

ENVIRONMENTAL SCAN

Heat Alert and Response Systems (HARS)

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Key Highlights

- Heat alert and response system (HARS) structures, roles, responsibilities, and associated actions to address health harms (e.g., heat-related illness, stress and mortality) varied widely between Ontario and 10 comparable jurisdictions and public health organizations included.
- Temperature, humidity index (humidex) and time-based thresholds varied across jurisdictions for the purpose of issuing a heat warning, alert, or emergency. Few jurisdictions, including Ontario, have a single-tiered system, meaning a Heat Warning triggers response actions and the system does not elevate required response actions beyond the initial warning level. More jurisdictions have multi-tiered systems that enable escalation from a “standard” heat warning to an “emergency” or “extreme” level when elevated thresholds are met, and this escalation triggers additional response actions.
- All 11 jurisdictions and organizations considered older adults, infants and children, and people living with a disability or chronic disease (mental or physical) at increased risk of adverse health impacts during heat events. There was variability across jurisdictions and organizations concerning other groups or demographics considered at elevated risk of adverse health outcomes during a heat event. Other commonly identified groups included: people who work in the heat, people who live alone, people who are unhoused, underhoused or live in spaces that are difficult to cool, people taking certain medications, low income earners, and people who use substances.
- Commonly identified interventions or actions directed at those considered at greater risk of health harms during a heat event included: considering messaging modes most likely to reach people at elevated risk; developing processes to identify, and possibly register, populations or individuals at elevated risk; focusing outreach efforts (e.g., wellness checks, water deliveries) on people at elevated risk; and ensuring public cooling spaces are welcoming and suitable for people at elevated risk.
- Short-term improvements may blunt some of the worst health impacts, but it is crucial to note that they will not resolve systemic problems that contribute to inequitable health impacts of heat events. Future work is needed to develop a more comprehensive approach to protecting the population from heat events.

Objectives and Scope

The purpose of this jurisdictional scan is two-fold. First, it aims to understand current HARS and interventions to prevent morbidity and mortality from heat events in Ontario and comparable jurisdictions. Interventions were broadly defined and may include approaches, recommendations, initiatives, education, etc. Second, this scan aims to highlight gaps and/or themes to inform future areas of work and potential improvements.

Three broad questions guided the information collection:

1. What early preparedness, monitoring/surveillance and response interventions (i.e., HARS) for heat events are being used in these jurisdictions? Are there interventions specifically aimed at protecting people most vulnerable to heat-related harms?
2. Who is considered vulnerable to/at high risk of harm from extreme heat events in these jurisdictions?
3. What are the thresholds used by jurisdictions to trigger a heat alert, warning, provision of specific supports or mitigation activities?

As part of this jurisdictional scan we also used feedback from experts in the field to provide a clearer understanding of the current context of HARS. This scan is not exhaustive and is intended to provide background contextual information and examples of actions that may be considered within the existing policy landscape to address heat events in the immediate future. Implementation considerations, policies related to climate change, and policies not directly related to heat events and mitigation activities were out of scope.

Background

Due to climate change, heat events are expected to become increasingly frequent, prolonged and severe.^{1,2} Heat events are known to cause excess preventable deaths and heat-related mortality is a growing concern in Ontario. There are varied terms and definitions for heat events; for consistency throughout this report, “heat event” will be used interchangeably with other terms such as heat wave, heat warning, heat dome and extreme heat event.

A study of all non-accidental deaths in Ontario over a 15-year period (1996 to 2010) found that mortality increased by 2.5% with each 5°C increase in average daily temperature between June and August.³ Ontario’s harmonized Heat Warning and Information System (HWIS) was implemented province-wide in 2016.⁴⁻⁶ An extended heat event occurred in Ontario in the summer of 2018, during which a Heat Warning was issued from June 28 to July 6.⁷ There are data to show increased emergency department visits during the heat event; however, data did not indicate if increased emergency department visits were due to exposure to the heat (or sun), vigorous outdoor activity during the event (recreational or occupational), lack of access to air conditioning, or for another reason.⁷ A 2022 time-series analysis found that emergency department visits for heat-related illness, adjusted for maximum daily temperature, appeared to decline following implementation of the HWIS in some subpopulations, however increased in people with recent history of homelessness, and overall change was not statistically significant at a population level.⁸

The heat dome in British Columbia (BC) during the summer of 2021 resulted in over 600 deaths, and nearly all of these heat-associated deaths occurred indoors.⁹ According to the BC Coroner's report and a recent study on this event, certain populations were disproportionately represented among these deaths, such as older adults with chronic health conditions, people with chronic conditions that potentially could impact cognition (e.g., schizophrenia, and people living in areas of higher material and social deprivation).^{9,10} Understanding who is at greatest risk of harm from heat events, how to protect individuals and particularly vulnerable populations from harm, and when to initiate preparedness and response activities are important considerations for preventing mortality and/or morbidity during these unavoidable heat events.^{11,12} For the purposes of this scan, vulnerability or risk in relation to heat-related harm is reported as it is described in the source materials.

Given ongoing climate change, heat events are expected to increase in frequency and magnitude. To prepare for these events, a better understanding of current systems and potential improvements is needed. Foundational Canadian national guidance related to heat alert and response system (HARS) and the identification of vulnerable individuals was published over 10 years ago.^{13,14} The Ontario HWIS is more recent, and provides multiple suggested actions to allow for a tailored response in each region, however in practice there is variation in response plans across the province. Lessons on emergency preparedness, response, and recovery for heat events can be learned from other jurisdictional experiences.

Methods

The jurisdictional scan was conducted in May 2023 using targeted and snowball search methods to collect evidence from public websites outside of peer-reviewed journals. The jurisdictions included were Ontario, BC, Alberta, Québec, France, Italy, United Kingdom, and the State of California. The organizations included were Health Canada, Canadian National Collaborating Centre on Environment Health (NCCEH), and United States CDC. The jurisdictions and public health organizations for this scan were selected for their comparability to the Ontario context (e.g., similar climates, social systems), known histories of addressing health outcomes of extreme heat events, or relevant content for extraction revealed from preliminary searching. The scan was not exhaustive and we are aware that other potentially relevant jurisdictions and organizations were not included.¹² Additionally, we utilized feedback from Ontario's PHUs who were asked about heat-related planning and response activities beyond information found on their respective website. Please see Appendix A for additional methods details.

Results

The findings from the scan are organized into three parts. First we describe how each jurisdiction's HARS is structured and their respective reported thresholds. Next, we describe the people considered at elevated risk of adverse health impacts during heat events according to jurisdiction's resources. Finally, the types of interventions, supports and measures to mitigate adverse health harms across jurisdictions are described.

Selected programs or services are presented throughout the results to provide examples of informative resources, particularly with respect to vulnerability.

HARS Structures and Thresholds

ONTARIO

ONTARIO HWIS STRUCTURE

The HWIS provincial system was launched in 2016 and aims to provide a consistent approach for processing and issuing heat warnings in Ontario in order to better protect residents, vulnerable community members and visitors during the summer season.⁴ The HWIS was developed jointly by Environment and Climate Change Canada (ECCC), Health Canada, the Ontario Ministry of Health and Long-Term Care, and Public Health Ontario, in consultation with public health units (PHUs).⁴ PHUs' roles in HWIS activities are enabled through the Ontario Public Health Standards and Protocols which include minimum requirements for public health programs and services in this area.^{4,15-17}

The HWIS outlines the thresholds and processes for Heat Alerts and Extended Heat Alerts.^{5,7,18} Ontario PHUs receive weather forecasts from ECCC. A community's heat response plan is generally activated when specific criteria are met (e.g., if specific conditions are forecasted to last at least 2 days) and ECCC issues a Heat Warning.¹⁹

Ontario's HWIS system is **single-tiered**, meaning the issue of a heat warning by ECCC is the only formal trigger to initiate response actions for affected PHUs and municipalities.¹⁸ If a Heat Warning is issued, the relevant PHU(s) will then advise residents of the forecasted heat event and provide recommendations on how to protect themselves from heat-related illnesses.²⁰ There is no additional threshold to formally escalate the response to an elevated level, such as an "emergency" level.¹⁸ However, individual PHUs may describe compounding threats (e.g., power outages, wildfires, extreme weather)¹⁹ or "heat emergencies" on their websites (e.g., Chatham-Kent: heat emergencies are declared during extenuating circumstances such as a concurrent large scale power outage or water emergency during a heat event.).²¹

ONTARIO HWIS THRESHOLDS

In Ontario, a **Heat Warning** is issued by ECCC when specific temperature or humidex conditions are forecast to occur for two consecutive days.⁴ A heat warning is called an **Extended Heat Warning** if it persists for three or more days, however this change in label does not mandate a change or escalation in response actions. ECCC may issue a **Special Weather Statement** at their discretion if conditions could pose health risks, but do not meet the thresholds for a Heat Warning (e.g., duration less than two days). Issue of a Special Weather Statement also does not formally trigger any required responses at the affected PHU, municipal or local level. While initiation or escalation of response is not mandated by the provincial system for a Special Weather Statement or Extended Heat Warning, there are no restrictions on PHUs, municipalities or community partners enacting responses in these scenarios.

Table 1. Definitions of Alert Statuses in the Ontario HWIS

Alert Status	Conditions
Special Weather Statement	Concerns surrounding elevated temperatures, without meeting heat warning criteria
Heat Warning	Regional heat alert thresholds exceeded for 2 days
Extended Heat Warning	Regional heat alert thresholds exceeded for 3 or more days

Ontario is organized into three Heat Warning regions, Northern, Southern, and Extreme Southwestern, each with different thresholds to trigger a Heat Warning.^{4,22,23} Please refer to the [HWIS guidance resource](#) for a map of these regions.²² The different heat warning thresholds between these three regions are designed to be reflective of potential adaptability/ tolerance of the population residing in each area (also considered vulnerable populations impacted by heat as well) to various temperatures.¹⁸

The temperature thresholds for a heat warning are 29°C (Northern) and 31°C (Southern and Extreme Southwestern) or warmer in the daytime and 18°C (Northern), 20°C (Southern) to 21°C (Extreme Southwestern) or warmer in the evening for two or more consecutive days. The humidex criteria to trigger a heat event ranges are 36, 40 and 42 or higher for two or more consecutive days, for the Northern, Southern and Extreme Southwestern regions, respectively. Either the temperature **or** humidex threshold must be forecasted to endure for two or more days to trigger the Heat Warning process.^{18,22,23}

If the thresholds are forecast, the ECCC will issue a public **Heat Warning**, ideally 18–24 hours before the onset of the elevated temperatures. Also in ideal forecasting circumstances, PHUs receive an advance notice from ECCC one hour prior to the public Heat Warning, which allows PHUs to prepare for the potential heat event, associated response activities, and potentially support those most vulnerable to health harms. Weather is unpredictable, thus there are times when the Heat Warnings are issued without the 18–24 hour lead time or the one hour advance notice to PHUs.

ONTARIO PHU FEEDBACK

Among the 13 PHUs that provided further information on their local HWIS activities, one was located in the Extreme Southwestern region, ten in the Southern region, and two in the Northern region. Several PHUs shared that they were involved in sharing or distributing Heat Warning messages or notifications from ECCC, with one PHU indicating that once an ECCC Heat Warning was issued, they would “amplify the warning by providing communication internally, to community partners, local media outlets and update the [city] website for public information”. In terms of thresholds, one PHU added “the topic of ‘extreme heat warnings’ or ‘extended heat warnings’ has always been up for discussion as Environment Canada does not issue these, and the discretion has been left to individual boards of health”.

JURISDICTIONS BEYOND ONTARIO

HARS STRUCTURES

The structure of HARS varied across the additional jurisdictions. Similar to Ontario, several jurisdictions do not have a multi-tiered system. Other jurisdictions’ HARS used two-tiered or multi-component systems which provide a formal escalation from a “standard” heat alert, to an “emergency” or “extreme” level when certain conditions are met. The jurisdictions beyond Ontario included in this scan report have been organised according to the tier system.

Single-Tiered

Alberta issues Heat Warnings based on ECCC thresholds.^{23,24} The Government of Alberta and public health organizations provide various individual-level suggestions to the general public and also refer to Health Canada resources related to heat events; we did not identify a specific heat alert and response plan. The Government of Alberta initiated a pilot in 2022 to support Alberta Health in the development of a heat alert and response system for the province.²⁵ This pilot is based around Health Canada’s Best Practices Guidance for heat alert and response systems.¹⁴ The Government of Alberta’s website also flags a scan (2022) of strategies to inform options for extreme heat in Alberta.²⁶

Two-Tiered

BC recently updated their provincial heat alert and response system (2023) following the 2021 heat dome. A key component of the update to BC's Provincial Heat Alert and Response System (BC HARS) was an enhancement to a two-tiered warning system. The two tiers are: Heat Warning and Extreme Heat Emergency. The tiers are each associated with specific recommended actions for health sector and other partners including Public Health, Health Emergency Management BC, health authorities, health care providers, hospitals, and community care sites; Ministries, Ministry of Health, and Emergency Management BC; Local authorities and Indigenous communities; and non-government organizations and other partner organizations.^{23,27,28}

- **A Heat Warning** means daytime and overnight temperatures are higher than usual for 2+ consecutive days, but they are not getting hotter every day. The public is encouraged to take usual steps to stay cool.
- **An Extreme Heat Emergency** means daytime and overnight temperatures are higher than usual, and they are getting hotter every day for 3 or more consecutive days. The public is encouraged to activate personal emergency plans. Consensus to issue an Extreme Heat Emergency comes from members of the BC HEAT Committee and public health representatives from the impacted regions. The BC Heat Committee includes representatives from BC Centre for Disease Control, BC Ministry of Health, each BC regional health authority, First Nations Health Authority, BC Emergency Health Services, BC Housing, Emergency Management BC, ECCC, Health Emergency Management BC, Office of the Provincial Health Officer and WorkSafe BC. ECCC will not end the Extreme Heat Emergency without a recommendation from the BC HEAT Committee.

Québec has two different heat alert systems in place. A heat warning in Québec is issued to affected region(s) per the ECCC thresholds (conditions must persist for at least one hour), and a regional response plan is triggered. The same threshold is used across the province. This Warning is valid for a relatively short time period (6 hours). Response plans vary based on the region.²⁹

An extreme heat event is issued by the Institut national de santé publique du Québec (INSPQ) SUPREME system. Temperature thresholds differ across the province based on health region and are designed such that the triggering of an Extreme Heat Event implies greater health and mortality risk than an ECCC warning.²⁹ As soon as two or more regions are at the "Alert" level of their regional plan, triggered by the INSPQ SUPREME system, the Ministère de la Santé et des Services Sociaux (MSSS) fully activates the departmental plan and implements all provisions of the plan in terms of data and information collection and consolidation, as well as the circulation and dissemination of information. MSSS assumes leadership to facilitate the coordination of stakeholders measures.³⁰ This does not replace regional plans, but rather complements them by giving the MSSS and network response a provincial scope.

Multi-Tiered

France operates a National Heat Wave Plan which is a multi-tiered system with four levels:³¹⁻³³

- Green: seasonal observation is in place automatically from June 1 to September 15 each year, no particular concerns. Météo-France begins heat wave surveillance and updates the alert map twice daily. National helplines are open (free to call from landline), national and local authorities prepare for heat waves.
- Yellow: heat warning, “be attentive”. Regions that are yellow are observed more closely by relevant authorities. Services (e.g., emergency services) prepare for an orange alert and communicate advice on how to manage during a heat wave.
- Orange: heat wave alert. In the event of an alert, each sector involved in response can refer to their action sheet (11 sectors and action sheets). Examples of actions include: increased communication to spread awareness of the dangers of heat waves; in retirement homes, a “plan bleu” can be announced, which involves greater mobilisation of staff and resources to counter specific threats; ambulance and nursing services are mobilised; municipalities establish lists of people vulnerable to heat waves and can offer support; additional support is given to people experiencing homelessness.
- Red: extreme heat wave, announced during exceptional, intense or prolonged heat waves which may be associated with droughts, water supply issues, excess burden on health care services and funeral homes, power outages, forest fires, etc. The government facilitates an inter-regional crisis group to implement exceptional measures. The Prime Minister can entrust the management of the operational crisis to a minister whom they appoint according to the nature of the events.

The United Kingdom heat event plan was recently updated (2023). It is in place from June 1 to September 30 each year, and involves a multi-tiered system that is similar to France.³⁴ The tiered system has four levels that range from: Green (preparedness) which is no alert, business as usual, through yellow (response, could impact those who are particularly vulnerable), amber (enhanced response, with weather impacts felt across the whole health service, with potential for the whole population to be at risk) and red. A red alert (emergency response) indicates significant risk to life for even the healthy population.

Italy uses a national alarm system called the Heat Health Watch Warning System. From May to September, bulletins from the system³⁵ describe the level of risk over the next 24, 48, and 72 hours. The bulletins are published daily on the Ministry of Health portal and sent to the Local Health Authority in each city. There are four levels. Level 0 is no risk to health. Level 1 is low risk predicted for next 24-72 hours. In addition for level 1, level 2 risk may be expected in the future, along with a need to pre-warn health and social services. Level 2 is high risk conditions which may adversely affect health predicted for next 24-72 hours. In level 2, health and social services are placed on alert. Level 3 is high risk conditions persisting for 3 or more days, with health and social services remaining on alert. Individual and organizational interventions are related to levels of risk. Health Authorities in each city may also create and use their own locally developed alarm system to activate heat health-related interventions.

HARS THRESHOLDS

Two Canadian jurisdictions' thresholds are structured relatively similar to Ontario's.

- BC:^{23,27} the minimum temperature range in the daytime (28°C to 33°C) and nighttime (13°C to 18°C) vary based on the region within the province. Time threshold for Heat Warning: 2+ consecutive days. Extreme Heat Emergency if triggered when the Heat Warning criteria have been met AND the forecast indicates that the daily highs will substantively increase day over day for 3+ consecutive days.
- Alberta:²³ minimum temperature range daytime (29°C to 32°C) and nighttime (14°C to 16°C). Time threshold for Heat Warning: 2+ consecutive days.

The international jurisdictions have similar thresholds to the Canadian jurisdictions.

- France:³⁶ minimum temperature daytime (32°C to 36°C) and nighttime (17°C to 24°C). Time threshold: average temperature reach thresholds over at least 3 consecutive days.
- Italy:³⁷ thresholds are based on a complex model, and temperature ranges vary based on designated risk level, and month of the year. To summarize at a high level, Risk Level 1: temperature range encompassing all thresholds from May to September between 25.5°C to 36.5°C. Risk Level 2 temperature range encompassing all thresholds from May to September: 27.5°C to 39.5°C. Risk Level 3: when Level 2 persists for 3+ days.
- United Kingdom:³⁸ minimum daytime temperature range: 25°C to 28°C. Time thresholds: at least three consecutive days with daily maximum temperatures meeting or exceeding the minimum temperature threshold.

Two jurisdictions are less similar to Ontario.

- Québec:^{23,29} temperature minimum 30°C and humidex value minimum 40°C. Time thresholds: both temperature and humidex persist for at least one hour, or temperature is 40°C or more. An Extreme Heat Warning is issued by INSPQ, typically if weighted average of the maximum temperature expected over the next three days are between 31°C and 33°C and the minimum temperatures expected are between 16°C and 20°C.
- California:³⁹⁻⁴¹ currently does not have a formalized heat warning system or threshold to define an extreme heat event. A law has been proposed to create advanced warnings for heat waves.

People at Elevated Risk of Adverse Health Impacts

ONTARIO

According to Emergency Management Ontario and the HWIS, groups reported at elevated health risks during heat events include: older adults; infants and young children; people with chronic illnesses, such as breathing difficulties, heart conditions, or psychiatric illnesses; people with disabilities, people who work in the heat; people who exercise in the heat; people experiencing homelessness; and low-income earners.^{18,42}

IDENTIFYING PEOPLE AT ELEVATED RISK OF ADVERSE HEALTH IMPACTS

Ontario PHUs use the **Ontario Climate Change and Health Toolkit** (2016) to identify the health vulnerability status of their communities and develop mitigation plans.^{15,43} The **Ontario Climate Change and Health Toolkit** includes guidelines, a checklist and a workbook to support PHUs to identify and assess vulnerabilities within their communities.⁴³ Within the toolkit, vulnerability is described as “the propensity or predisposition to be adversely affected”. Vulnerability can arise because of individual susceptibility, geographic location, socioeconomic factors, and a wide range of other factors that determine an individual or community’s susceptibility to harm and ability to cope with an event. For example, certain individuals can be vulnerable to extreme heat events because of where they live (parts of cities may warm more than others), characteristics of their dwelling (such as whether there is cross ventilation) that influence inside temperature, socioeconomic status, age, fitness, and a range of other factors that determine their susceptibility to high ambient temperatures”.¹⁷ Some examples of indicators in the toolkit include: socially and economically disadvantaged populations, people with conditions that inhibit temperature regulation, seniors, children, and those without air conditioning. Several PHUs (e.g., Waterloo Region, Wellington-Dufferin-Guelph) have completed vulnerability assessments.¹¹

Similar lists of people at elevated risk during heat events were identified on PHU websites. For example, the City of Hamilton website describes people at increased risk as: those age 65 and older, young children, people with chronic medical conditions, outdoor workers and people who exercise outdoors.⁴⁴ The Niagara Region website list: infants and children, seniors, people living in poverty and/or without permanent shelter, people who work or exercise outside, and people with high blood pressure, heart and/or respiratory problems.⁴⁵ Public Health Sudbury and Districts (PHSD) reported a comparable list on their website, however also included: pregnant people, people taking certain medications, and people who use alcohol or illicit drugs.⁴⁶

ONTARIO PHU FEEDBACK

The website scan did not identify municipal or public health registries of vulnerable individuals for use during heat events. PHU experts were asked about perceived barriers to implementation of such a service. The most commonly described barrier was staff capacity. Other perceived barriers included: privacy/security; database maintenance; and being located in a large geographical area and/or with a large and varied population. There was also acknowledgement that community service providers may have pre-established relationships with clients that could more efficiently connect vulnerable populations with resources.

JURISDICTIONS BEYOND ONTARIO

This scan identified variability across jurisdictions in terms of the groups considered at elevated risk of adverse health outcomes during a heat event. Only three groups were listed by all 11 jurisdictions: older adults, infants and children, and people with disabilities or chronic illness (mental or physical). Of note, among these three groups, specific parameters also varied. For example, some specified an age for older adults (e.g., 65 years and older) whereas other simply stated “seniors”. Some specified the relevant chronic conditions (e.g., heart or lung conditions, diabetes, kidney disease, Parkinson's disease or some mental health conditions) and others were broader in referring to any chronic illness.

Other identified groups included: people who work in the heat,^{13,18,24,25,28,42,47-52} people who live alone or are socially isolated,^{24,25,28,48-50,52-58} people who are unhoused, underhoused or live in spaces that are difficult to cool,^{13,18,24,25,28,42,47-50,52,53,58} people taking certain medications,^{13,18,24,25,42,47-50,53-58} low income earners,^{13,18,42,47,51-58} people who use substances,^{24,25,28,52-58} people who are pregnant,^{24,25,28,48,51,52,58} people with limited mobility,^{24,25,28,53-58} people who exercise in the heat,^{13,18,42,47,48,51,58} people who are dependent, fragile or lack autonomy (e.g., bedbound),^{48-50,52,53} and people in areas with low neighbourhood safety or high crime rate.^{52,53}

To provide a comparison of the groups and/or individuals considered vulnerable as described above to a real-world event, the BC Coroner’s Report following the 2021 heat dome was reviewed. Major findings in relation to the demographics and characteristics of those whose deaths were attributed to the heat dome, included:⁹

- 98% of deaths occurred indoors;
- Heat-related deaths were higher among persons on specific chronic disease registries (schizophrenia, substance use disorder, epilepsy, chronic obstructive pulmonary disease, depression, asthma, mood and anxiety disorders, and diabetes) compared to the BC population;
- More than 60% of those who died had seen a medical professional within the month prior to their death;
- 67% of those who died were aged 70 years or older;
- More than half of all who died (56%) lived alone;
- More people who died lived in socially or materially deprived neighbourhoods than the general population; and
- Most deaths were in homes without adequate cooling systems, such as air conditioners or fans.

An additional recent study examined chronic diseases associated with mortality during BC’s 2021 heat dome.¹⁰ Results found that schizophrenia was significantly associated with extreme heat event mortality, and was the only disease significantly associated with mortality across all study subgroups (all-cause mortality, heat-related mortality, mortality category pending, and non-heat related mortality).

IDENTIFYING PEOPLE AT ELEVATED RISK OF ADVERSE HEALTH IMPACTS

The NCCEH has developed several useful resources and tools related to heat events. A practical tool developed in 2022 supports people (health or social care professionals, laypersons) to know who is most at risk of heat-related harm and how to approach a wellness check.⁵⁵ The **Health Checks During Extreme Heat Events Checklist** is a brief user-friendly tool available in English, French, Chinese (traditional and simplified), and Punjabi. The tool has five components with guidance for the user completing the check. The components include: 1) Rapid risk assessment checklist; 2) recognizing and responding to heat-related illness; 3) in-person health checks; 4) remote health checks; and 5) measuring body and room temperature which includes actions to reduce body temperature (e.g., remove clothing layers, drink cool water, prepare cool damp towels) and indoor temperature (e.g., air conditioner, use fan if below 35°C, turn off heat-generating devices).

A second example at the Canadian national level, are heat-related guidance resources developed by Health Canada for various levels of health or public health organizations and professionals. Please see the Additional Resources section for the full list. A resource directly relevant to the identification and protection of individuals or groups vulnerable to harm is **Adapting to Extreme Heat Events: Guidelines for Assessing Health Vulnerability** (2011).¹³ This guidance outlines six assessment steps for identifying current and future vulnerability of individuals and communities to extreme heat events. These steps may be informed and facilitate by review of literature, inventory of data, surveys and interviews, geographic information systems, public health mapping, or climate modelling.

- **Initiate the assessment:** identify assessment scope and objectives, develop work plan, engage stakeholders.
- **Describe current vulnerability:** characterize heat exposure, air pollution exposure, community vulnerability and individual vulnerability; inventory programs and activities to address heat risks; evaluate effectiveness of current programs.
- **Assess future risks:** trends expected to influence heat-related health outcomes, projected increases in temperature and heat events, describe potential health outcomes of projected increases in temperatures.
- **Identify adaptation options:** inventory possible option, prioritize options, assess barriers to options and how they can be addressed.
- **Examine measures in other sectors:** assess how changes in other sectors influence heat-health risks (e.g., transportation, infrastructure, urban planning, energy systems).
- **Develop performance protocols:** develop evaluation protocols for the adaptation options, develop monitoring protocols for burden of heat health outcomes.

HARS Interventions to Mitigate Health Harms

ONTARIO

HWIS

According to the HWIS, PHU actions to mitigate heat health impacts may include notification and response activities. As noted earlier, once the ECCC issues a Heat Warning, the affected PHU will notify key response partners, community agencies and the public.¹⁸

The HWIS also outlines the roles, responsibilities, and suggested preparedness and response activities for various public health, government and community partners. The HWIS describes the role of PHUs to: receive the ECC heat warnings; communicate the information based on the warnings and appropriate health protective measures; review the guidance provided regarding local partnerships and planning activities, and share with partners for their consideration in local heat response and/or emergency management plans; conduct surveillance of local heat related health impacts; and participate in evaluation activities.¹⁸

The HWIS provides suggestions and flexibility to allow for tailored regional approaches and encourages PHUs to implement various actions, but does not provide specific requirements or mandates for the PHU-level response.¹⁸ At a local level, the responsibility to prepare and respond to heat alerts is shared across municipalities, PHUs, and other local partners. Specific to municipalities and other community partners, the HWIS suggests some areas where PHUs can optimize plans and coordination efforts. For example, working to address the needs of vulnerable populations, making cooling spaces and hydration accessible to the public and responding to impacts on critical infrastructure such as power supply.¹⁸

The Ontario HWIS suggests multiple activities for PHUs to consider leading up to or during a heat warning, grouped into the following categories: preparedness, public education, media and response activities.^{4,22} The full list of these suggested actions is available on the HWIS website.^{4,22} As mentioned above, PHUs can collaborate with municipalities and community partners to enact the response plans appropriate and necessary for the local population. Multiple HWIS suggested activities are related specifically to populations at elevated risk of adverse health impacts. For example, considering a registration service for vulnerable populations, identifying key community partners in accessing and supporting vulnerable groups, identifying cooling options for the public who do not have access to air conditioning at home, and considering financial barriers to individuals cooling themselves and whether mitigation strategies are possible.

ONTARIO PHU FEEDBACK

Among the PHUs who provided additional local information, some described their current heat preparedness and response plans. The most frequently reported preparedness activities included: updating webpages; social media messaging; collaboration and communication with community agencies, committees, and/or municipalities; and review of available cooling shelters.

Beyond communication (required by HWIS) the most common response activities included social media messaging, collaboration and communication with community agencies, committees, and municipalities, as well as preparing media releases.

With respect to key barriers to implementing heat warning activities, staff capacity was noted most frequently. Others included PHU reliance on community partners or municipalities to implement activities (e.g., cooling centres) and funding.

KEY ONTARIO PHU EXAMPLE

The Public Health Sudbury and Districts (PHSD) website includes their Hot Weather Response Plan.^{59,60} The PHSD plan describes the tasks and some of the practical supports that occur in their jurisdiction when a heat alert is declared. The Hot Weather Response Plan incorporates protections for all citizens of the Greater Sudbury Area, as well as more precise and detailed cautions with regard to the highest-risk segments of the population.

- When a heat event occurs, the PHSD declares a heat alert, notifying the City of Greater Sudbury's Emergency Management Section. Following this, the City's Emergency Manager activates the Hot Weather Response Plan and uses their established communication network to inform all community heat response partners of the alert. The PHSD uses various media platforms to inform the public about the heat event, including the dangers posed by extreme heat, where to find cooling shelters, and other notifications deemed salient. The following points are highlighted with respect to those more vulnerable to the heat.
- A level 1 heat warning includes: emphasis on the need for citizens to check in on friends, family and neighbours who may be vulnerable to the heat, and may need assistance in implementing recommended protective actions.
- A level 2 alert or extended heat warning may include: distribution of bottled water to vulnerable populations in conjunction with community partners; extending hours of operation of public swims at city pools; requesting that local utilities halt all service cancellations until after heat warning has passed; extending hours of operation and supervision at municipal beaches. The Hot Weather Response Plan also outlines opening cooling centres at public libraries, citizen service centres and community arenas.
- A level 3 extreme heat alert includes consideration of broader distribution of water; extending hours at cooling centres to 24 hours a day; free bus service by Greater Sudbury Transit to cooling centres; increased public outreach using additional resources such as police, postal workers on rounds and utility staff.

JURISDICTIONS BEYOND ONTARIO

The level of detail reported in each jurisdictions' heat alert and response plan varied, and some included comprehensive multi-layered details of many intervention activities. We summarized the most commonly identified approaches or interventions across jurisdictions in relation to preparedness and early response to heat events.

All jurisdictions reported some level of formal regional, local, or organizational heat alert and response system; however, the structure of systems, number of required or recommended actions, and level of detail in plans varied significantly. Within these plans, some commonly identified high-level approaches included:

- **Coordination of region-, organization-, or department-wide conference calls and communication networks** to initiate preparedness or response actions. These were typically inter-sectoral, involving government agencies beyond health or public health.^{30-33,61,62} For example, in Québec, when a region enters a Heat Alert, the MSSS prepares for other regions to enter an Alert. This initiates coordinating actions with bordering regions via conference calls.³⁰ This practice facilitates exchange of information and provision of support, bringing together civil protection coordinators and potentially representatives of public health and other relevant departments.

- **Public educational or media campaigns regarding heat-related harms and protective behaviours to implement** (e.g. social media, print advertising), typically implemented by health, public health or municipal agencies, some in collaboration with national agencies or environmental or meteorological agencies.^{27,61-66} For example, Health Canada has a Toolkit with standard public messaging related to heat events developed through review of scientific literature and best practices in health risk communication.⁶³ These are available for all provinces, PHUs, municipalities or any other relevant organizations to use and amplify through their own channels. The Toolkit also includes guidance around choosing methods of communication, special considerations for rural communities, and many other useful resources.
- **Opening of call centres, helplines, or other pathways for individuals to connect with social services, clinicians, or others in the health, social, or community sector.**^{31-33,64-66} These types of supports are available at the national level in France,³¹⁻³³ regional level in Italy,⁶⁶ and recommended by Canada's NCCEH to be included in heat response plans.⁶⁴
- **Opening pre-designated cooling centres, implemented at municipal or local levels.**^{27,61,64,66} For example, in BC there are pre-season, Heat Warning and Extreme Heat Emergency actions related to public cooling centres which are the responsibility of multiple groups. These include local authorities and Indigenous communities, public health agencies, Health Authorities and Health Emergency Management BC, non-government organizations and community partners (additional details found in key examples below).²⁷

Interventions to prepare for or respond to heat harms specific to vulnerable individuals or populations were complementary to those for the general population. Examples of interventions or approaches to be implemented by organizations responsible for heat alert and response systems included:

- Considering messaging modes most likely to reach vulnerable individuals;^{27,61}
- Developing processes to identify vulnerable individuals;^{13,14,27,64,67}
- Focusing outreach efforts on high-risk populations (e.g., wellness checks for people at high risk of severe outcomes);^{27,55,64,66,68,69}
- Considering registries of vulnerable individuals;^{31-33,62,69} and
- Ensuring cooling spaces were welcoming and suitable to vulnerable individuals.^{27,61,66,69}

KEY JURISDICTIONAL EXAMPLES

The **BC Provincial Heat Alert and Response System** outlines actions specific to the protection of vulnerable populations at various stakeholder levels:

- **Public Health, Health Emergency Management BC, health authorities, health care providers, hospitals, and community care sites:** utilize messaging modes most likely to reach the most susceptible individuals; impacted regions to consider starting up coordination centre support for susceptible populations; undertake community outreach focusing on high-risk client populations in your health authority; review discharge plans for at-risk patients, keeping in mind their specific needs during heat events; ensure that staff are appropriately trained to identify clients who may need assistance during extreme heat; consider plans for moving susceptible individuals from dangerously hot environments into cooler environments; ensure that staff engaging with the public are aware of local activities to support and protect those at risk; talk with families and caregivers of susceptible individuals about identifying actions to protect those clients and family members from the impacts of heat (and when feasible, check in with those families/caregivers about executing plans).
- **Ministries, Ministry of Health, and Emergency Management BC:** incorporate heat health messages into existing programs that provide services to those most susceptible and at risk.
- **Local authorities and Indigenous communities:** carry out assessments identifying the most susceptible to heat-related illness; identify and engage with key partners and strategic community groups that have interfaced with high-risk or susceptible populations to raise awareness about the risks of heat, and to provide information about tools such as wellness checks; identify relevant information sources for local residents who may be more susceptible to the negative impacts of extreme heat; distribute heat health communication material to groups/programs that have interfaced with high-risk or susceptible populations; assess if cooling centres are an appropriate spaces for high-risk or susceptible populations; undertake community outreach focusing on susceptible and high-risk populations and groups that support them; in partnership with the local health authority, encourage wellness checks for people at high risk of severe outcomes; distribute water to at-risk populations outdoors.
- **Non-government organizations and partner organizations:** create or review and update your heat outreach plans and communication strategies geared towards any susceptible and high-risk populations that you support; identify relevant information sources for your clients who may be at risk of extreme heat and prepare any additional messaging; distribute heat health communication material to strategic teams/employees that have interfaced with high-risk or susceptible populations; assess if cooling centres are an appropriate spaces for high-risk or susceptible populations; conduct community outreach focusing on susceptible and high-risk populations that your group or organization supports; inform local governments and partners of community needs for establishing cooling centres/shelters that are culturally and socially appropriate for the most susceptible and high-risk populations that you work with; engage in wellness checks (multiple times a day, especially in the evening) for people at high risk of severe outcomes.

The Lived Experience of Extreme Heat in BC report was conducted and published in 2022, following the severe heat dome that occurred in 2021.⁶¹ This report includes multiple recommendations for the province based on what was heard from sharing circles, a service provider workshop, service provider interviews and surveys among providers and people with disabilities. Recommendations include short- and long-term focuses and are listed below, each is accompanied by more specific considerations which can be found in the report full text:⁶¹

- **Cooling spaces:** ensure cooling centres are welcoming to all; enable a range of cooling options suitable to specific needs of heat-vulnerable individuals; address underlying challenges of inadequate housing.
- **Mobility and transportation:** increase availability of air conditioned public transit options during extreme heat events; plan for a range of available transportation options to meet accessibility needs during extreme heat events.
- **Communications:** produce and distribute clear, targeted communications materials specific to heat-vulnerable populations; work with the media to raise public awareness; communicate early, directly and in a coordinated fashion with local and regional authorities and service providers.
- **Community and social networks:** develop ways to reach out with time-critical lifesaving information to people that are isolated; work with community partners to enhance mutual support networks (e.g., neighbour-to-neighbour); develop easily accessed supports to fill the gaps in community and social networks.
- **Service providers:** invest in capacity of service provider organizations to provide enhanced services and be a direct distribution point for required resources to heat-vulnerable populations; develop coordinated communication and response protocols and improve extreme heat planning and preparedness at local and regional levels.
- **Policy development:** enable solutions tailored to different needs in rural and urban areas; consider a range of needs and situations; build on existing programs and tools.

Implications for Practice

For this scan, we identified 10 broad jurisdictions and organizations comparable to Ontario and their associated HARS, interventions, or recommendations to minimize harms of heat events. Jurisdictions included BC, Alberta, Québec, the State of California, France, Italy, and the United Kingdom; organizations included US CDC, Health Canada and NCCEH. We found diversity in HARS structures, number of alert levels, and associated actions or recommendations to prepare for, mitigate, or respond to human health harms. All jurisdictions used temperature and duration triggers, with some also incorporating humidex. Older adults, infants and children and people living with disability or chronic diseases were consistently considered at elevated risk of heat related harms across all jurisdictions and organizations.

Based on the findings of this scan, potential areas for further exploratory work and considerations to optimise Ontario's existing HARS (i.e., the HWIS) include:

- Further exploration of characteristics and factors that place individuals or groups at greater risk of mortality and morbidity during heat events. Furthermore, how can these individuals or groups be better identified, communicated with and protected prior to or during heat events.
- Further investigation of evidence on best practices and effective interventions to mitigate mortality and morbidity during heat waves.
- Exploration of how all partners involved in Ontario's HWIS (i.e., PHUs, municipalities, community partners) may be supported to strengthen and tailor their Heat Warning preparedness and response activities to protect individuals and groups in the community at greatest risk of harm. For example, further engagement with these partners to understand barriers, facilitators and needs in relation to their Heat Warning preparedness and response activities; look to exemplar resources like the BC Provincial Heat Alert and Response System which outlines actions specific to the protection of vulnerable populations at various stakeholder levels.
- Investigation of the impact and effectiveness of multi-tiered systems in comparison to single-tiered systems. Specifically, do multi-tiered systems reduce mortality and morbidity during heat events or heat emergencies, and if so do these protections apply to people at greatest risk of harm?
- Overall, continue to emphasize that heat events are expected to increase in frequency and severity. Dedicated attention and action are needed to mitigate the harms of heat events which inequitably harm certain individuals and groups more than others. Heat may compound with other events such as power outages or severe weather such as wildfires to create complex and deadly emergencies.

Resources

The full jurisdictional scan data collection document is available upon request. This list collates actionable or practical resources identified through the scan, organized by jurisdiction/organization.

Alberta

- [Strategies to manage heat: a jurisdictional scan \(2022\)](#):²⁶ synthesis of strategies used to manage heat collected from municipal, provincial, federal and international agencies.
- [Adaptation Strategies for Reducing Extreme Heat Health Impacts: A Rapid Review \(2022\)](#):⁷⁰ report identifying strategies or interventions to reduce adverse heat-related health outcomes, with a focus on vulnerable populations.
- [Extreme heat information sheets \(2022\)](#):²⁴ information for the general public, seniors, adult care facilities, child care facilities, and schools about the risks of extreme heat, how to identify heat illness, how to prepare for extreme heat events, and what actions can be taken to reduce risk during an extreme heat event.
- [Best Practice – Working Safely in the Heat and Cold \(2014\)](#):⁷¹ describes the potential health risks associated with working in hot environments and steps take to monitor and mitigate these risks. Document has sections aimed at both the employee and employer.

British Columbia

- [Extreme Heat Preparedness Guide \(2021\)](#):⁷² includes tips for individuals and organizations to prepare ahead of the summer season, in as temperatures, and during a heat event or heat emergency. While produced for the BC population, tips are also directly applicable to any population.

NCCEH:

- [Health checks during extreme heat events \(2021\)](#):⁵⁵ checklist which may be used by general population (e.g., checking on family on neighbours) or health/social care providers conducting home visits or wellness checks.

Health Canada

- [Acute Care During Extreme Heat: Recommendations and Information for Health Care Workers \(2018\)](#):⁷³ fact sheet for any type of health care worker with the information related to heat illnesses and heat sensitive diseases, signs and symptoms, risk factors, and treatment priorities.
- [Adapting to Extreme Heat Events: Guidelines for Assessing Health Vulnerability \(2011\)](#):¹³ guidance for public health providers, as well as community providers, partners and other stakeholders, to conduct a health vulnerability assessment
- [Communicating the Health Risks of Extreme Heat Events \(2020\)](#):⁶³ a toolkit for public health and emergency management officials to provide practical and useful information to health service providers, caregivers and the public to help manage health risks from extreme heat events.
- [Community Care During Extreme Heat: Heat Illness: Prevention and Preliminary Care \(2018\)](#):⁶⁸ fact sheet for health care workers working outside of facilities in the community and in patient/client homes; includes a client visit checklist.

- [Extreme heat and human health: For pharmacists and pharmacist technicians](#) (2021):⁷⁴ fact sheet with focus on recognizing and preventing heat-related illness, how certain medications can impact heat-related illness, and specific recommendations for pharmacists and pharmacist technicians during extreme heat.
- [Extreme Heat Events Guidelines: Technical Guide for Health Care Workers](#) (2011):⁶⁷ This comprehensive document provides background information on extreme heat events, physiology of heat-related illnesses, risk factors, prevention, disaster preparedness and future directions.
- [Health Facilities Preparation for Extreme Heat: Recommendations for Retirement and Care Facility Managers](#) (2020):⁷⁵ fact sheet with recommendations related to managing staff, supplies, patient care, facility emergency plans, and planning for new facilities and renovations.
- [Heat Alert and Response Systems to Protect Health: Best Practices Guidebook](#) (2012):¹⁴ guidebook that covers heat-health vulnerability, adaptation options, development of heat alert and response systems (HARS), evaluation of HARS, and examples and case studies

US CDC

- [Climate Change and Extreme Heat – What You Can Do to Prepare \(2016\)](#):⁷⁶ booklet for individuals describing the effects of extreme heat and what can be done before and during extreme heat events to reduce health risk.
- [Warning Signs and Symptoms of Heat-Related Illness \(2017\)](#):⁷⁷ infographic including the symptoms of heat-related illnesses and how to respond.
- [Planning for an Emergency: Strategies for Identifying and Engaging At-Risk Groups \(2015\)](#):⁷⁸ document aimed at professionals who prepare for, mitigate, respond to, assist in recovery from, and provide products and services for emergencies and disasters to assist in identifying, planning for, and assisting at-risk groups or socially vulnerable populations.

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Appendix A: Jurisdictional Scan Methods

This jurisdictional scan was conducted using several methods to collect non-peer-reviewed, or grey, evidence.

First, key word searches were conducted in the Google search engine and in specific government and public health organization websites. Key words included, but were not limited to: heat wave, extreme heat, heat dome, heat event, heat warning, heat alert, heat preparedness, heat-related illness, vulnerability and risk. A snowball search method was used to allow exploration of relevant resources and webpages within and beyond the initial search results; for example, by scanning reference lists and navigating through multiple related webpages. Potential resources were also obtained through discussions and suggestions from key informants and subject matter experts; these were assessed against the eligibility criteria for this scan. Searching was conducted by three individuals between April 3 and May 18, 2023.

The jurisdictions and organizations for this scan were selected following discussion and consensus among those involved. These were selected for their comparability to the Ontario context (e.g., similar climates, social systems), known histories of addressing health outcomes of extreme heat events, or relevant content for extraction and/or clear examples revealed from preliminary searching.

The 11 broad jurisdictions included in this scan were:

- Canadian jurisdictions/organizations: Ontario, British Columbia, Alberta, Québec, Health Canada, and the National Collaborating Centre for Environmental Health (NCCEH).
- United States (US) jurisdictions/organizations: US Centers for Disease Control and Prevention (CDC), and the State of California.
- International jurisdictions: France, Italy, and the United Kingdom (UK).

The eligibility criteria used to select records for this jurisdictional scan are described below.

Inclusion criteria:

- Records published from 2011 onward.
- Records relevant to heat events.
- Records include interventions, measures or initiatives aimed at mitigating adverse health outcomes of heat events, and interventions are intended to be implemented in preparation for the summer season or in the event of an extreme heat event (i.e., immediate or short-term approaches). This eligibility was applied to identify records that are most applicable to the current Ontario context, where we are approaching the summer season and heat events may occur in the coming weeks to months.
- Records that describe people, communities or populations who are vulnerable to or at greater risk of health harms from a heat event; or otherwise address key health equity considerations for the mitigation of heat-related harms.
- Records that describe the threshold(s) used in jurisdictions to implement a heat alert, warning, specific support or mitigation activities.

Out of scope:

- Records focused on non-health outcomes of heat events.
- Records focused on non-human outcomes.
- Records focused on interventions, measures or initiatives focused only on long-term changes (e.g., urban design, green infrastructure that takes extensive time to implement), which are not implementable in the context of a heat event that may occur in the coming weeks to months.

The synthesis and overviews of results from the scan were completed narratively and developed through discussion among the research staff.

To augment the website information and to increase PHO's understanding of the Ontario context, PHUs were asked to share feedback about how they are, or will be, preparing for and responding to heat events. They were asked to share information that may not be readily available on their respective websites. This included feedback about reaching vulnerable populations, implementation challenges, and perceived needs for improvement. All PHUs were asked in advance for permission to share the findings. PHUs were also asked separately if their feedback was presented as a quote. At the time of writing this scan report, a total of 13 health units provided information, representing 38% of all (n=34) PHUs in Ontario.

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