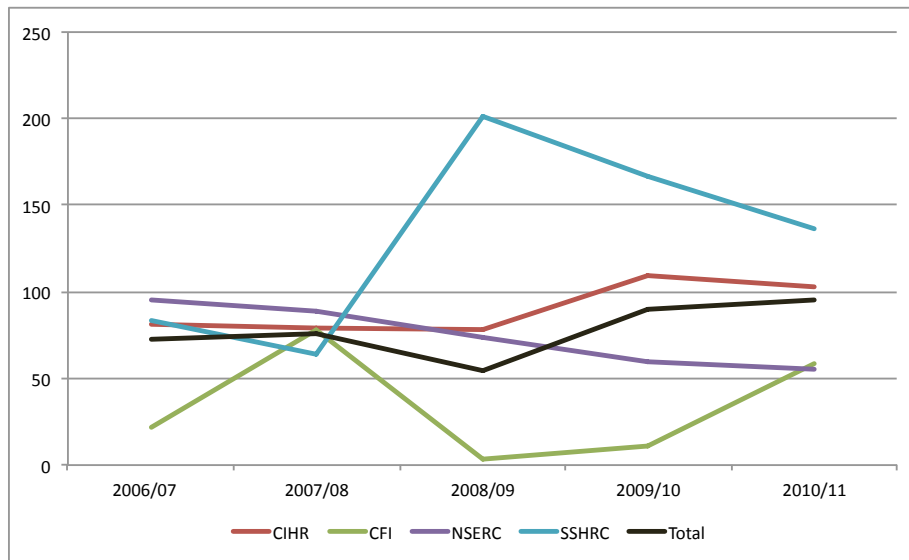
Source: CIHR, NSERC, CFI, and SSHRC online databases

What cannot be seen in Figure 14 is the percentage share of funding within each agency awarded to Nova Scotia. While CIHR represents the lion’s share of health research funding in Nova Scotia, it only represents roughly 3% of total national CIHR funding. For a closer look at

Nova Scotia’s per-capita share of health research funding from all national funding agencies Figure 15 is provided below. This figure reveals the following:

- Nova Scotia’s CIHR funding index rose above 1.0 in 2009-10, and its average CIHR funding index is .90 over the 2006-07 to 2011-12 period.
- Nova Scotia’s NSERC funding index decreased steadily from .95 in 2007-08 to .55 in 2010-11.
- Nova Scotia’s health research funding index is below 1.0 for CFI throughout the 2006-07 to 2011-12 period.
- Nova Scotia’s health-related SSHRC funding index rose above 1.0 in 2008-09 and remained above 1.0 in 2010-11.

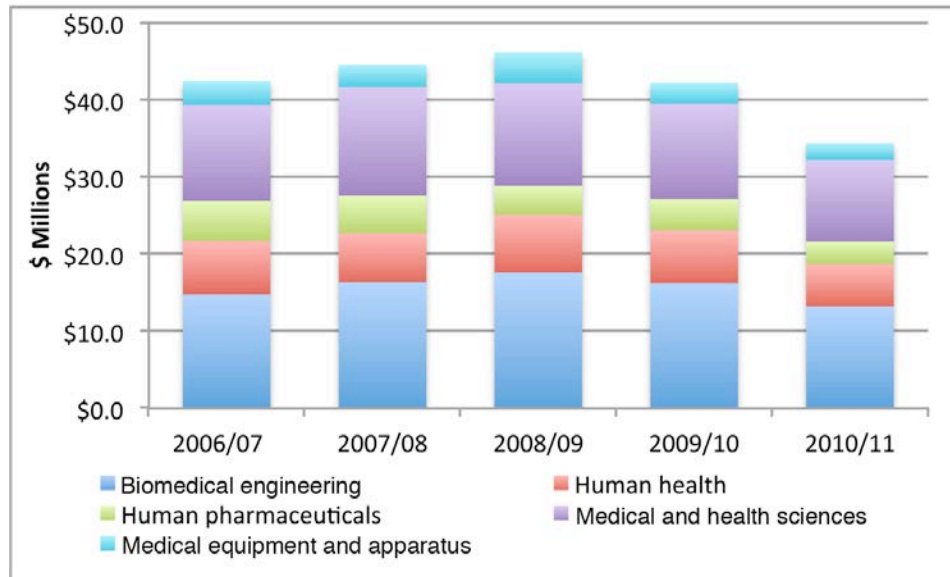
Figure 15: Nova Scotia’s funding index for research funding from national funding agencies, (SSHRC, NSERC, CHIR, and CFI), 2006-07 to 2010-11



Source: CIHR, NSERC, CFI, and SSHRC online databases

The total health-related NSERC funding in Nova Scotia over the previous five-year period (Figure 16) was also examined. Total NSERC health-related funding has fallen substantially in Nova Scotia from \$46.2 million in 2008-09 to \$34.5 million in 2010-11.

Figure 16: Health-related NSERC funding by health area in \$millions, Nova Scotia, 2006-07 to 2010-11



Source: NSERC online database

When NSERC health-related funding in Nova Scotia is examined, it is noted that funding has decreased not only in one area, but in all NSERC health areas in 2010-11 as compared to the 2006-07 to 2010-11 period (Table 5). The implications of this are highlighted in the summary at the conclusion of this section.

Table 5: NSERC funding by health area in constant 2011 dollars (millions) 2006-07 to 2010-11

	2007	2008	2009	2010	2011
Biomedical engineering	\$14.8	\$16.4	\$17.6	\$16.3	\$13.2
Human health	\$6.9	\$6.4	\$7.5	\$6.9	\$5.6
Human pharmaceuticals	\$5.2	\$4.8	\$3.8	\$4.0	\$2.9
Medical and health sciences	\$12.5	\$14.1	\$13.3	\$12.4	\$10.6
Medical equipment and apparatus	\$3.1	\$2.8	\$4.0	\$2.7	\$2.2

Source: NSERC online database

National Research Council

The NRC is a federal organization established for research, development, and technology-based innovation. Nationally, there are six NRC institutes dedicated to biotechnology, several of which are health related: the Biotechnology Research Institute in Montreal, the Institute for Biodiagnostics in Halifax, and the Institute for Biological Sciences in Ottawa. In addition, the NRC has state-of-the-art research facilities across the country that Canadian companies and universities can access.

On the East Coast, the NRC Institute for Biodiagnostics fosters collaborative research within the neuroscience community with the objective of capitalizing on existing regional expertise through

capacity building in areas that enable knowledge translation.

Nova Scotia is also home to three health-related NRC-established labs: two within the Institute for Biodiagnostics, the Neuroimaging Research Laboratory and the Biomedical MRI Research Laboratory, and the magnetoencephalography (MEG) lab at the IWK. All three labs reflect substantial infrastructure support.

That support is dwindling, however. Last year the NRC announced the closure of the MEG lab, which provides an unparalleled combination of spatial and temporal resolution for measuring brain function. A collaborative effort by Nova Scotia stakeholders has produced a process for ongoing access to the equipment and expertise of the personnel for the immediate future. Plans are under way regarding longer-term sustainability.

Canadian Foundation for Innovation

An independent corporation created by the Government of Canada, the CFI is the primary national funding agency for health-related infrastructure in Nova Scotia. Its mandate is to strengthen the capacity of Canadian universities, colleges, research hospitals, and non-profit research institutions to carry out world-class research and technology development that benefits Canadians. Typical infrastructure funded by the CFI includes equipment, laboratories, databases, specimens, scientific collections, computer hardware and software, communications linkages, and buildings necessary to conduct leading-edge research.

The CFI's funding formula is based on matching funds. CFI provides up to 40% of a project's eligible infrastructure cost with researchers and their institutions obtaining the remaining project funding from other government sources or the private sector. The provincial matching body in Nova Scotia for CFI funding is the Nova Scotia Research and Innovation Trust.

State-of-the-art infrastructure not only allows individuals to conduct research effectively, efficiently, and innovatively, it also helps institutions attract, retain, and train top researchers from around the globe.

There is an extensive infrastructure available to support health research in Nova Scotia. That support is primarily delivered through capacity development and funding. However, within any thriving health research enterprise, collaborative networks exist to promote, support, and generate high-quality research. Such networks tend to build on existing traction: the more infrastructure, in terms of equipment, buildings, technology, and human capital, that a province has, the greater the likelihood for attracting additional investment and additional human capital.

Individuals interviewed for this report noted that attracting and retaining highly qualified personnel constitutes an important component of investment in infrastructure and is required to develop a sustainable health research enterprise. Many key informants indicated that there is a perception that infrastructure funding is becoming increasingly competitive. Successful application is more dependent on establishing capacity and excellence in research areas with

established collaborations and partnerships. Yet research excellence, collaborative arrangements, and strategic partnerships take time to establish and nurture – and require a strategic approach to build research capacity.

Another issue raised by key informants was related to the inaccessibility of Canada Foundation for Innovation funding in particular. CFI funding is not available for all academic disciplines or for all types of infrastructure, and many universities give priority to disciplines where projects are CFI-eligible. Largely excluded by the CFI eligibility requirements are the humanities and the non-experimental sciences.

What this means for the health research enterprise:

1. Health-related research funding received by Nova Scotia from national funding bodies (excluding CIHR) has been decreasing in constant dollar terms over the 2006-07 to 2010-11 timeframe. This loss significantly decreases Nova Scotia's ability to fund and support the province's researchers, graduate students, and institutions dedicated to health research and finding new, innovative, and evidenced-based solutions to growing systems issues.
2. A disjointed funding system that requires matching funds places undue pressure on researchers, takes time away from conducting health research, and creates an added – and unnecessary – level of administration.

Matching Grants

Funding begets funding. This reality in many cases enables researchers to conduct their research at a level that is both necessary and appropriate – or at any level at all. In addition to supporting health researchers in the province, NSHRF's funding programs leverage additional international or national health research funding, thereby generating incremental benefits. This is usually done by way of matching grants.

One example is the joint NSHRF-CIHR Partnership for Health Systems Improvement (PHSI) program, which supports alliances of researchers and decision-makers in conducting applied health services and policy research. Under the PHSI program, the principal applicant must obtain secure partnership contributions equivalent to a minimum of 20% of the total grant amount requested from CIHR. Many projects would not be eligible to receive the CIHR funding without NSHRF assistance.

The impact of leveraged funds is noteworthy. An earlier study (Collins Management Inc. 2009) tracked additional funds leveraged from sources external to Nova Scotia and found NSHRF programs had a leverage ratio of \$7.40. This means that for each dollar awarded by NSHRF, health researchers leveraged an additional \$7.40 in incremental funding through external national and international sources.

This number may well be underestimated. There is a time lag between when researchers receive NSHRF funding and when they are successful in attracting additional funding. Therefore, it is likely that some incremental funding leveraged had not yet been realized at the time of the Collins Management Inc. Report in the 2009 study.

The seriousness of this situation was highlighted by experts interviewed for this report. They indicated that one of the main challenges with many national research funding programs is the requirement for matching funds. The requirement for matching funds places pressure on smaller provinces with limited budgets to step in and step up. Most often the ability to provide matching funds requires a trade-off in the health-related budget allotment for alternative funding requirements within provincial treasuries. As a result, these programs create an inequality based on the ability to pay. Key informants indicated that as a result of the limitations posed with the matching funds requirement, programs no longer feel national in nature when they are virtually inaccessible to many provincial health researchers.

What this means for the health research enterprise:

1. With the erosion of funds to health research organizations like NSHRF comes erosion in researchers' ability to leverage external funding.
2. A weakened provincial system resulting from decreased funding leads to a weakening of the entire provincial health research landscape.
3. The bottom line is that the public, our health researchers, health professionals, and funding institutions rely on the impact of a strong leverage ratio. If NSHRF's current ratio declines, like a domino effect, the health research enterprise and all who count on it will feel the impact.

Success is possible

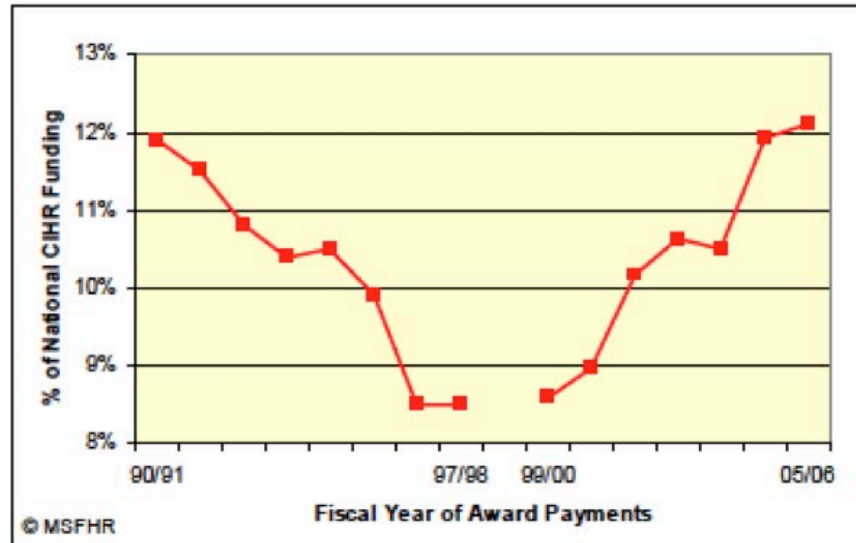
British Columbia experienced – and addressed – a similar dilemma to that facing Nova Scotia. As shown in Figure 17, B.C.'s share of funding from national funding sources steadily declined between 1990 and 2000, hitting a low of approximately 8.5% at a time when its share of the total population was roughly 13%.

This imbalance was recognized – and the province reacted. It served as the impetus for initiatives led by the Coalition for Health Research in B.C. to gain provincial government support for and investment in efforts to build provincial health research capacity.

A coalition of health research stakeholders was formed to address the urgent issue of B.C.'s declining share of federal health research funding in 1998. The Coalition produced a strategy document outlining a vision and plan for restoring the province's competitiveness. The provincial government provided a substantial amount of provincial funding for the strategy.

Figure 17 demonstrates the impact of that decision and the value of investing locally in order to support national success in health research.

Figure 17: British Columbia's share of national (CIHR) funding, 1990-91 to 2005-06



Source: MSFHR, *Evaluating British Columbia's Performance in Health Research, 2007*

Note: Funding from 1990/91 to 1997/98 was from the Medical Research Council of Canada, not CIHR.

Health research networks, a provincial strategy, and investments in infrastructure are important pillars for attracting funding from a variety of sources. Indeed, provincial funding offers substantial leveraging opportunities, which is described in more detail in the section entitled "Matching Grants."

Discussion

The analysis conducted for this study, both quantitative and qualitative, identified three significant emergent themes:

- ❑ Funding
- ❑ Capacity
- ❑ Collaboration

Funding

The pool of funding for health researchers in Nova Scotia has shrunk. Significant changes on both the national and provincial stage have adversely affected individual researchers specifically and the health research enterprise generally. While the nature of these changes are uneven - some beneficial, others detrimental - the overall result is fewer dollars for more researchers, duplication of effort, and greater demand on resources.

Matching funds are also an issue. A declining proportion of the NSRIT matching funds budget has been allocated to health-related research infrastructure for Nova Scotia. NSHRF has limited ability to provide matching funding for the growing number for federal/national programs requiring them due to a shrinking budget. In some case this may preclude Nova Scotia researchers from even entering the competition.

Requirements for matching funds put pressure on smaller provinces such as Nova Scotia with limited provincial budgets. In many respects, “national” programs no longer live up to their name because funds are inaccessible to smaller provinces. An under-funded provincial system that does not allow for pre-approval of project funding also creates a built-in bias against Nova Scotia health research grant applications going forward.

Researchers in the province are also affected by changes to research funding at the national level, which have been substantial in the last few years.

Collaboration

There is an increasing requirement for collaboration. In and of itself, this is not unreasonable or disadvantageous. However, Nova Scotia researchers simply do not have the same opportunity to build large local collaborative networks as researchers in other provinces because of the small number of researchers engaged here. Their work is, as a result, disjointed. At the same time, as a comparatively small player on the national stage, researchers have little choice but to work together. This dissonance has not gone unnoticed by those involved in the health research enterprise. On one point, however, there is universal agreement: there is a willingness to engage in more collaborative initiatives on the part of researchers and health research administrators.

Capacity

Nova Scotia researchers depend on the province’s network of universities for access to employment, expertise, and knowledge. As universities shrink under the weight of cutbacks, research capacity diminishes accordingly.

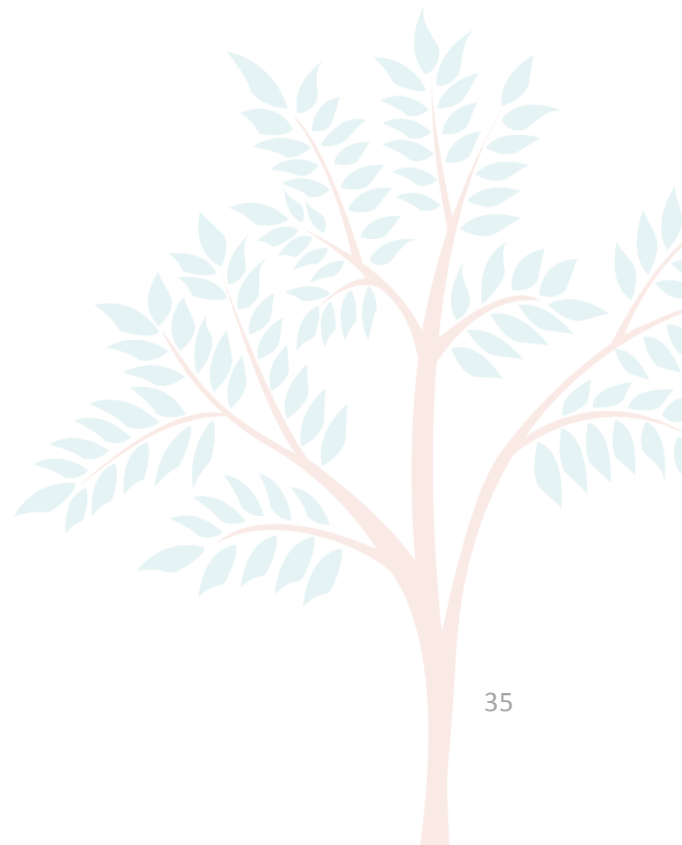
The nature of health research itself is also changing in Nova Scotia. As a result, health researchers need to be strategic in developing research capacity in areas likely to be critical to the future of the health research enterprise here.

Conclusions

Nova Scotia’s health researchers have made and continue to make an indelible contribution to the health care of Nova Scotians, Canadians and individuals around the world. Their contribution, however, goes much further. Health research makes a vital contribution to the province’s health system and to its economy.

That contribution is in jeopardy. Changes to national funding programs, declining funding for health research at the national and provincial level, and a disjointed system for conducting research and awarding grants have taken a toll on health researchers in this province and the organizations that support them.

The ramifications of such a shifting landscape are significant. The quality of health care diminishes; advances in diagnosis and treatment are slowed; the economy is less robust; and there are fewer researchers to contribute to the knowledge economy.



APPENDIX 1: Detailed Qualitative Results

Methods

Interviews were conducted with subject matter experts throughout Canada. Fifteen key informants were interviewed in total, representing various facets of the Canadian health research enterprise including national/provincial funders, universities, and not-for-profit organizations. Interviews were unstructured in nature and conducted by a consultant who had no conflict of interest with any of the respondents. Respondents were generally asked to comment on the current state of the health research enterprise, and no interview guide was used; rather, respondents were encouraged to reflect upon issues of concern and interest to them and the organizations they represented.

The majority of interviews were conducted over the phone, and notes were taken by the interviewer. Notes, transcriptions of audio files, and audio files themselves were analyzed by two raters experienced in conducting analysis of qualitative data of the sort gathered by the interviews. Atlas.ti survey software was used to facilitate the analysis. Raw data were uploaded to Atlas.ti and coded first by one rater and then the second. The two raters discussed any discrepancies and came to agreement on code names and meanings. Next, each code was further analyzed for subthemes. The findings of the analysis were compiled based on broad themes, which are reflected in the headings below.

The results of this analysis are presented without interpretation or opinion of the analysts. One limitation of this approach to analysis is that the data were being analyzed by individuals who did not collect it. This means that there are uncertainties regarding interpretation. To elaborate, participating in the interview allows for interpretation of meaningful pieces of information that are conveyed through the respondent's gestures, demeanor, tone, and word choices. Such contextual information is lost when those conducting the analysis are not present for data collection. Attempts were made to address this limitation by having two coders analyze all raw data and then discuss any noted inconsistencies or uncertainties identified by either coder.

Supporting quotes from the notes are used here to illustrate key findings of the analysis. These quotes are from the notes that were taken by the consultant who conducted the interviews and should not be interpreted to represent verbatim responses from individual key informants.

The following sections summarize the findings of the interviews by theme.

Access to funds

Access to funding at national, regional, provincial, and institutional levels was generally seen as becoming increasingly difficult to secure. Investment in health research has been decreasing across all levels, and the commitment to national health research in general was questioned by respondents. Informants believed that national changes to programming will further deplete access to funds, more so for some types of research than others (i.e., social science research), and in general, early-career researchers currently being funded or new to the research enterprise will be the first to suffer the consequences.

Increased competition for funding dollars was identified as a major barrier for health research. Funds were seen to be in continual decline, and as a result, researchers in all fields of study face enormous pressures as they deal with decreased success rates due to growing application pressures. This was agreed to be the case within all levels of funding sources. Relatedly, researchers and research administrators are spending more time on securing funding and subsequently time available for actually doing research is diminished. Increased application pressure combined with fewer available funds at all levels is generally seen to be an issue that will have a multi-layered effect and, ultimately, result in negative outcomes for the Canadian health research enterprise.

Researchers have been identified as the stakeholder at greatest risk to suffer negative consequences in light of national funding changes. In particular, informants were concerned for Canadian researchers in the early and middle stages of their careers. Available funding to these two groups was acknowledged as the key factor to creating sustainable research programs, retaining trained professionals, and building capacity to create seasoned senior researchers. Respondents noted that with decreased funding available for both groups potential difficult times lie ahead. An expected consequence was said to be having insufficient and under-qualified mentors for research trainees, which interviewees identified as a key element for capacity building.

It was recognized that early-career researchers are quickly becoming unable to attain start-up funding, generally believed to be due to national changes, and changes in funder requirements and criteria, such as matching/partnership funding, established research relationships, and peer-reviewed funding track records. Additionally, the increased application pressure and decreases in available funding mentioned previously compound all these challenges affecting researcher time availability, and early-career researchers are now seen to be a cohort that will be under enormous performance pressures not equitable to increased health research outcomes.

Many national program changes were seen to potentially cause issues for mid-career researchers. Researchers able to move to this career level after being successful with early-career, peer-reviewed funding will face additional new challenges. A key challenge identified among informants was the increased focus on project versus program funding. Requiring this level of researcher to attempt to access funding on a project by project basis and not focus on

developing a sustainable research program was expected by informants to negatively affect outcomes and return on investment.

An uncoordinated approach among funders was acknowledged to have also left researchers, who are able to obtain decreasing infrastructure support dollars, in a bind because without access to sustainable research program funding infrastructure becomes difficult to maintain and support. Furthermore, the identified issues for early- and mid-career researchers were recognized to continue for this group as a whole. That is, increased competition, competing alongside senior researcher track records, and limited access to program funding were seen to create inevitable negative consequences that will affect researchers' ability to succeed in creating health research programs in the current environment.

Access to matching funding was overwhelmingly recognized to be the largest challenge for all stakeholders in the health research enterprise. Informants agreed that accessing matching funding will be the largest change negatively affecting success in health research among all the funding changes anticipated. Requirements for matching funding were identified as issues for provinces and institutions of all sizes and budgets. However, the greatest concern was recognized to be the effect these requirements will have on smaller funding sources, in particular smaller provinces and universities.

Matching funding requirements were noted as placing enormous pressure on smaller provinces who have limited budgets to provide the funding needed to compete at the national level. Most often it was recognized that for smaller provinces providing these matching funds often requires a trade-off in health-related budget allotments for alternative funding requirements within provincial treasuries.

Respondents reported that this leaves researchers working in smaller provinces at a disadvantage when competing at the national level. The requirements to get national level funding were expected to be increasingly time consuming and competitive at the provincial level before even having the opportunity to compete for national funding.

“The requirement for matching funds creates inequality in funding and places pressure on smaller provinces with limited budgets to provide matching funding. Only some provinces benefit – so many programs are not really national.”

Key informants explained that for smaller institutions it will be a challenge to find matching funds that allow researchers to be competitive at national competitions when competing against institutions with larger cash flows, and doing so will leave researchers working in these universities at a disadvantage. As a result, these program changes were noted to have created an inequality among Canadian researchers based on the “ability to pay” effect through matching funds criteria. Respondents reported that matching funding programs will be virtually inaccessible to researchers in many provinces. Informants also noted that this inequality will give applicants from large provinces with deeper wallets an unfair advantage to access the already limited research funding available.

Inequality due to matching requirements was a common concern among the key informants interviewed, but additional inequalities created by funding program changes were also acknowledged. Spillover effects of matching funding requirements were noted to affect the need for increased human resources to manage the matching funds, an additional challenge for smaller provinces and institutions unable to support this extra cost. Furthermore, as previously mentioned, additional time is required by researchers to maintain these relationships, ultimately diminishing the time spent doing research and limiting the ability of researchers with less access to funds to support this additional work.

“Big emphasis on partnering continues to be a challenge. These programs create inequality and require an extraordinary amount of human resources to manage the matching funds. Programs are inaccessible to many funders and institutions.”

Impact of changes

Decreased access to funding was identified as the lynchpin of the changes and challenges, but of greatest concern for the health research enterprise was the impending impact these changes will have on Canadian health research.

National research priorities and funding strategies have begun to change in response to decreased available budgets and access to funding. Funding sources have become more streamlined and clearer regarding what types of research they will fund. Many interviewees responded that at first sight this seems like a positive strategy in a time of decreased funding; however, it was widely noted that doing so without actively communicating and strategizing as an industry is creating a disjointed system that will have negative impacts on many specific types of health research important to Canadian health care. In particular, it was noted that funding for foundational and social science research will be most affected. A large focus was recognized to be on short funding loops, fast reportable outcomes, and quick return on investments, great for research fields such as policy development, but for foundational research, this presents a large problem as this is not the nature of how foundational research functions.

Respondents reported that foundational research has long been an integral part of the health research enterprise, a key source of transformational research findings, and the beginning foundations of important health research programs. It was of wide concern among respondents that with this community of research having trouble accessing funds there will be negative consequences for the future of research programs dependent on foundational research. There were also identified implications for Canada’s ability to be a health research leader and Canadian health outcomes as a result of basic research being under supported.

Social sciences and humanities research was expected to be greatly impacted by changes in funding priorities and strategies. Respondents reported that some research programs often have very different peer-review methods and publication practices, and participating in a multi-stage review process such as that proposed currently by CIHR is not the norm for social

scientists, which will potentially result in them being less competitive and, therefore, at a disadvantage. Many potential projects are at risk of not being funded due to the emphasis on peer-reviewed track records versus overall merit of the application. Many respondents worried about Canada's potential loss of knowledge in this field.

Informants were also concerned with commercialization and industry becoming an increasingly common funding requirement for funding applications. It was noted that this focus more commonly required by funding sources, specifically at the national level, created a continued disadvantage to early-career researchers that have yet to establish these relationships, smaller provinces with smaller commercial industries to draw on, and projects not suitable for commercialization. However, it was also noted that this focus remains a good alternative for some types of research (e.g. pharmaceutical).

Provincial health research foundations and other provincial funders were recognized to be undergoing distinct challenges caused by the alterations happening at the national level. It was widely agreed that changes have occurred fast and with minimal consultation or communication. These stakeholders are reportedly struggling to keep up with the changes and to shift their operations such that they can create opportunities for their researchers to support the new national direction. This was identified to be particularly challenging because short time frames for announcing exact changes make strategizing to support those changes at the provincial level very difficult.

Most organizations and agencies reported supporting research projects/programs complementary to national programming, and most focus on local capacity building. However, as these changes are happening fast and with minimal communication with key provincial stakeholders, changes affecting foundations and agencies who are trying to "keep up" were noted to further add to the disjointed environment being created. These stakeholders were recognized as not able to properly strategize their own funding priorities in time for national change implementation. This was noted as important as these stakeholder groups will be those researchers turn to for funding to replace decreases at the national level, mostly for providing new matching funding and support for the noted increased need for administrative infrastructure to keep programs afloat amid new environmental challenges (e.g., increased application pressure, project versus program funding).

The impact of changes identified for provincial funders and universities will cause further challenges for charitable groups nationally. In particular, charitable groups that have mandates for supporting specific types of research not prioritized within new national program changes will encounter difficulties. Most fund specific types of research related to a disease or cause, and due to research priorities and strategies changing, along with decreased researcher access to funding generally, charities and foundations acknowledged they are feeling the increased pressure to fund additional applications that fall within their funding areas. It was also noted that available fundraising dollars have decreased and these stakeholders are finding it increasingly difficult to move forward with important research in their areas of concern.

Furthermore, these funders were also recognized to be candidates for providing matching funding, in particular in areas where this is limited (e.g., smaller provinces, smaller universities) creating another stakeholder in an already challenged funding environment further burdened and forced to make impactful budget-related decisions. Respondents noted that in the case of charities this will likely be the difference between funding relevant research or programming. In addition, it was noted that these issues will raise the potential for researchers changing fields of research because of changing funding priorities and the general increased difficulty in securing funds for their initial research program ideas. This was identified by many to be of greatest consequence for charities that fund research in areas that are not complementary to national research priorities but that are of key importance to their charitable mandates.

“As a result of national changes, we are losing researchers in key research areas that are a priority for our charity. This is understandable – researchers need to go where the funding dollars are - but charities like ours now need to find new ways to support research with already limited fundraising dollars.”

Infrastructure support was generally identified as being an area of concern; decreased funding and increased application pressure were noted to make this funding harder to secure, notwithstanding new requirements for matching funding and/or industry partners. Overall this was acknowledged as providing a means to complete research increasingly hard to secure. However, the largest concern in regards was the effect on the attraction and retention of researchers.

Attraction and retention of researchers was considered to be of great concern and an area needing to be addressed at both national and provincial levels. Many national changes (such as increased focus on project versus program funding) require more time spent administratively applying for funding and an increased need for relationship building. This was expected to take a toll on the research community. It was of wide concern among interviewees that with increased pressures and the difficulties in general the number of researchers who will want to stay in the research profession will decrease; as a career in research is becoming potentially viewed as overly burdensome. Additionally, this effect was also recognized to likely prevent research trainees from continuing in their chosen profession because of the drawbacks mentioned (especially the early-career issues noted previously) and, in particular, for those working in smaller provinces with minimum infrastructure support.

Researcher trainees were expected by informants to be increasingly likely to move to larger provinces where larger budgets exist to support their programs of research and where they have access to an appropriate amount of mentorship time. Many respondents believed that the most important infrastructure support needed at national and provincial levels was the support for people (i.e., researchers, research trainees and research administrators); unless these individuals are functioning at their best research outcomes will be negatively affected. Overall, the message received from informants was that the impact of national changes expected for these key stakeholder groups will create additional gaps and a further disjointed system.

“Attracting and retaining highly qualified researchers is critical for the future of health research in Canada – and our ability to do this is becoming more uncertain.”

Looking Forward: Suggestions for Change

When respondents were asked how Canada should move forward to best support health research, three areas were identified as needing immediate attention from all funding sources: accurately illustrating the current research environment (reporting abilities), capacity building, and national coordination/strategy.

Looking forward, respondents identified what is currently missing is a clear picture of what is really happening on all funding and support levels, a full picture of all the players and their various contributions that create the national health research enterprise, and agreed-upon indicators and metrics for measuring research impact. Identified as most important was a method to achieve a full picture of the true return on investments from the various levels of support, which was currently identified as unavailable.

A more immediate suggestion put forward by informants was that with the impending changes at the national level, provincial-level funders now need to be strategic to respond and keen to support their researcher community in these times of change. Although few respondents believed most provincial funding sources would be able to address all gaps and challenges created by the national changes, they did agree that consultation with their communities on how to best and realistically move forward was the next step in addressing the current disjointed system.

Capacity building was at the top of most respondents’ list of important areas of concern moving forward. As previously mentioned, it was widely felt that people make the research enterprise successful, and it was overwhelmingly agreed that building capacity among research professionals was key to moving forward. Preparing them for the research environment that has been created and giving them the skills to be successful was deemed crucial.

All the issues created by national level changes and the disjointed system has created a widely held view that the community should move forward with a coordinated and common strategy. Respondents reported that the impact of national changes will generally leave many gaps and unaddressed areas of concern. Informants believe that overall what is needed to move forward and properly address this issue is to first ensure all funding sources are part of the communication and coordinate their efforts. Most agreed that currently, even at the national level, there is little coordination among government-funded agencies about changes and their impact. Most agreed that national agencies that were once created to address gaps are now swaying from their mandate, no longer fully addressing gaps and, in general, the organizations are no longer complementing each other. They were seen to be disjointed and uncoordinated, seemingly working in silos. Government-funded agencies were noted as needing to be held accountable, to be more strategic in their work, and to actively consult with all players when making major changes.

It was recognized that the changes at the national level occurred without considering the role other funding sources played to create the national health research enterprise, (e.g., provincial funders, charities). Respondents agreed coordination among all groups needs to happen to move forward; stakeholders need to work together to create a better funding system and need to refrain from making changes without consideration of others. Changes at the national level were overwhelmingly noted to have caused major gaps that may not be able to be addressed by other funding sources; a national strategy with stakeholders working together in a coordinated manner was acknowledged as the best way to build an inclusive and meaningful strategy for health research in Canada.

“We need to look at the full system, all the pieces. There is a myriad of health research funding sources in Canada. We need to coordinate and strategize together, together address gaps and focus on a systematic approach. We need to communicate and work together to avenge this disjointed health research enterprise that has been created. It’s a large exercise but it needs to be done.”

