



**STAFF REPORT
ACTION REQUIRED**

**Strategies to Prevent Heat-Related Illness and Deaths
from Extreme Heat Emergencies**

Date:	June 13, 2014
To:	Board of Health
From:	Medical Officer of Health
Wards:	All
Reference Number:	HL28.9

SUMMARY

Due to the changing climate, Toronto can expect a fivefold increase in three-day heat waves and an increased likelihood of a heat emergency with high mortality such as has occurred in large cities in other developed countries. Climate models suggest that by 2049, the annual average temperature will have increased by 4.4°C and there will be more than triple the amount of days (approximately 60) with temperatures that exceed 30°C compared to historical conditions (2000 to 2009). As heat episodes increase, so will the health impacts.

Currently, Toronto Public Health administers the Heat Alert and Response Program to prevent heat related deaths and illness during usual summertime conditions. However, the program was not designed to address heat emergencies when heat conditions are more severe and last longer, and which may lead to high mortality. In that case, the Medical Officer of Health can request the Toronto Office of Emergency Management activate the City of Toronto’s Emergency Operations Centre (EOC) and if necessary, scale up the response through the City's Emergency Plan. To date, the City's Emergency Plan has never been activated for a heat event.

This report outlines strategies to strengthen Toronto's preparedness for heat emergencies, strengthen the healthcare sector's preparedness for heat emergencies, build Toronto's resiliency and develop policies that increase access to cool spaces for heat-vulnerable populations.

RECOMMENDATIONS

The Medical Officer of Health recommends that:

1. City Council request the City Manager, in consultation with the Medical Officer of Health, to work through The Emergency Management Program Committee (TEMPC) and the Emergency Management Working Group to ensure that heat emergency preparedness and management includes measures to identify vulnerable populations and to provide outreach and heat relief through:
 - a. a review of heat related risks as part of annual risk assessment;
 - b. updating Operational Support Functions as required; and
 - c. updating the Emergency Plan as required.
2. the Board of Health request the Medical Officer of Health to engage with Toronto area Local Health Integrated Networks (Central West, Mississauga/Halton, Toronto Central, Central and Central East) to:
 - a. ensure that all hospitals and other health service providers have adequate plans to respond to a heat emergency; and
 - b. encourage all health service providers to ensure that vulnerability assessments for all clients consider if they will be affected by extreme heat.
3. the Board of Health request the Medical Officer of Health to collaborate with the Chief Corporate Officer and the Director of the Environment and Energy Division to:
 - a. ensure that extreme heat events are considered in the Resilient City divisional risk assessments related to extreme weather and that measures are developed to prevent adverse health impacts; and
 - b. develop and implement an engagement strategy with key stakeholders from the private sector and community services sector to improve resiliency.
4. The Board of Health forward this report to the Canadian Red Cross, Ontario Medical Association, Faith and the Common Good, Social Planning Toronto and Street Health.

Financial Impact

There are no financial impacts directly resulting from the adoption of this report.

DECISION HISTORY

On July 26, 2011, the Board of Health adopted the "Protecting Vulnerable People from Health Impacts of Extreme Heat" report and directed the Medical Officer of Health to work with other City divisions to integrate heat specific emergency plans and increase the capacity of local organizations during heat events.

<http://app.toronto.ca/tmmis/viewAgendaItemHistory.do?item=2011.HL6.3>

On February 20, 2013, Toronto City Council considered the report "Toronto's Future Climate: Study Outcomes", which predicts significant increases in extreme heat 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 identify key adaptations in their plans relating to core services.

<http://app.toronto.ca/tmmis/viewAgendaItemHistory.do?item=2013.PE18.2>.

On December 16 2013, City Council adopted a report from the Medical Officer of Health entitled "Exploring Health and Social Impacts of Climate Change in Toronto". City Council requested the Medical Officer of Health, in consultation with the Director of the Environment & Energy Division, Office of the Chief Corporate Officer, carry out a detailed climate and health vulnerability assessment for the City of Toronto.

<http://app.toronto.ca/tmmis/viewAgendaItemHistory.do?item=2013.HL25.4>

On February 10, 2014, the Board of Health requested the Medical Officer of Health to report to the June 30, 2014 meeting on strategies to assist in preventing deaths during extreme heat emergencies.

<http://app.toronto.ca/tmmis/viewAgendaItemHistory.do?item=2014.HL28.9>

ISSUE BACKGROUND

Probability of Heat Emergencies in Toronto

Heat emergencies have been deadly in other regions in the world, killing thousands. In 2003, a European heat wave resulted in the death of approximately 70,000 people (Robine, et al., 2008). In Russia an estimated 55,000 people died during the 2010 heat wave where temperatures exceeded 30° C for 28 days (Barriopedro, Fischer, Luterbacher, Trigo, & García-Herrera, 2011). In 1995 in Chicago, a four day heat wave with unprecedented highs for maximum and minimum temperatures along with extreme relative humidity led to over 700 heat related deaths (Kleinenberg, 2002).

The probability of heat emergencies is increasing in Toronto. Observed changes in temperature trends show a steady increase in average annual temperatures for Toronto. Climate models suggest that by 2049, the annual average temperature will increase by 4.4°C and there will be more than triple the number of days (approximately 60) with temperatures that exceed 30°C compared to historical conditions (2000 to 2009) (see Table 1).

Table 1: Expected Climate Changes for Toronto by 2049

Extreme Heat	Description	Historical (2000-2009)	Future (2040-2049)
	Extreme daily maximum temperature	37°C	44°C
	Average number of days with temperatures higher than 30°C	20	66
	Average number of heat events with 3 consecutive days with temperatures greater than 32°C	0.57	2.53

Source: Toronto Environment Office (2012). Toronto's Future Weather and Climate Drivers Study.

Toronto can also expect a five-fold increase in three day heat waves and an increased risk of more severe or prolonged heat events such as heat emergencies. It is estimated that current heat conditions contribute to an average of 120 premature deaths per year in Toronto (Toronto Public Health, 2005). Average annual heat-related deaths could double by 2050 and triple by 2080 (Toronto Public Health, 2005).

Exacerbating this overall warming trend is the urban heat island effect that concentrates heat in cities like Toronto. Areas that are built-up and dominated by hard surfaces (e.g. roads and buildings) and without much vegetation are hotter than those with more green space which provide natural cooling. The dark surfaces release the stored heat overnight, preventing the City from cooling off. Increasing night-time minimum temperatures due to the changing climate further limits night-time cooling.

The danger of prolonged heat events is also increased by the fact that indoor temperatures tend to escalate with each hot day (in the absence of mechanical cooling systems), even when the outdoor temperature remains similar.

Vulnerable Populations

The impacts of heat are disproportionately borne by frail, elderly, and isolated people (Kovats & Hajat, 2008). Deprivation, particularly in downtown urban areas, increases sensitivity to heat (Ishigam, et al., 2008). Low-income households are at higher risk, likely due to poorer quality housing and limited access to air conditioning (Medina-Ramo et al., 2006, O'Neill et al., 2005). Individuals on low incomes are also more likely to suffer from chronic diseases or other medical risk factors that put them at higher risk for heat related illness or death.

People who face language or literacy barriers, cognitive disorders, mobility limitations, mental health issues or addictions, homelessness or marginalization related to experiences of discrimination or social exclusion may also be at increased risk. They may be less likely to hear, interpret or be able to respond to public warnings and recommendations. Practical limitations such as language and literacy can be compounded by fear, lack of social networks, and reluctance to ask for help (Phillips & Morrow, 2007) (Fothergill, Maesta, & Darlington, 2007).

The exact number of highly heat-vulnerable people in Toronto is difficult to quantify. Toronto Public Health estimates that there are 62,000 households or about 150,000 people that are at high risk of heat exposure and adverse impacts. This is based on low

income (less than \$20,000) as a proxy for heat sensitivity due to its link with higher likelihood of chronic disease and poor living conditions, and lack of air conditioning as a proxy for exposure¹. In addition, there are approximately 5,253 homeless people on the street (2013 Street Needs Assessment) who are also considered to be highly vulnerable to heat.

Current Response to Hot Weather Conditions

Since 1999, TPH has co-ordinated a Heat Alert and Response Program for the City of Toronto. The program was designed to address typical hot days that occur in Toronto, and it focuses on people who are especially vulnerable to heat. The program combines a Heat-Health Alert System, proactive outreach activities and a Hot Weather Response Plan that triggers activities once an alert is called. To effectively deliver the program to vulnerable populations, Toronto Public Health, City Divisions and community partners can make use of TPH's heat vulnerability maps to focus service delivery and resources (http://map.toronto.ca/maps/map.jsp?app=TPH_HVMAP).

Many of the activities are carried out in partnership with community agencies and include providing bottled water, and promoting libraries and community centres as places to stay cool. As well, shelters ease their curfew rules to allow people to stay inside during the day and transit tokens are distributed at drop-in centres, so homeless and marginally housed clients can get to an air-conditioned place. Additional responses are triggered for an Extreme Heat Alert. The City opens designated cooling centres at various public locations such as civic centres and extends hours for some swimming pools.

City Response in the Event of a Heat Emergency

A heat emergency which is much more severe and/or longer than typical summer hot weather will likely strain the capacity of the health and social services sectors to respond. In that case, the Medical Officer of Health can request the Toronto Office of Emergency Management to activate the City of Toronto's Emergency Operations Centre (EOC). The EOC complements the hot weather response and provides an established and recognized point of authority to coordinate response resources, personnel and incident information. If the decision is made to escalate the municipal response, the City of Toronto Emergency Plan will be activated (Toronto Public Health, 2013). To date, the emergency plan has not been activated for a heat emergency.

COMMENTS

Strategies to prevent heat-related deaths and illness due to expected heat emergencies can be grouped into two main themes:

- Toronto's preparedness and response for heat emergencies; and
- Toronto's resiliency to prevent or reduce the adverse health impact of extreme heat.

¹ Calculated based on the following assumptions: In Toronto, 176,300 private households have a total income less than \$20,000. Based on TPH survey, approximately 35% of households with low income do not have air conditioning in their homes. On average there are 2.5 people per household.

Strengthen Toronto's Preparedness and Response for Heat Emergencies

City of Toronto Emergency Preparedness and Response

Preparing and responding to a heat emergency involves two fundamental elements: finding the vulnerable people and providing them with heat relief. In jurisdictions around the world, there are several strategies to address each element. A jurisdictional review of heat emergency plans was undertaken by TPH in 2012. Heat plans from England and the City of Philadelphia highlight strategies to reduce impact of heat emergency. These strategies should be considered to improve Toronto's responses to heat emergencies. Some aspects of these strategies are already reflected in Toronto's current approach.

1. In England's National Heatwave Plan there are several strategies used to maximize dissemination and raise awareness of risks and provide options for cooling, especially with the most vulnerable and hard to reach populations. Local agencies:
 - identify individuals who are at particular risk from extreme heat and encourage education regarding heat illnesses and their prevention (particularly for caregivers of the old and infirm and parents of infants);
 - identify any changes to individual care plans for those in high-risk groups, including those with chronic illness or severe mental illness, which might be necessary in the event of a heatwave, including initiating daily visits by formal or informal care givers to check on people living on their own;
 - work with the families and informal care givers of at-risk individuals to ensure awareness of the dangers of heat and how to keep cool and to put simple protective measures in place, such as installing proper ventilation and ensuring that fans and fridges are available and in working order;
 - do an assessment using the Housing Health and Safety Rating System (HHSRS) where individual households or care home residents are identified as being at particular risk from hot weather; and,
 - provide detailed guidance for hospitals, long term care homes, nursing homes, community groups and voluntary sector organizations.

2. The City of Philadelphia's Heat Watch/Warning system also has an extensive range of coordinated heatwave responses that support finding and reaching vulnerable populations which include:
 - air-conditioned overnight shelter accommodation;
 - advice on the protection of nursing and personal care boarding home residents, and mobile field teams to ensure adequate hot weather care;
 - deferment of all water and power utility service suspensions;
 - increased emergency medical service staffing;
 - daytime outreach to the homeless (a shift from the normal evening outreach);
 - extended hours at senior's centres;
 - promotion of the "Buddy System", which encourages friends, neighbors, relatives, church members, and other volunteers to make daily visits to elderly persons during hot weather, to ensure that vulnerable individuals have sufficient fluids and proper ventilation;

- activation of a “Heatline” – a hotline operated in conjunction with the Philadelphia Corporation for Aging to provide information and counseling to the general public on avoidance of heat stress and home visits to people requiring more attention than can be provided over the Heatline.

In Toronto, during a heat emergency, the hot weather response would be scaled up through the City's Emergency Plan, its Operational Support Functions (OSFs) and its Risk Specific Plans. In particular, a heat emergency response could make use of the following OSFs as appropriate depending on the specifics of the emergency:

- Emergency Human Services - an organized response (e.g. reception centre) to the urgent needs of people once they are out of immediate danger of a disaster or emergency situation;
- Emergency Information and Media Relations - outlines the role of the Strategic Communications Division during an emergency incident and supports the City of Toronto’s efforts to assist Toronto residents in coping with and recovering from a major emergency incident;
- Emergency Operations Centre - the structure and framework for the activation, mobilization and coordinated management of resources, personnel and incident information;
- Mass Fatalities - describes and identifies roles and practices in mitigation, preparedness, response to and recovery from mass fatality incidents; and
- Volunteer Management – facilitates and coordinates the recruitment, selection and placement of volunteers in order to augment staff resources during an emergency.

Additionally, divisional plans and standard operating procedures would be implemented.

In April 2014, Toronto Public Health, in consultation with the Office of Emergency Management, initiated a review of ability of the current plans to respond to a heat emergency through a preliminary interdivisional workshop. City officials from the Emergency Management Working Group and the Hot Weather Response Committee participated in the workshop to provide insight into potential gaps, opportunities and preparedness activities that should be further reviewed. They identified a range of activities that could be considered for future evaluation, such as:

- Enhanced inter-divisional information exchange on heat related activities through existing mechanisms such as the Emergency Management Working Group and Resilient City Working Group
- Enhanced divisional training for:
 - operational level responsibilities during heat emergencies
 - relationship between the Emergency Plan and the Hot Weather Response Plan
- Enhanced co-ordination of City Divisions during an event
- Increased communication both internally and with the public
- Additional cooling centres in both public and private facilities (e.g. recreation centres, shopping malls)
- Additional resources for finding and reaching out to the most vulnerable population who are "hidden", beyond traditional messaging through media

- An emergency response products list for resources required during a heat emergency.

Participants also highlighted the relationship between power failure and heat emergencies as a particular challenge. Power outages can be emergencies by themselves, so concurrent heat and power outage emergencies can quickly overwhelm responders. 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 and access to cool places becomes very limited. Heat events may also coincide with other extreme weather conditions that may also lead to power failure. The activities identified by the workshop participants fit into the two fundamental aspects of emergency response during a heat emergency namely finding vulnerable people and providing them with heat relief.

The existing authority for emergency planning lies with Chapter 59 of the Toronto Municipal Code. The Emergency Management Program Committee (TEMPC) and the Emergency Management Working Group are the venues for working through emergency policy and planning issues. This report recommends that City Council direct the City Manager to work with the City's Emergency Management Structure to ensure that the City's plans include the appropriate measures to address the fundamental aspects of emergency response during a heat emergency. As a result, the Emergency Management Working Group would:

- review heat related risks as part of annual risk assessment;
- consider the strategies identified in the preliminary workshop and the results of TPH's jurisdictional review;
- update Operational Support Functions as required; and
- recommend changes to the Emergency Plan that are required to address the additional risks associated with heat emergencies.

When considering heat emergencies, TEMPC could consider the follow-up to the December 21st and 22nd winter storm event and the subsequent co-ordinated emergency response. The City Manager, in consultation with The Emergency Management Program Committee (TEMPC), will prepare a Post Mortem report that will provide more comprehensive details on the activities of City divisions, Agencies and Corporations and other partners. It will identify successful aspects of the emergency response and will identify and make recommendations to improve the co-ordination of the City's response for future emergency events. Many of these improvements will also support the City's ability to respond to a prolonged heat event. Improvements include development of a "geographical information systems" (GIS) through the Geospatial Competency Centre to map assets and services located across the City. This includes mapping of facilities that could be used as cooling reception centres during extreme weather events and consideration of a vulnerable persons' registry. The review will examine ways to improve communications within the city divisions and with the public during an emergency. The review will also assess the City's Emergency Human Services Operational Support Function and related protocols.

Healthcare Sector's Emergency Preparedness and Response

The broader healthcare sector also plays an important role in preventing heat-related deaths and illness during a heat emergency.

Following the H1N1 pandemic, the Ministry of Health and Long-Term Care (MOHLTC) led a review process to identify opportunities to strengthen emergency preparedness in Ontario. The review identified a need to formalize the roles and responsibilities of Local Health Integration Networks² (LHINs) during pandemics and other emergencies in the health system. The LHIN/MOHLTC accountability agreement directs the MOHLTC and LHINs to jointly develop guidelines and/or protocols clarifying roles and responsibilities related to emergency management. By June 2015, all Toronto area LHINs (Central West, Mississauga/Halton, Toronto Central, Central and Central East) are expected to have emergency plans in place in time for the 2015 Pan/Parapan American Games.

Toronto Public Health participated in the development of the Toronto Central LHIN's Integrated Health System Emergency Response Plan. The Toronto Central LHIN's plan can be used as a model for the other LHINs.

The Toronto Central LHIN emergency response plan recommends that health service providers develop emergency plans for clients at risk that consider vulnerability to extreme weather, including extreme heat. To assist health service providers (HSPs) to determine their own ability to provide ongoing services as well as their ability to provide resources to other organizations in need, the response plan recommends development of a capacity assessment tool. The HSPs' plans could include an internal registry of vulnerable clients. It should be noted that while the Toronto Central LHIN Integrated Health System Emergency Response Plan recommends HSPs develop emergency plans for clients, it is not mandated. Consequently, it is recommended that these guidelines encourage all HSPs ensure that vulnerability assessments for all clients consider if their clients will be affected by extreme heat (e.g. determine if the client has a chronic condition that would be exacerbated due to heat).

The LHIN also encourages HSPs to increase their knowledge of heat preparedness and heat health issues. HSPs can make use of an accredited course (www.extremeheat.ca) to update health care workers about the current state of heat-health evidence. This course is suited for public health professionals, physicians and nurses as well as those working with those most at risk including seniors, children, outdoor workers and the physically active as well as people with cardiovascular, respiratory or mental illness. The course was developed by Health Canada in collaboration with McMaster University, the Ontario College of Family Physicians and the Clean Air Partnership.

² Local Health Integration Networks bring together health care partners from hospitals, community care, community support services, community mental health and addictions, community health centres and long-term care facilities.

Increase Toronto's Resiliency

In addition to being prepared for and responding to a heat emergency, actions can be taken today to prevent heat-related illness and death during the anticipated heat emergency conditions. These include building resilience and developing policies to ensure vulnerable populations have access to cool space.

City of Toronto and Community Resiliency

Toronto is committed to creating a more resilient city that is better able to repair and recover more quickly from extreme weather events. Resiliency is the ability of the system to withstand shocks and stresses while still maintaining its essential functions. Resilient cities are also better able to repair and recover afterwards.³

The Chief Corporate Officer through the Environment and Energy Division co-ordinates the Resilient City Working Group to help prepare the City for climate related changes. Through this Working Group, City divisions, agencies, corporations (including Toronto Public Health and the Office of Emergency Management) examined planned or existing efforts to prepare for and prevent extreme weather-related impacts. The Working Group is identifying potential risks to their services and operations.

It is recommended that heat emergencies are considered in the Resilient City divisional risk assessments related to extreme weather and that measures are developed to prevent adverse health impacts. It is also recommended that heat emergencies are considered in the development and implementation of an engagement strategy with key stakeholders from the private sector and community services sector so as to improve resiliency.

Community services sector organizations such as community agencies, neighbourhood groups and associations, faith groups, volunteer agencies and business improvement areas are critical stakeholders in building Toronto's communities and resiliency and preparedness to prevent heat related illness and deaths during a heat emergency.

City divisions, including Toronto Public Health, can engage community organizations and support them in developing heat emergency plans to protect vulnerable populations and communities. This can be coordinated through the Strong Neighbourhood Strategy and the Resilient City Working Group activities. Currently, Toronto Public Health is beginning to collaborate with two agencies in North York to support the development of neighbourhood plans for extreme weather, including heat. Efforts in these communities can serve as a model that could then be applied in other communities in Toronto.

Access to Cool Spaces for Vulnerable Populations

The most effective tool to preventing heat-related deaths and illness is accessing a cool environment such as an air conditioned one. In Toronto, many people who are vulnerable to heat are unable to keep their home environments cool (through air conditioning or design of their homes) or have limited access to places to cool off. Policies and regulations should be developed to enable increased access to cool spaces for vulnerable

³ NYS 2100 Commission, page 24

populations. This can be achieved through access to onsite cooling or by moving to a cool space.

According to a 2010 TPH survey, 15% of Toronto residents do not have air conditioning in their home. Residents without in-home air-conditioning are much more likely to be born in another country, to rent their place of residence, live in an apartment building, live in community housing or be classified as low-income. Thirty-five percent of low-income households report not having air conditioning.

Renters in multi-residential buildings without central air conditioning face a number of challenges in keeping their units cool:

- Limited natural ventilation because most windows are restricted from opening more than 10 cm to protect children from falling out;
- Air conditioning options are expensive and in some cases, landlords require third-party installation, inspection and certification. If a landlord is not satisfied that a unit is safely installed, they can request that it be removed; and
- Heat is legislated to remain on to a minimum air temperature of 21 degrees Celsius from September 15 to June 1 regardless of outdoor temperatures. In the past, heat alerts have been called during this time period.

These protective regulations have unintended consequences of making multi-residential buildings without air conditioning into heat sinks. To address this complex problem and identify options for improving cooling in multi-residential dwellings Toronto Public Health, in collaboration with Municipal Licensing and Standards, plan to host a Municipal Roundtable. Participants will include representatives from the Provincial government, City agencies and divisions, along with tenants and landlord groups. Topics to be explored will include maximum heat standards, heating requirements, cooling rooms, building codes, air conditioning, subsidies and access to cool spaces.

In the summer of 2010, Toronto Public Health collaborated with Toronto's Tower Renewal to initiate a "cool room" scoping project in a privately owned high-rise building without central air conditioning. The majority of residents (59%) did not have air conditioners in their homes. A cooling room was set up in collaboration with the landlord who purchased and installed an air-conditioner. Residents indicated some support for the cool room with modifications such as providing social activities in the room. They also wanted more cooling on-site via central air conditioning and more shade and seating outside. Most residents said they get relief from the heat by going to a park or a shopping mall.

Improving public access to cool spaces where programming and entertainment already exist can help residents in buildings without air conditioning. For example, the City of Ottawa partners with a local movie theatre to provide free and discounted movie tickets during extreme heat events.

Heat-related deaths and illnesses during heat emergencies can be prevented. This report outlined strategies to prevent, prepare and respond to a heat emergency and build community resiliency.

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: 416-338-0661
Email: mcampbe2@toronto.ca

SIGNATURE

Dr. David McKeown
Medical Officer of Health

REFERENCES

1. Barriopedro, D., Fischer, E. M., Luterbacher, J., Trigo, R. M., & García-Herrera, R. (2011). The hot summer of 2010: Redrawing the temperature. *Science*, 332, 220-224.
2. Fothergill, A., Maesta, E., & Darlington, J. (2007). Race, ethnicity and disasters in the United States. A review of the literature. *Disasters*, 23(2), 156-7.
3. Ishigam. (2008). An ecological time-series study of heat-related mortality in three European cities. *Environmental Health*, 7(5).
4. Kleinenberg, E. (2002). *Heat Wave: A Social Autopsy of Disaster in Chicago*. Chicago: The University of Chicago Press.
5. Kovats, R. S., & Hajat, S. (2008). Heat Stress and Public Health: A Critical Review. *Annual Review of Public Health*, 29, 41-55.
6. Massey, R. (2011). Program assessment at the 20 year mark: experiences of Massachusetts companies and communities with the Toxics Use Reduction Act (TURA) program. *Journal of Cleaner Production*, 19, 505-516.
7. Medina-Ramo, M. (2006). Extreme temperatures and mortality: assessing effect modification by personal characteristics and specific cause of death in a multi-city case-only analysis . *Environmental Health Perspectives*, 114(9), 1131-6.
8. O'Neill, M. (2005). Disparities by race in heat-related mortality in four US cities: the role of air conditioning prevalence. *Journal of Urban Health*, 82(2), 191-7.
9. Phillips, B., & Morrow, B. (2007). Social science research needs: Focus on vulnerable populations, forecasting and warnings. *Natural Hazards Review*, 8(3), 61-6.
10. Robine, J.-M., Cheung, S. L., Le Roy, S., Van Oyen, H., Griffiths, C., Michel, J.-P., & Hermann, F. R. (2008). Death toll exceeded 70,000 in Europe during the summer of 2003. *Biologies*, 331.
11. Toronto Environment Office. (2012). *Toronto's Future Weather and Climate Driver Study: Outcomes Report*. Toronto.
12. Toronto Public Health. (2005). *Influence of Weather and Air Pollution on Mortality in Toronto. Summary report of Differential and Combined Impacts of Winter and Summer Weather and Air Pollution due to Global Warming on Human Mortality in South-Central Canada*. Toronto.
13. Toronto Public Health. (2013). *Hot Weather Response Plan*. Toronto.