Surveillance Data: Covering All the Bases

To detect and effectively assess the health impacts of climate change and climate variability, it is important to recognize the various ways by which climate can affect health (e.g., direct stress from temperature extremes, impacts of poor air quality episodes, more favourable conditions for waterborne and vector-borne diseases). Timely, accurate and reliable health surveillance data are key to detecting changes in disease patterns over time and between different populations, including changes that may result from the combined ecological and societal impacts of climate change. A key public health challenge is to understand the causes of these disease patterns and then to implement programs that reduce the burden of illness.

Comprehensive Disease Tracking Systems

Effective disease surveillance requires a variety of activities and the involvement of health authorities at all levels. As Figure 1 illustrates, local, provincial and federal health departments are all active participants in surveillance. Each maintains registries of health data on certain diseases, infections, hospitalizations and injuries, while the World Health Organization (WHO) monitors similar data at a global level.
Local Communities Play a Role

Local communities may also contribute helpful information often not captured by health surveillance activities alone. Sources such as these are especially important when studying the impacts of weather and climate on health. For example, First Nations elders may contribute pertinent observations on changes taking place in their communities and environments.\(^4\) Farmers may understand the significance of weather patterns and can provide useful insights regarding health impacts. Similarly, hunters and fishers may observe changes in the health of wildlife that represent a human health risk.\(^5\)

Linking Weather to Health

For specific information on health risks associated with climate and weather, public health professionals depend on research findings about the links between health outcomes and various health determinants, including climate and weather. Canadian researchers are increasingly active in this area and use meteorological records, climate models and data on many environmental and social health determinants to understand how some health problems may be vulnerable to changes in weather and, eventually, to the impacts of climate change. The following study, funded by Health Canada’s Health Policy Research Program, found that heavy rainfall was linked to increased risk of waterborne disease.

Heavy Rain and Waterborne Disease

The Public Health Agency of Canada (PHAC) collaborated with the University of Guelph and Environment Canada on an analysis of historical outbreaks of disease linked to a source of drinking water. Preliminary findings indicate that warmer temperatures and very heavy rainfall tend to increase the risk of disease outbreaks within a six-week period.\(^6\) As shown in Figure 2, only the heaviest rainfall periods contributed to increased risk of waterborne disease. Warmer temperatures also contributed to an increased outbreak risk.

The findings suggest that warmer temperatures and extreme rainfall are contributing factors to waterborne disease outbreaks in Canada. Given that warmer temperatures and more extreme precipitation are projected under many climate change scenarios, decision makers...
and planners should consider watershed protection measures and increasing safety barriers to protect drinking water from extreme rainfall.

**Modelling the Health Impacts of Climate Change**

Knowing how certain health problems are influenced by weather is vital. However, it is also important to use this knowledge to anticipate and predict future health risks posed by a changing climate. As the following study demonstrates, new disease modelling techniques that project the impacts of climate change on Canadian health issues are becoming valued public health tools.

**Mapping the Spread of Vector-Borne Diseases**

The geographic range of many vector-borne diseases is limited by climate conditions.\(^7\)\(^-\)\(^10\) A case in point is Lyme disease, which is caused by a bacterial infection transmitted by black-legged ticks in certain regions of Canada. Research funded by the Climate Change Action Fund of the Government of Canada has shown that vector tick distribution east of the Rockies is confined by climate and habitat. However, a changing climate could extend the tick’s range, thereby exposing more Canadians to Lyme disease.

Lyme disease infects about 20,000 people a year in the United States.\(^11\) Fewer than 50 cases are diagnosed annually by laboratory in Canada,\(^*\) but many more are treated for Lyme disease based on symptoms and history alone. Lyme disease ecology differs from region to region across Canada. The current northern limit of the vector tick *Ixodes scapularis* is southern Ontario, with a few isolated tick populations on the shores of Lakes Erie and Ontario, and one population on the south coast of Nova Scotia.\(^12\) The western black-legged tick, *Ix. Pacificus*, is found throughout British Columbia,\(^13\) but because this tick prefers reptilian hosts that do not harbour the Lyme disease bacteria, the disease is not as easily spread to humans.

Due to projected climate change, a northward shift in range is expected for many arthropods such as ticks.\(^14\),\(^15\) Figure 3 illustrates the northward shift in range expected for *Ix. scapularis*. Established populations and present-day limits of the tick’s geographic range (using 1971–2000 data) are shown, along with projected future geographic ranges of temperature conditions suitable for the tick to become established.

If the range of *Ix. scapularis* expands northward, it will extend into parts of southeastern Canada that are densely populated, with consequent risks for public health. Such an expansion is considered likely in the face of climate change for the following reasons:

- Some areas of the United States most severely affected by Lyme disease border on Québec, Ontario and the Maritimes. Migrating birds carry infected ticks into Canada from these areas.
- These same areas in southeastern Canada already provide a habitat for mice and white-tailed deer.

\(^*\)Approximately half of the cases diagnosed by laboratory are linked to travel to areas outside of Canada where Lyme disease is very common.
which are animal hosts to *Ixodes* ticks. The ticks are also able to survive in these areas when off their animal hosts.

- At the northern edge of its range, *Ix. scapularis* survival is closely controlled by temperature.\(^{10,12}\)

**Short- and Long-Term Health Challenges**

Climate variability and change have impacts on a broad spectrum of health determinants and, consequently, far-reaching impacts on society. For this reason, public health professionals and health care providers will need to be alert to the indirect as well as the direct impacts of climate change. For example, while warmer and drier summer conditions in the Canadian Prairies might not result in an increased number of heat-related deaths, attention must be paid to the more subtle and long-term health effects of drought. Drinking water supplies may be threatened. Crop failure and loss of farmland from soil salinity may have enormous economic implications for farm families and rural communities, with repercussions on overall nutrition, child health and mental health. This, in turn, may result in an increasing incidence of suicide and family violence, injuries and chronic diseases.

**Moving Forward**

Climate change poses complex short- and long-term public health challenges. It requires that health professionals from all disciplines take a broader, more systemic view of the possible linkages and trends between health determinants and health outcomes, as well as the linkages between human health and the health of our natural and built environments. The diverse pathways through which climate change affects health underscores how human health and well-being are intricately linked to the health of the ecosystems in which we live.

Evidence shows that human activity has contributed to climate change and that changes in weather patterns and reduced predictability of weather are having health impacts. Public health professionals and health care providers play an important role in providing evidence about these impacts and in helping reduce the health impacts of climate change.

In Canada, disease surveillance has moved from the traditional work of recording past events to a more active, anticipatory activity designed to identify health threats as early as possible. To be effective, such an approach requires a collaborative effort among health professionals and their allies at all levels of government, as well as internationally. Currently, the Public Health Agency of Canada (PHAC) is working with provincial and territorial ministries and agencies to conduct health surveillance. PHAC is also leading important research on how climate change may affect Canadians’ risk of infectious diseases. Together with Health Canada, the Agency is fostering partnerships with other federal departments to determine the impacts of climate change on the broader determinants of health and to better identify the risks posed by climate change.

@ Click here for references.

**Myth?**

Climate change may cause malaria to re-emerge in Canada.

**True**

There is considerable uncertainty about how climate change will affect the vector life cycle and disease incidence of malaria in North America. Climate change is only one of a number of factors that can affect the spread of malaria; increased travel and immigration, and increased drug resistance are some of the other causes. People infected with malaria who are exposed to North American mosquitoes capable of transmitting the *Plasmodium* parasite can cause local outbreaks.\(^5\) As well, new insect vectors introduced to North America from other countries and capable of spreading the parasite may extend their range to Canada if climatic conditions become more favourable. However, Canada’s public health infrastructure minimizes the threat of disease spreading beyond a local outbreak.
References

References for Signs of Change, Signs of Trouble: Finding the Evidence (p. 27)


References for Extreme Weather Events: Facing the Challenges in Health Emergency Management (p. 31)


6. Public Health Agency of Canada, Office of the Voluntary Sector, voluntary sector definition. Retrieved May 2, 2005, from: <http://www.phac-aspc.gc.ca/vs-sb/voluntarysector/index.html>. The voluntary sector consists of private, non-profit organizations, devoted to the public good, whose activities are carried out by volunteers and paid staff, and whose existence depends on the engagement of citizens to donate their time, knowledge, skills, energy and resources to assist fellow citizens. Voluntary sector organizations are involved in activities designed to provide help to individuals, families, groups and communities.


References for Planning Our Future: Reducing the Health Impacts of Climate Change (p. 35)


6. Statistics Canada. (1997, 2000). *Canada Survey of Giving, Volunteering and Participating*. Ottawa, ON: Author. Retrieved from <http://www.phac-aspc.gc.ca/vs-sb/voluntarysector/index.html>. The voluntary sector consists of private, non-profit organizations, devoted to the public good, whose activities are carried out by volunteers and paid staff, and whose existence depends on the engagement of citizens to donate their time, knowledge, skills, energy and resources to assist fellow citizens. Voluntary sector organizations are involved in activities designed to provide help to individuals, families, groups and communities.


