

Climate Change and Health Impacts

Overview

"To a large extent, public health depends on safe drinking water, sufficient food, secure shelter, and good social conditions. All these factors can be affected by climate change." World Health Organization (2001)¹

Climate change will affect human health in a whole range of ways, some of them direct and some indirect. Although Canada will be better able than poorer countries to cope with and adapt to these health problems, our already overburdened health care system will be stretched even further. As individuals, we will undoubtedly experience negative effects on our health and well-being as a result of climate change. Canadians who are already vulnerable (young children, the elderly, and others like athletes who spend a great deal of time outdoors) will be most affected and most at risk. Health professionals are also concerned that, in addition to exacerbating current health problems, climate change could also bring new, unexpected challenges.

Climate change will likely affect human health by increasing the incidence of:

1. Heat stress
2. Respiratory diseases (from increased air pollution)
3. Vector borne diseases
4. Food and water borne diseases
5. Direct injuries and deaths in severe weather events
6. Diseases related to stress, malnutrition and poor sanitation

Scientists now report¹ a high or very high level of confidence that climate change will:

- Increase malnutrition
- Increase deaths, injuries and disease from extreme weather events
- Increase cardio-respiratory disease related to air pollution (especially ground level ozone)
- Change the ranges of infectious disease vectors
- Change the range and season of malaria transmission

Heat Stress

When the environment is hot or humid your body must work harder to get rid of its heat. Working or playing where it is hot puts stress on your body's cooling system. When heat is combined with other stresses such as hard physical work or exercise, loss of fluids, fatigue or some medical conditions, it may lead to heat stress - a term covering heat-cramps, fainting, heat exhaustion and heat stroke. Everyone is susceptible to heat stress, even the young and fit. Heat stress can ultimately lead to death.

Climate change is expected to lead to more frequent and more intense heat waves, resulting in more people being hospitalized and dying from heat stress and its

¹ World Health Organization. 2001. Climate and Health. Fact Sheet No. 266. Available online at: <http://www.who.int/mediacentre/factsheets/fs266/en/>

complications. Children, the elderly and those with cardiac and respiratory disease are most at risk.

Those living in urban areas will be particularly affected by heat waves, because of higher levels of air pollution and the 'heat island effect' (see box below). Heat waves are particularly serious when nighttime temperatures do not drop enough to provide relief (cooler temperatures at night help our bodies deal with higher daytime temperatures).

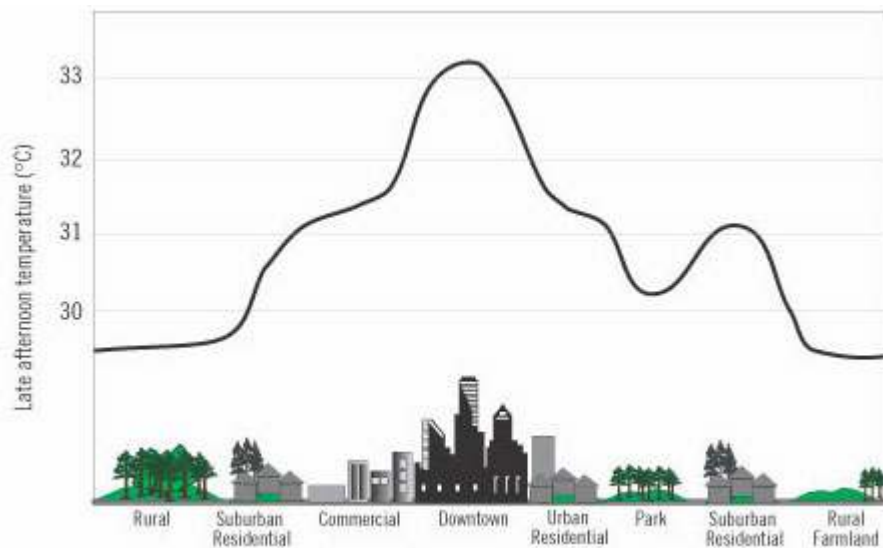
Athletes have to be particularly careful when they are training at high temperatures and high humidity. Working muscles generate 10-20 times the amount of heat as resting muscles, and during training blood are directed to the muscles (rather than the skin where it can aid cooling).² This can lead to dangerous increases in core body temperature. Athletes training at high temperatures are also vulnerable to dehydration.

Some Examples:

- A study released by Toronto Public Health in 2005 concluded that extreme heat killed an average of 120 people a year in Toronto, 121 in Montreal, 41 in Ottawa and 37 in Windsor (based on data from 1954-2000). The study predicted that heat-related deaths will double by 2050 and triple by 2080 because of global warming.³
- In the summer of 2003 an intense and prolonged heat wave affected all of Europe, causing 22 000 - 35 000 deaths. Drought, fire and decreased water availability compounded the impacts of the heat wave on people, crops and forests. Particulates from fires exacerbated air pollution.⁴
- In 2003, a severe heat wave in Andhra Pradesh, India caused over 3 000 deaths.⁵
- Heat already kills more people in the United States than all other weather-related causes combined.⁶
- In July 1995 a heat wave in Chicago, which was characterized by high humidity and high nighttime temperatures, caused over 500 deaths.⁵

The heat island effect

The heat island effect, where urban areas are hotter than the surrounding suburban and rural areas, occurs because asphalt, concrete, rooftops and other manufactured materials have largely replaced natural vegetation. These artificial materials store much of the sun's energy and remain hot long after sunset. The stored heat energy is slowly released into the air keeping cities warmer than rural areas at night. Tall buildings also block heat from escaping and further slow the cooling process.



Source: Government of Canada. 2004. *Climate Change Impacts and Adaptation: A Canadian Perspective*, p.157. Available online at: http://adaptation.nrcan.gc.ca/links_e.php

Respiratory Diseases

Respiratory diseases will increase due to the reinforcing effects of climate change on air pollution. Warmer temperatures will enhance the reaction that produces ground-level ozone, particularly in urban and industrialized areas. Prolonged heat waves will lead to more intense and frequent smog episodes. A vicious cycle may ensue if people stay inside and crank up their air conditioning, further increasing consumption of fossil fuels and emissions of GHG and pollutants. This will compound health problems for those who are vulnerable (children, elderly, athletes and those with pre-existing respiratory and cardiac disease).

In fact, lung related illnesses such as asthma and bronchitis are reaching epidemic proportions in Canada and other developed countries. Today, asthma is the leading cause of absenteeism in children in Canada and its rates of occurrence in children have risen by over 400% since the late 1980s. Many top-level athletes suffer from lung diseases that are exacerbated by air pollution and smog so much so that the term 'sport induced asthma' was coined decades ago. In fact, scientists now know that ground level ozone and other air pollutants can actually cause asthma – this defies a long held medical belief that asthma was a genetic anomaly.

Furthermore, elevated levels of CO₂ stimulate pollen production (plants produce more pollen, and produce it earlier in the season) and fungal growth, both of which aggravate allergy-related respiratory diseases.

For more information on air pollution and its effects on health, see Backgrounder 'Air Pollution, Smog and Health Impacts'.

Vector Borne Diseases

We may like warmer temperatures – but so do mosquitoes, ticks and other organisms ('vectors') that carry disease. Higher temperatures (including warmer winters) will allow disease-carrying vectors to expand their ranges to higher latitudes and higher elevations (e.g. cold temperatures currently keep mosquito populations in check).

Unusual weather patterns can also provide favourable conditions for vectors to breed, allowing localized population explosions (e.g. flooding could increase breeding areas for mosquitoes by creating more shallow pools of warm stagnant water). Warm winters, spring droughts and summer heatwaves have been shown to favour the West Nile virus.

Examples

- The northward spread of West Nile virus (carried by mosquitoes), and Lyme disease and encephalitis (carried by ticks) may be attributable, in part, to climate change.²
- Unusual heavy rains in the Wajir district of Kenya in 1998 triggered a local malaria epidemic. This was especially serious because malaria is not common in this area (it is usually too dry for mosquitoes). The local population lacked immunity to the disease and the health authorities were unprepared for a major malaria epidemic.¹

Water and Food Borne Diseases

Warmer temperatures, warmer water, and changing patterns of rainfall will provide favourable conditions for various bacteria and other disease-causing micro-organisms (e.g. giardia, cryptosporidium, toxoplasmosis). In addition, heavy rainfall and flooding associated with severe weather events can flush bacteria, sewage and toxins into the water supply system. Overcrowding and poor sanitation, which often result when people are displaced from their homes, will favour the spread of infectious diseases such as cholera. Red tides (blooms of toxic algae that cause paralytic shellfish poisoning) are expected to become more common as ocean temperatures rise. Warmer temperatures will allow food pathogens to multiply more quickly, increasing the risk of food poisoning (e.g. salmonella and botulism).

Examples

- In Walkerton, expert witnesses testified that the outbreak of *E.coli*, which resulted in seven deaths and thousands of illnesses, could be partly attributed to an unusually heavy rainfall event, which followed a period of drought.²
- *Cryptosporidium* outbreaks in Collingwood, Ontario (1996) and *Toxoplasma* contamination of the water supply in the greater Victoria area, British Columbia (1995) are at least partly due to changes in climatic conditions.²

Extreme Weather Events

Extreme weather events (e.g. tornadoes, floods, hurricanes) can kill and injure people directly and indirectly, through contaminated water and food and the spread of infectious disease. Psychological and emotional stress (from loss of loved ones, homes, and jobs, uncertainty about the future, overcrowding) further contributes to health problems. Scientists expect that global warming will lead to more severe, extreme weather, such as bigger, more powerful hurricanes, with heavier rainfall, higher winds

and larger storm surges. Some parts of Canada will probably be hit more often by large tornadoes, such as the one that devastated Pine Lake, Alberta.

Examples

- In 1999, a cyclone in Orissa, India killed 10 000 people. 10-15 million people were directly affected by the cyclone.¹
- In 1998, China experienced its worst flooding in 50 years. 180 million people were affected; close to 4 000 people were killed and nearly 7 million homes were totally destroyed.¹ In 2003, 130 million people were affected by flooding in China.⁷
- In 1998, Hurricane Mitch caused over 7 500 deaths in Honduras, Guatemala, Nicaragua and El Salvador. Half the population was evacuated; in Honduras, 75% of the population was left without clean water. There were outbreaks of cholera and other infectious diseases (due to contaminated water supplies).¹
- In 2000, Mozambique experienced 3 tropical storms in 6 weeks – killing 500, leaving 330 000 homeless and resulting in a 4-5 fold increase in malaria, as well as increases in cholera and other gastrointestinal illnesses.^{1,5}
- In the massive ice storm that affected parts of Ontario, Quebec and New Brunswick in 1998, over 600 000 were evacuated, 28 people died, 945 were injured and damage amounted to over \$5.4 billion.²
- The World Meteorological Organization reported 4 major monsoons in 2007 – twice the normal number – that caused heavy floods in India, Pakistan and Bangladesh, killing more than 500 people, displacing over 10 million others and destroying vast areas of croplands, livestock and property.⁸ One woman describes how her village was completely underwater for 15 days: “Everywhere you look all you can see is mud, we are always in the mud. All our toilets are underwater so the mud and water is contaminated... our children are playing and bathing in this water.”
<http://www.ifrc.org/Docs/News/07/07082701/index.asp>.

Food Supply

Heat waves, drought and flooding may affect local and national food supplies. Food production may be further undermined by changes in the distribution and abundance of pests, and plant and animal pathogens. Changes in ocean currents will likely affect the distribution and abundance of fish. Displacement resulting from severe weather events can also disrupt food production. Local declines in food production may lead to malnutrition, which will further compromise health, especially for children.

Sources and Useful Links

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³ Toronto Public Health. 2005. Backgrounder: Combined effect of extreme heat and air pollution on mortality. Available online at: http://www.toronto.ca/health/hphe/pdf/backgrounder_smogheat.pdf

⁴ Epstein, Paul R. and Christine Rogers. 2004. The Impacts of CO₂ and Climate Change in the Inner City. The Center for Health and the Global Environment, Harvard Medical School. Available online at: <http://chge.med.harvard.edu/publications/>

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