

# Canadian Federal Support for Climate Change and Health Research Compared With the Risks Posed

James D. Ford, PhD, Tanya R. Smith, BA, and Lea Berrang-Ford, PhD

For emerging public health risks such as climate change, the Canadian federal government has a mandate to provide information and resources to protect citizens' health. Research is a key component of this mandate and is essential if Canada is to moderate the health effects of a changing climate.

We assessed whether federal support for climate change and health research is consistent with the risks posed. We audited projects receiving federal support between 1999 and 2009, representing an investment of Can\$16 million in 105 projects.

Although funding has increased in recent years, it remains inadequate, with negligible focus on vulnerable populations, limited research on adaptation, and volatility in funding allocations. A federal strategy to guide research support is overdue. (*Am J Public Health*. 2011;101:814–821. doi:10.2105/AJPH.2010.300105)

The dangers of climate change are acute in Canada, where a strong climate change signal has already been detected.<sup>1,2</sup> Future climate change will be amplified, and its effects across the Canadian landmass will occur faster, sooner, and with greater magnitude than in many other nations; these effects will undoubtedly stress the public health system.<sup>1,3–9</sup> The federal government has a constitutional responsibility to protect the health of Canadians, and climate change has been identified as a significant challenge and priority area.<sup>10–12</sup> This responsibility includes the commissioning and funding of studies by federal departments and agencies to identify and prepare for emerging health risks such as climate change<sup>13–15</sup> (see Appendix A, available as a supplement to the online version of this article at <http://www.ajph.org>).

Although successive governments have been criticized for assigning climate change a low priority, to our knowledge no systematic assessment of the federal role in supporting climate change and health research has been carried out. How much is being invested? Is funding changing over time? What projects are being supported, and which departments or agencies are involved? Is research targeting vulnerable groups? And most important, is funding consistent with the risks posed? To address these questions, we assessed the extent

to which the Canadian federal government has invested in research to understand, avoid, prepare for, and respond to the health effects of climate change. We conducted an audit of 105 federally funded projects commissioned between 1999 and 2009. Full details on our search strategy, analysis, included projects, and overview of results are available online in Appendixes A through F (<http://www.ajph.org>).

## FUNDING TRENDS

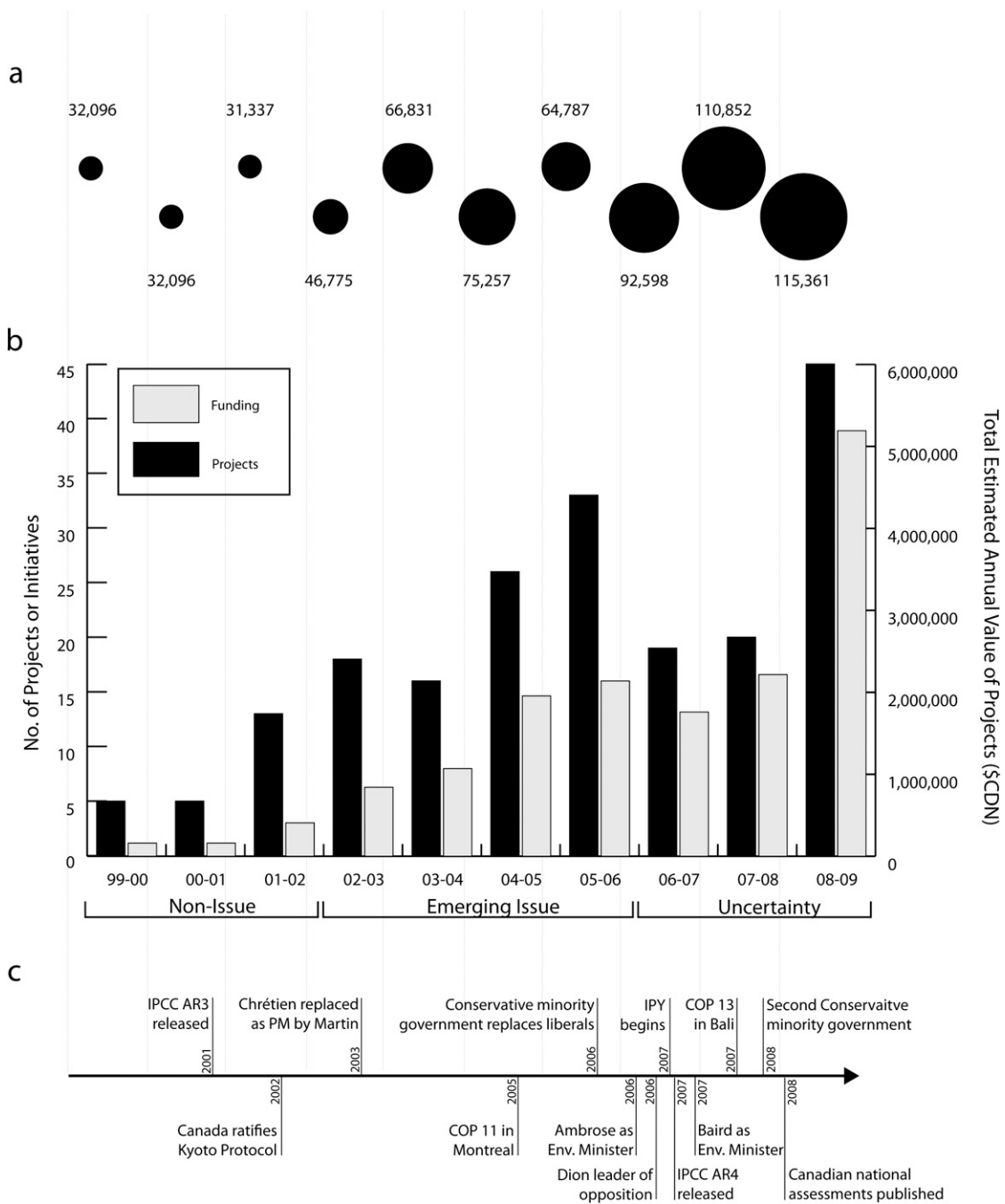
Between 1999–2000 and 2008–2009, the federal government invested approximately Can\$16 million in climate change and health research (Figure 1). (All subsequent date ranges also connote fiscal years, spanning from March 31st of one year to March 31st of the next year.) The number of projects supported was 8 times as high in 2008–2009 as in 1999–2000. A bimodal distribution was evident for number of projects supported, with peaks in 2005–2006 (33 projects) and 2008–2009 (45 projects). Annual allocations for climate change and health research had a similar distribution, increasing from Can\$160 000 in 1999–2000 to Can\$5 million in 2008–2009 (Figure 1). Annual funding per project increased over the past decade (except for 2005–2006) from an

average of Can\$32 000 per project in 1999–2000 to Can\$115 000 per project in 2008–2009.

## Volatility in Funding

Our data showed bursts of research activity (Figure 1). The number of projects funded nearly tripled in 2001–2002 (from 5 to 13) from the previous year; in 2008–2009 the number more than doubled (from 20 to 45) from the previous year. Expenditures increased from the previous year by more than 150% in 2001–2002 and 130% in 2008–2009. The federal granting councils provided relatively consistent funding; volatility was a function of programming by federal departments (Figure 2). The granting councils are federal agencies that typically support university-based research; federal departments are the primary vehicles through which government policies and programs are delivered (see Appendix B, online at <http://www.ajph.org>). The decline in funding in 2006–2007, for instance, reflected cuts by federal departments, specifically a scaling back by Natural Resources Canada (NRCan) of its Climate Change Impacts and Adaptation Program (CCIAP) and less funding from Health Canada's Climate Change and Health Office. During the 2008–2009 fiscal year, funding from the granting councils actually increased.

Conversely, during the 2008–2009 fiscal year the expansion of funding was driven by projects initiated by federal departments, which accounted for 84% of projects and 80% of funds. Two new research programs were particularly important: Health Canada's Climate Change and Health Adaptation in Northern First Nations and Inuit Communities program and the Assisting Northerners in Assessing Key Vulnerabilities and Opportunities (ANAV) program administered by Indian and Northern Affairs Canada (INAC), which together accounted for 47% of projects supported and 44% of funds.



Note. AR = Assessment Report; COP = Conference of the Parties to the Kyoto Protocol; Env. = Environment; IPCC = Intergovernmental Panel on Climate Change; IPY = International Polar Year; PM = Prime Minister. Date ranges connote fiscal years, spanning from March 31st of one year to March 31st of the next year.

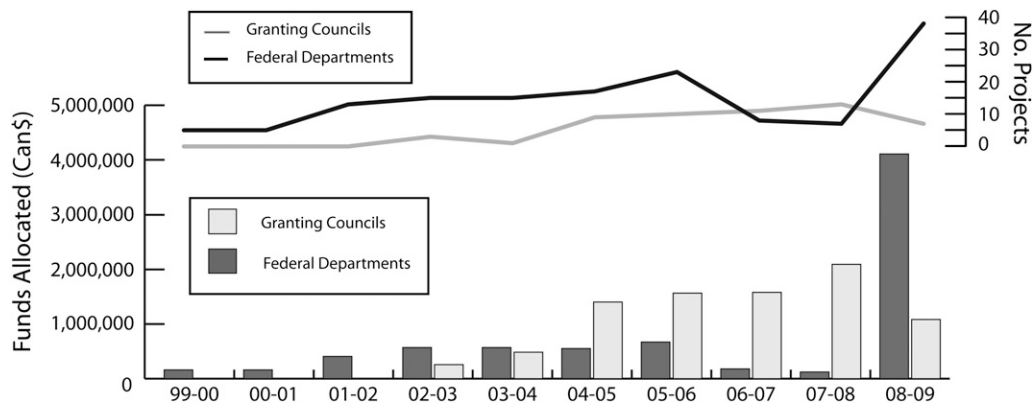
**FIGURE 1—Trends in Canadian climate change and health research by (a) calculated average funding per project (Can\$), (b) funding provision, and (c) major events in Canadian climate change policy, 1999–2000 and 2008–2009.**

Interestingly, during 2008–2009 funding from the granting councils decreased slightly from the previous year. The 2001–2002 burst was entirely a function of the NRCan’s CCIAP.

**Politics and Research Funding**

Figure 1 shows an overlay of annual funding and number of projects with a timeline documenting scientific and political milestones in

climate change. We broke the time series into 3 distinct periods to test our hypothesis that political factors have a major effect on research funding.



Note. Date ranges connote fiscal years, spanning from March 31st of one year to March 31st of the next year.

**FIGURE 2—Canadian federal support of climate change and health research over time, by funding source, 1999–2000 and 2008–2009.**

Until 2001–2002, federal funding of climate change and health research was limited. This was consistent with the status of climate change in the political and public consciousness in Canada: from the adoption of the Kyoto Protocol in 1997 until the release of the Intergovernmental Panel on Climate Change's *Third Assessment Report* in 2001, the issue was largely ignored.<sup>16,17</sup> All projects during this period were funded by NRCan's CCIAP.

From 2002–2003 to 2005–2006—a time of emerging focus—climate change became a major topic of debate in Canada, with the Canadian ratification of the Kyoto Protocol in 2002 and establishment of climate change as a potential election topic. During this 4-year period, the number of projects supported, funds allocated, and project size steadily increased, culminating in 2005–2006, when Canada hosted the Conference of the Parties to the United Nations Framework Convention on Climate Change in Montreal. NRCan's CCIAP continued to fund a significant number of projects, Health Canada's Climate Change and Health Office ramped up investment, and the granting councils established a presence, particularly through large multiyear grants from ArcticNet and the Canadian Institutes of Health Research.

Politics as a driver of funding was particularly noticeable between 2006–2007 and 2008–2009, a period of uncertainty characterized by instability in research support. During the winter of 2006, the Conservative Party, known for its climate change skepticism,

became a minority government. Immediately, across-the-board cuts were made to climate change programs.<sup>16,17</sup> The number of funded projects related to health decreased by approximately half, and Canadian dollars invested declined by nearly 20% in 2006–2007. Funding by the granting councils, however, remained steady (Figure 2).

In response to wide domestic and international criticism, in 2007 the government appointed a senior minister to the environment portfolio and reestablished and then increased expenditures on climate change and health research through federal departments. Science also played an important role in bringing the issue to the fore: the release of the Intergovernmental Panel on Climate Change's *Fourth Assessment Report* clearly highlighted the human causation of climate change,<sup>18</sup> and 2 major assessments of climate change in Canada released in 2008 outlined the risks posed to the health of Canadians,<sup>1,2</sup> establishing the need for federal action.

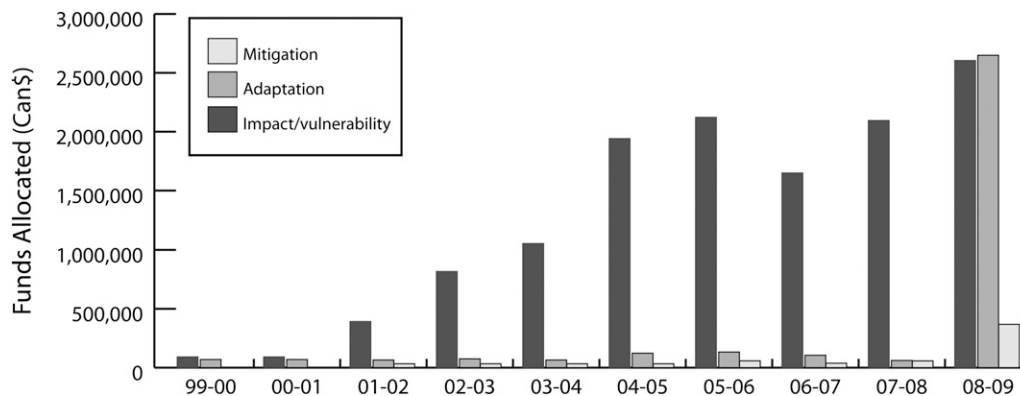
### Funding Priorities of Granting Councils and Federal Departments

Approximately half of funding for climate change and health research over the observation period came from the federal granting councils: the Networks of Centres of Excellence contributed 41% via the ArcticNet program, the Canadian Institutes of Health Research 36%, and the International Polar Year (a multiyear program supporting scientific research in Arctic regions and administered

through the granting councils) 21% (see Appendix F, available as a supplement to the online version of this article at <http://www.ajph.org>). The Social Sciences and Humanities Research Council of Canada was only marginally involved, providing 0.01% of funds.

The first projects on climate change and health funded by the granting councils were initiated in 2002–2003. Federal departments supported the most projects (78%) over the observation period (1999–2000 to 2008–2009), but these projects were generally smaller, shorter, and geographically broader than were those funded by granting councils. All projects supported by federal departments from 1999–2000 to 2002–2003 were funded by NRCan's CCIAP. Thereafter, health departments (Public Health Agency of Canada, Health Canada) became important sources of funding, and later still, departments less related to health (e.g., INAC) contributed. The funds allocated by federal departments, especially in recent years, indicated a preference for community-led initiatives focused on identifying local vulnerability, building community capacity, and identifying adaptations.

The majority of projects (76 projects, or 72%) and funding (Can\$13 million, or 81% of the total) focused on identifying and characterizing the nature of climate change effects on health and the vulnerability of health systems, for which granting councils provided the majority of funding and health departments supported the most projects (Figure 3).



Note. Date ranges connote fiscal years, spanning from March 31st of one year to March 31st of the next year.

**FIGURE 3—Focus of Canadian federally supported research on climate change and health over time, 1999–2000 and 2008–2009.**

These projects, particularly those funded by granting councils, involved large multiyear grants. Thirty-one percent of projects (Can\$3.5 million) developed or assessed new measures or assessed existing measures that aimed to reduce or moderate the negative effects of climate change, with 9% focusing on mitigation.

The granting councils were only marginally involved in funding adaptation research, supporting 1 project: a Can\$10 000 grant from the Canadian Institutes of Health Research during 2002–2003. Adaptation research was primarily funded by federal departments and typically involved small- to medium-sized projects (<Can\$150 000 annually). The majority of adaptation projects (78%) were initiated in 2008–2009 (Figure 1) and funded predominantly from Health Canada's Climate Change and Health Adaptation in Northern First Nations and Inuit Communities program and INAC's ANAV program.

### Funding for Arctic and Other Vulnerable Populations

Research focusing on the Arctic region accounted for more than one third of projects and two thirds of funds allocated (Can\$10 million). Approximately half of Arctic projects and 73% of funds focused on Inuit populations. This concentration of support on the Arctic in general and Inuit populations in particular originated in the granting councils, who invested the most in Arctic research (73% of the total) and funded major Arctic initiatives through multiyear, ongoing research programs, such as the Nasivvik Centre for Inuit Health

and Changing Environments, International Polar Year (2007–2011), and ArcticNet (created in 2004). The majority of projects, however, were supported by federal departments—particularly from INAC and Health Canada—with the Arctic a more recent focus: 80% of Arctic projects supported by federal departments were initiated in 2008–2009.

Other vulnerable populations were neglected in federally funded research. Only 1 project, a meeting, specifically focused on child health, and it received only 0.07% of funds allocated. Three projects (all funded in 2008–2009 and accounting for 1% of funds) focused on women's health in a changing climate; 2 of these studied Inuit women in the Arctic territory of Nunavut, and 1 was a meeting. Seven projects, accounting for 5% of total funded research, pertained to the vulnerability of elderly populations, mostly in the context of heat stress in urban areas. The majority of studies focusing on the elderly were conducted between 1999–2000 and 2004–2005 (71%) with funding provided through NRCan's CCIAP. Three projects (totaling Can\$449 889) focused on non-Arctic Aboriginal populations, all supported through INAC's ANAV program. One small project examined the efficacy of heat advisories among low-income populations.

### Variety of Health Risks in Climate Change Research

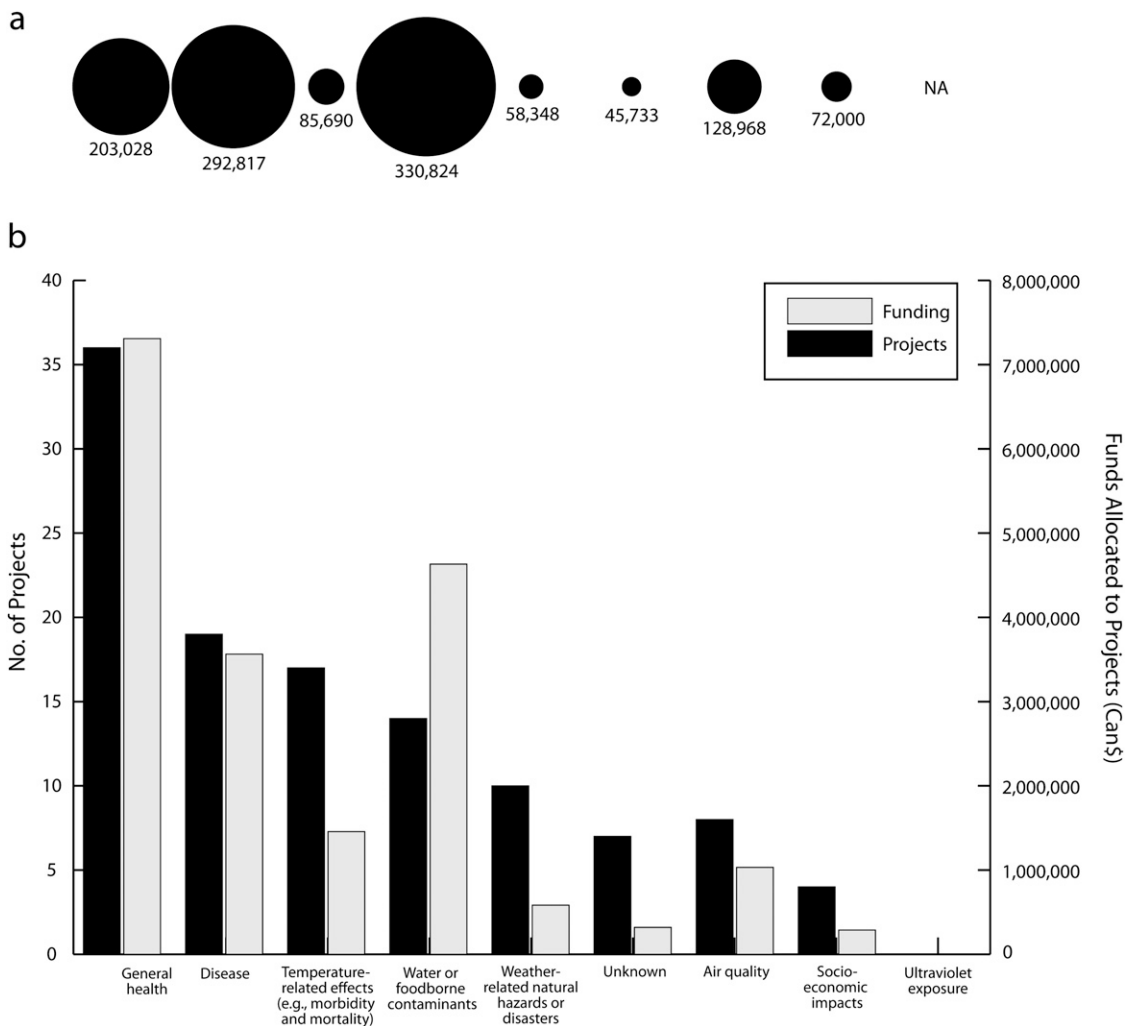
Research on a combination of mental, physical, cultural, emotional, and spiritual health effects of climate change was the focus of 34% of projects and received 46% of funds

(Figure 4). A significant number of these projects were established in 2008–2009 under INAC's ANAV program and Health Canada's Climate Change and Health Adaptation in Northern First Nations and Inuit Communities program and focused on community-level adaptation.

Other studies examined the implications of climate change for vector-borne and zoonotic disease, specifically disease modeling and baseline prevalence estimation. The majority of funding for these projects came from the granting councils, which supported multiyear initiatives; several large projects had an Arctic focus. Federal departments supported the most disease studies, which typically received small- to medium-sized grants from the Public Health Agency of Canada (8 of 11 projects). Lyme disease and West Nile virus received particular attention. Projects focusing on water- or foodborne contaminants received the most support per project (Can\$330 824), represented 12% of projects and 29% of funds allocated, and studied impacts and vulnerability. Disease research focused on Arctic populations in 79% of projects, accounting for 83% of funds in this category.

### ADEQUACY OF FEDERAL SUPPORT

The risks to health posed by climate change are significant and have not been matched by the federal response. Canada's investment of Can\$16 million in 105 projects focusing on climate change and health over the past decade—an average of Can\$1.6 million and 10



Note. NA = not available. Date ranges connote fiscal years, spanning from March 31st of one year to March 31st of the next year.

**FIGURE 4—Health impacts being investigated by Canadian federally supported climate change and health research by (a) average project size (\$CDN) and (b) number of projects and funds allocated, 1999–2000 and 2008–2009.**

projects per year—was only a fraction of other federal expenditures and was insufficient for a problem of such magnitude and complexity. Comparing health funds with other federal climate change initiatives is particularly revealing. Between 2007 and 2009, for instance, Can\$3 billion was allocated to research on carbon capture and storage.<sup>19</sup> These investments will have economic spin-offs but will not affect the magnitude of climate change in the short to medium term. Conversely, the health effects of climate change have already been documented in Canada, vulnerable populations (e.g., elderly, immigrant, and Aboriginal populations) are growing, and

research and intervention needs have been identified.<sup>1,2,9,20</sup>

The limited funding of climate change and health research appears to be attributable to the priorities of successive governments, Liberal and Conservative, which have consistently favored mitigation in parliamentary debates and policy. It may also be attributable to a common perception among policymakers and Canadians generally that Canada has limited vulnerability to climate change because of its well-developed health care system and high per-capita income,<sup>5</sup> and the extent to which many health professionals view climate change as a risk for Canada

remains unclear.<sup>21,22</sup> These factors are likely to make efforts to increase support for climate change and health studies challenging.

### Canada's Obligations

Canada has made progress in meeting its obligation to address climate change. It ratified commitments under the United Nations Framework Convention on Climate Change to prepare for climate change and assess risks,<sup>23</sup> federal departments are charged with protecting the health and well-being of Canadians, and the granting councils are mandated to support university-based fundamental scientific research.

Identifying and studying vulnerable populations is a key aspect of these obligations. Research on child health, for example, is lacking despite the significant risks posed.<sup>24,25</sup> And although Arctic research is well supported, vulnerable groups elsewhere have been neglected. Few projects focus on Aboriginal populations outside the Arctic, despite the expectation that these groups will be particularly susceptible to climate change.<sup>5</sup> Similarly, only a small number of projects are examining gendered dimensions to the health effects of climate change in Canada or whether low-income populations will experience differential vulnerability to such effects. The granting councils, in particular, have yet to fund projects focusing on vulnerable populations outside the Arctic region.

Progress is being made, however. Over the observation period, the number of projects supported and the funding allocated increased. Several large multiyear programs have been developed, and 2008-2009 signaled a major expansion of research activity.

### Support for Scientifically Identified Research Priorities

Significant progress has been made toward supporting climate change and health research in the Arctic region, where the effects of climate change are most pronounced and populations are at highest risk.<sup>9,20,26</sup> Commensurate with the risks posed and the expense of working in the North, Arctic research typically involves large, long-term investments, with a focus on fundamental research (from granting councils) and community-specific initiatives (from federal departments). Research on adaptation is also a key aspect of Arctic projects, which is important in light of effects already documented.<sup>20,27-30</sup> However, funding provided through the International Polar Year will end in 2011, as this initiative winds down. Furthermore, the wide geographic scope of Arctic research and research on adaptation is largely a function of 2 departmental programs, which, like all department-funded studies, are subject to significant political influence and are not guaranteed to continue past 2011.

Outside the Arctic, however, we found gaps caused by the nature of funding agencies and processes that are sometimes insufficiently responsive to scientific identification of

research needs. Only a limited number of funded projects seek to develop or assess new measures or evaluate existing measures that aim to reduce or moderate the negative effects of climate change, although funders made a major investment in adaptation research in 2008-2009. Although baseline research on impacts and vulnerability is needed to guide policy intervention, enough is known to begin developing interventions.<sup>3,27,31-35</sup> In particular, granting councils should support research on adaptation, which will be unavoidable if the health risks of climate change are to be managed.<sup>32-34,36,37</sup>

The volatility of research support from federal departments suggests political influence. This relationship has been beneficial in stimulating a burst of funding for research on vulnerable Arctic populations arising from the government's interest in northern issues and Arctic sovereignty.<sup>38</sup> The overall effect of political influence is more complicated. Departmentally funded research plays an important role in understanding and preparing for climate change, especially in supporting adaptation studies and community initiatives, which the granting councils are less likely to fund. The number of Canadians concerned about climate change appears to be declining,<sup>39</sup> and it remains to be seen how research support will be affected by political capital made from "climate-gate," when leaked e-mail messages from the University of East Anglia's Climate Research Unit were interpreted by climate skeptics as an indication of malpractice within the scientific community (allegations that were independently refuted).

### STRATEGIES

Federal support for climate change and health research is improving, but not by enough to address the magnitude of the problem. Research funding has been volatile because of political influences and an absence of long-term strategic planning. New projects have been created rapidly, and others have abruptly ceased to exist. Combined with increasing recognition of the risks posed by climate change, a federal strategy to address the human health dimensions of climate change impacts and adaptation is clearly needed.<sup>1,2,36,40-43</sup> Such a strategy must recognize the varied and diverse

risks and responses to the health effects of climate change.<sup>44</sup> This strategy should:

- Identify research priorities regarding specific populations, regions, and types of studies;
- Determine which agencies and departments will provide climate change and health research funding and what types of support they will provide (e.g., project size, research focus);
- Coordinate the contributions of each funding entity to researching the health dimensions of climate change; and
- Allocate budgets for research in the context of projected total funding, and specify the size of projects to be supported and specific programs through which research will be supported.

The granting councils have supported fundamental scientific research on the health effects of climate change. They have funded a few large, long-term initiatives that have been effective for knowledge creation and for targeting highly vulnerable populations and that offer a model for addressing neglected aspects of climate change and health. Funds committed, however, have been insignificant. Research on climate change and health should play a more central role in granting council allocations, possibly through the creation of special funds to study and mitigate the serious risks posed by climate change.<sup>1,2,45</sup>

Social scientists should also have a more active role in health research because their contributions are essential for understanding how social, economic, and cultural factors affect health system vulnerability and for examining how institutions can more effectively manage change.<sup>46-51</sup> Unfortunately, a recent decision (which we believe was a mistake) brought all health projects—including social science projects previously funded by the Social Sciences and Humanities Research Council of Canada—under the mandate of the Canadian Institutes of Health Research, which focuses on health sciences. Finally, the granting councils need to consider the broader health dimensions of climate change, such as adaptation as a response to climate change, effects on non-Arctic vulnerable populations, and effects on vulnerable regions (e.g., coastal zones).

Federal departments have funded diverse small- to medium-sized projects across Canada. The strong focus on adaptation and community involvement developed in 2008-2009 is welcome, but it is unclear whether this is part of a long-term shift or is a temporary political response. Two important research programs, which have funded the majority of adaptation research, are under review. Moreover, the research funds invested in climate change and health by federal departments are insignificant compared with investments in studies of other environmental health risks, such as contaminants, ultraviolet light exposure, and air pollution. Yet climate change is a major risk, perhaps one of the greatest threats to health in this century, with implications for multiple health outcomes and for health planning and provision. The federal government has jurisdiction to respond to this challenge, and its long-term strategic planning needs to recognize the magnitude of the problem and allocate funds and resources accordingly.

Climate change is not the first environmental issue to threaten the health of Canadians or the only emerging risk. Climate change planning can draw from the lessons of federal initiatives such as the Northern Contaminants Program<sup>52</sup> and the relatively successful emergency preparedness efforts mounted against severe acute respiratory syndrome. ■

### About the Authors

The authors are with the Department of Geography, McGill University, Montreal, Quebec.

Correspondence should be sent to James D. Ford, Dept of Geography, McGill University, 805 Sherbrooke St W, Montreal, Quebec, Canada H3A 2K6 (e-mail: james.ford@mcgill.ca). Reprints can be ordered at <http://www.ajph.org> by clicking the "Reprints/Eprints" link.

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### Contributors

J.D. Ford designed the project and analyzed and interpreted the findings. T.R. Smith collected the data. L. Berrang-Ford helped analyze and interpret the data.

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### Human Participant Protection

No protocol approval was required for this study because no human participants were involved.

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