

Exploring Health and Social Impacts of Climate Change in Toronto

Date:	October 21, 2013
To:	Board of Health
From:	Medical Officer of Health
Wards:	All
Reference Number:	

SUMMARY

Over the coming decades, climate change in Toronto is expected to be characterized by more extreme weather events including extreme heat and severe rainstorms. This report provides an overview of potential health impacts identified in the published research including: more illness and death from extreme heat, poor air quality, and vector-borne disease; more injury and illness arising from flooding of homes and businesses; and impacts on mental health. Increases in extreme weather could also have significant impacts on factors that indirectly affect health including food security, social networks, employment status, quality of housing, income and costs of recovery, and access to core services including electricity, transportation, and telecommunications.

Information specific to Toronto about the current burden of illness from climate-related health impacts is varied. No systematic evaluation has been completed to estimate how climate change might alter these risks and their health impact, characterize the numbers and characteristics of vulnerable people and places for the combination of these risks, or consider the resulting demand on public health and health care services.

A comprehensive assessment of Toronto's vulnerability to health and social impacts of climate change is needed to support efficient, effective service delivery and protection of health in a changed climate. With the appropriate information and partnerships in place, TPH will be able to identify opportunities for strengthening the resilience of Toronto's population, especially the most vulnerable groups.

RECOMMENDATIONS

The Medical Officer of Health recommends that:

1. The Medical Officer of Health, in consultation with the Director of the Environment & Energy Division, Office of the Chief Corporate Officer, carry out a climate and health vulnerability assessment for the City of Toronto;
2. The Board of Health forward this report to the Parks and Environment Committee to be considered at the meeting of December 6 together with the report from the Chief Corporate Officer on adaptation activities and capital plans across the City of Toronto;
3. The Board of Health forward this report to City Council to be considered at their meeting of December 16-17 in combination with the report from the Chief Corporate Officer on adaptation activities and capital plans across the City of Toronto.

Financial Impact

There are no financial implications arising from the adoption of this report.

DECISION HISTORY

On February 20, 2013, Toronto City Council considered the report *Toronto's Future Climate: Study Outcomes*, which predicts significant increases in extreme heat and severe rainstorms in Toronto by 2049. As a result of the findings, City Council requested that several City Divisions and agencies including Toronto Public Health participate in a working group to review the impacts on the City and its residents of an increasingly wet and volatile climate, and identify key adaptations in their plans relating to core services and what their capital plans will be moving forward. City Council also requested that the Board of Health review the findings, and report on the social and health impacts as a result of increased climate change and extreme weather conditions (<http://app.toronto.ca/tmmis/viewAgendaItemHistory.do?item=2013.PE18.2>).

ISSUE BACKGROUND

Climate change can be thought of as a lasting change in weather patterns. The types of changes expected in Ontario include gradual changes such overall warming as well as an increase in unpredictable, extreme weather events including heat events and rainstorms.

The City's climate modelling suggests that by 2049, Toronto could experience more frequent severe rainstorms, and more than triple the number of days with temperatures exceeding 30°C (See Table 1). According to the research, the average annual temperature could increase by 4.4°C by 2049.

Table 1: Expected Climate changes for Toronto by 2049 (See <http://app.toronto.ca/tmmis/viewAgendaItemHistory.do?item=2013.PE18.2>)

Weather Extreme	Description	Historical (2000-2009)	Future (2040-2049)
Extreme Rain	Most rain likely in one day	66 mm	166 mm
	Average of annual daily maximum rainfalls	48 mm	86 mm
Extreme Heat	Extreme Daily Maximum temperature	37°C	44°C
	Number of Days with temperatures higher than 30°C	20	66
	Number of heat events with 3 consecutive days with temperatures greater than 32°C	0.57	2.53

The updated heat predictions are in line with earlier predictions from a number of agencies. In 2005, Toronto Public Health (TPH) estimated that the number of heat alert days in the City could quadruple by 2080¹. Environment Canada suggests that the number of days with temperatures of 30°C or more in Toronto could increase from about 15 days per year between 1961-1990 to 54 days per year by 2080-2100². In 2011, the Ontario Ministry of the Environment reported that the average annual temperature in Ontario increased by up to 1.4°C between 1948 and 2008, and could increase by up to 3.7°C by 2050³.

Toronto may already be experiencing more extreme rain events. The recent IPCC report⁴ concluded that the frequency or intensity of heavy precipitation events has likely increased in North America, and the Ontario Ministry of the Environment recently noted that Ontario has experienced an increased number of significant urban flood events over the past several years³. On July 8, 2013, a record-breaking 140 mm of rain fell in some parts of western Toronto, causing extensive flooding.

Toronto may also experience other types of extreme weather more often in the future. A 2009 expert panel on climate change adaptation in Ontario concluded that in general, extreme weather events including rain, snow, drought, heat waves, wind and ice storms are likely to increase, and noted that weather is also likely to be more variable and less predictable from one year to the next⁵.

To help prepare the City for these changes, the Environment and Energy Division created and now co-ordinates the Resilient City Working Group. Through this Working Group, 16 City Divisions, agencies, corporations (including TPH), and Metrolinx provided information about how extreme heat and extreme rain could impact City infrastructure and services. Members reviewed their operations and responsibilities to assess risks associated with current and future extreme heat and extreme rain scenarios, identify regulations and Committee directives governing their operations, and outline current operations and resource levels. Members also provided information about their interdependencies with other City infrastructure and services and outlined any planned or existing efforts to prepare for and prevent extreme weather-related impacts. This information from the Resilient City Working Groups will be collated and summarized by the Environment and Energy Division in a report from the Chief Corporate Officer to Parks and Environment Committee on December 6, 2013.

COMMENTS

Reviews by agencies including Health Canada⁶, Natural Resources Canada⁷, a U.S. Federal advisory committee⁸, and the Ontario Ministry of the Environment³ consistently outline the following potential health impacts from climate change:

- increased heat-related illness and mortality
- degraded air quality leading to respiratory and cardiovascular outcomes
- increases in vector-borne diseases
- risk of food contamination leading to foodborne illness
- risks arising from extreme weather events such as flooding
- increased disparities in health status

Emerging research also suggests that increases in extreme weather could have significant impacts on mental health and determinants of health including food security, social support networks, employment status, quality of housing, income and costs of recovery, and access to core services including electricity, transportation, and telecommunications.

Overview of Health Impacts from Extreme Weather in Toronto

Information about the current burden of illness from climate-related health impacts in Toronto is varied. Some of this information is described below. However, no systematic evaluation has been completed to estimate how climate change might alter these risks and their health impact, characterize the number and characteristics of vulnerable people and places for the combination of these risks, or consider the resulting demand on public health and health care services.

Extreme heat is expected to become more common, with hotter temperatures and longer heat waves. Extreme heat is associated with a spectrum of effects ranging from weakness and disorientation to heat stroke, which can be life-threatening. Extreme heat may also contribute to cardiovascular and respiratory illness and death. Toronto Public Health estimates that heat contributes to an average of 120 premature deaths in the City each year, and that heat-related mortality could double by 2050 and triple by 2080.

The warmer weather patterns may degrade air quality. The hot weather conditions that are expected with climate change are also associated with increased ozone formation, which is a component of smog. Air pollution such as smog is associated with a variety of health outcomes, most notably illness and premature mortality from cardiovascular and respiratory causes. In 2004, TPH reported that air pollution contributed to 1700 premature deaths and 6000 hospitalizations in the city each year. While levels of some pollutants in Toronto have improved over the past decade, others including ozone, have remained stable or increased slightly.

Warmer weather and longer summers are expected to expand the range of some animals and insects that carry diseases, and increase the chance that they will be able to survive the winter. In Ontario, this could happen with the *culex* mosquito which carries West Nile Virus (WNV) and the black-legged tick, which carries Lyme disease. If the weather conditions shift to favour survival of these insects, there is more chance that people could

become infected with WNV or Lyme disease. Between January 2002 and October 2013, 604 cases of WNV were reported to Toronto Public Health, but the numbers are highly variable from year to year. About 20 cases of Lyme disease in humans were reported to TPH during each of the past five years, and almost all of these people acquired the disease outside Toronto.

Extreme rainfall increases the chance of flooding, which can affect beach water quality. Many parts of Toronto still have combined sewers, which collect sanitary sewage and stormwater runoff in a single pipe system. If the combined sewers are overwhelmed by large volumes of water flowing in, sewage can be released into the lake. Harmful bacteria in the sewage can make it more likely that swimmers or recreational lake users acquire infections or illnesses. Many Toronto beaches were unsuitable for swimming for up to a week after the July 8, 2013 storm.

Homes and businesses can also be flooded, and the floodwaters may or may not contain sewage. If the water includes sewage, large portions of the building may become uninhabitable because they are contaminated with harmful bacterial that can cause illness. Even when floodwaters do not include sewage, the moisture may lead to development of mould, which can lead to allergic reactions and respiratory illness. While it is difficult to estimate how many people may be affected by flooding events, the July 8, 2013 rainstorm points to the potential for high impact on residents. In September, the Insurance Bureau of Canada reported that it had received over \$850 million in insurance claims across the GTA as a result of the storm, and was expecting more.

As temperatures warm, standard food storage and handling practises may become insufficient, enabling bacteria to grow more readily. Growth of harmful bacteria can lead to foodborne illness. Although it is difficult to know how many cases are related to the weather, *Campylobacter* enteritis and *salmonellosis* are two foodborne illnesses that are reported frequently in Toronto. For example, 753 cases of *Campylobacter* enteritis were reported in 2010 and 1,130 cases of *salmonellosis* were reported between 2009-2010.

A more pressing issue may be that if extreme weather events trigger power outages, individuals and businesses will not be able to provide adequate refrigeration or freezing to protect the safety of their food. Without refrigeration, a variety of harmful bacteria may grow in the food. If spoiled food is eaten people can become ill, with symptoms of foodborne illness including vomiting and diarrhea.

Vulnerability to Extreme Weather and Increasing Disparities in Health Status

While extreme weather is likely to test the resilience of all populations, the ability of some groups to cope with such weather events may be especially limited⁹.

Some people are more likely to experience adverse impacts either because they are more likely to be exposed to the health risk, or because they are less likely to be able to cope with the fallout of an extreme weather event. For example, exposure will likely be higher in areas of the City that are subject to flooding or where the urban heat island effect is

especially intense. Examples of populations that are often sensitive to external stresses include the elderly and isolated groups, children, and those with pre-existing illnesses.

These vulnerabilities to extreme weather may add to significant health inequalities according to socioeconomic status that have already been documented in Toronto¹⁰. Groups with lower amounts of social support, education, or economic resources are also the most likely to be affected by extreme weather event. For example, many of these groups may already live in substandard housing, which is less likely to offer protection during an extreme weather event. People with lower income may have more difficulty repairing and replacing damaged property, or may have to rely on a landlord to make sure their home is liveable and healthy. Damage that does occur may force people to evacuate, potentially fracturing their social and community connections⁹. TPH staff working with vulnerable populations further identify that people in situations of precarious employment are at risk of losing their income if an extreme weather event prevents them from working. These types of compounded inequities and multiple stressors can have adverse impacts on physical, mental and social health.

Disruption of Core Services

Complications of extreme events may include loss of power, damaged infrastructure, and disrupted transportation and telecommunication. Such disturbances may increase risks of food contamination, displace people from their homes and jobs, disrupt social support networks, create challenges for accessing healthy food, and increase psychosocial stress.

The relationship between power and heat-related illness may be a particular challenge. Electrical power capacity and reliability is already a concern, as a result of aging and deteriorating infrastructure, a lack of operating flexibility, capacity to meet future load growth, and security of supply¹¹. Extremely hot weather leads to an increase in air conditioning use, placing a higher than normal demand on the electrical grid. This can lead to power outages, meaning that access to cool places becomes very limited. Spending time in an air-conditioned environment is a proven way to prevent heat-related illness and death. Anyone without access to cooling is at high risk and some groups including seniors, young children, people who are isolated, and homeless or under-housed people may be especially sensitive. Extended heat waves in Europe (2003) and Russia (2010) were linked to 70,000, and 55,000 deaths respectively, demonstrating that without sufficient services and opportunities for cooling, heat can contribute to extremely high numbers of deaths and illness.

Examples of the type of health impacts that might be expected during such emergencies include closure of most services including pharmacies or doctor's offices, difficulties delivering and purchasing food, limited ability of first responders to provide emergency services and care, and limited ability of public health and primary health care providers to reach their workplaces and deliver essential services.

Assessing Toronto's Vulnerability

Current understanding of the vulnerability of Toronto's population to health and social impacts of climate change is limited. A comprehensive assessment of the health and social impacts of climate change in Toronto will co-ordinate relevant data and work to build new partnerships with sectors having interdependencies with health (See Figure 1). This will enable TPH to:

- characterize the risk from climate-related health and social concerns for Toronto populations; and
- identify recommendations for improving the resilience of Toronto's population, especially the most vulnerable groups.

Data needs

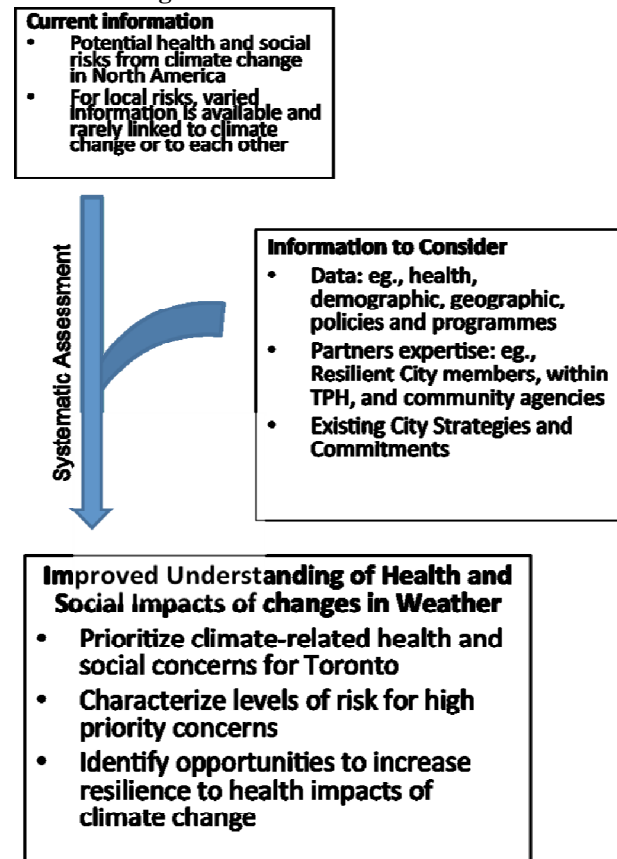
The assessment will rely on Toronto-specific data about demographics, health status, risk factors, the natural and built environment, historical impacts, and climate predictions. It will also be important to consider the numbers of people in potentially affected area and how demographics could shift over the upcoming years. For example, TPH projects that between 2011 and 2031, the senior population will increase by one-third. Seniors are expected to be especially sensitive to climate-related stressors including heat, floods, poor air quality, and infectious disease¹².

As well, assessing current regulations, policies, and programming that address extreme weather-related health risks could help to identify gaps in adaptive capacity and plan for the future.

Partnership Development

Exposure to risks such as extreme heat, flooding, vector-borne disease and foodborne illness depends in part on the quality of the City's physical infrastructure including electrical infrastructure, municipal infrastructure and housing. The Resilient City process offers a unique opportunity for TPH to learn from other City divisions and agencies about how extreme weather-related impacts on the City's infrastructure, programs and services could affect the health of Toronto's residents and how these vulnerabilities are being addressed. Building new relationships will also aid in identifying opportunities to

Figure 1: Components of a comprehensive assessment of health and social vulnerability to climate change



mainstream health and equity considerations into adaptation efforts across City divisions and organizations.

Finally, Toronto Public Health will develop or enhance partnerships with community agencies, to further explore the potential impacts of extreme weather on the health of specific groups or populations, and opportunities for increasing resilience.

Building on Existing Resources and Activities

Assessment of Toronto's vulnerability to climate change must also consider existing commitments related to climate change that may have implications for health. For example, City Planning will work with TPH to incorporate community resilience to extreme weather events into the Official Plan. As well, it will be important to link with ongoing City initiatives related to potentially vulnerable populations. For example, the Strong Neighbourhoods Strategy, the Newcomers Strategy, and the Seniors Strategy are focused on populations that may have higher than average vulnerability to weather-related health impacts. TPH may also be able to link into a new risk assessment process for Toronto to be led by the Social Development, Finance, and Administration division.

A More Resilient, Healthy Toronto

The World Health Organization called on decision-makers to prepare for climate change impacts through efforts to increase resilience in the health sector¹³. Although information about Toronto's vulnerability to health and social impacts of climate change is currently limited, there are opportunities to collate and assess existing information to develop a climate change health vulnerability assessment for Toronto.

In developing options for increasing resilience, TPH may recognize opportunities for co-benefits from taking action. For example, actions to green the City may reduce the urban heat island effect, improve air quality, reduce runoff, and reduce emissions of greenhouse gases. Although the focus of this report is on impacts of climate change and identifying opportunities for increasing resilience, it is important to note that resilience may also arise from actions that slow release of greenhouse gases.

Improving the population's resilience to the potential health and social impacts of extreme weather should reduce the severity and duration of health impacts. As a result, the population should experience better health, and agencies including TPH can maintain more efficient, effective service following an extreme weather event.

CONTACT

Carol Mee
Manager, Healthy Public Policy
Toronto Public Health
Phone: 416-338-8098
Email: cmee@toronto.ca

Monica Campbell
Director, Healthy Public Policy
Toronto Public Health
Phone: 416-392-7463
Email: mcampbe2@toronto.ca

SIGNATURE

Dr. David McKeown
Medical Officer of Health

References

- ¹ Cheng, C. et al. 2005. Differential and Combined Impacts of Winter and Summer Weather and Air Pollution due to Global Warming on Human Mortality in South-central Canada. Available from http://www.toronto.ca/health/hphe/pdf/weather_air_pollution_impacts.pdf
- ² Hengeveld, H., B. Whitewood and A. Fergusson. 2005. An Introduction to Climate Change: A Canadian Perspective. Science Assessment and Integration Branch, Environment Canada, Downsview ON.
- ³ Ontario Ministry of the Environment (OMOE). 2011. Climate Ready Ontario's Adaptation Strategy and Action Plan 2011 – 2014. Available from http://www.ene.gov.on.ca/stdprodconsume/groups/lr/@ene/@resources/documents/resource/stdprod_085423.pdf
- ⁴ International Panel on Climate Change (IPCC). 2013. Climate Change 2013: The Physical Science Basis. Fifth Assessment Report (AR5) Available from <http://www.ipcc.ch/>
- ⁵ The Expert Panel of Climate Change Adaptation (2009), Adapting to Climate Change in Ontario: Towards the Design and Implementation of a Strategy and Action Plan. Available from http://www.ene.gov.on.ca/stdprodconsume/groups/lr/@ene/@resources/documents/resource/std01_079212.pdf
- ⁶ Natural Resources Canada. 2007. From Impacts to Adaptation: Canada in a Changing Climate 2007. Available from <http://www.nrcan.gc.ca/earth-sciences/climate-change/community-adaptation/assessments/132>
- ⁷ Health Canada. 2008. Human Health in a Changing Climate: A Canadian Assessment of Vulnerabilities and Adaptive Capacity. Health Canada (Ottawa, ON).
- ⁸ National Climate Assessment and Development Advisory Committee (NCADAC). 2013. Draft Climate Assessment; posted for public comment. Available from <http://ncadac.globalchange.gov/>
- ⁹ Toronto Public Health (TPH). 2011. Climate Change Adaptation and Health Equity Background Report.
- ¹⁰ Toronto Public Health (TPH). 2008. The Unequal City Income and Health Inequalities in Toronto. Available from http://www.toronto.ca/health/map/pdf/unequalcity_20081016.pdf
- ¹¹ City of Toronto. 2013. Chief Planner Roundtable. Vol 1. Available from toronto.ca/planning/chiefplannerroundtable/

¹² Gamble et al. 2013. Climate Change and Older Americans: State of the Science. *Environ Health Perspect.* 121(1): 15–22.

¹³ Waddington et al. 2013. Preparing for the Impacts of Climate Change. How ready is your health Care Organization? *Canadian Healthcare Facilities* Summer. p. 34-39.