



Climate and Human Health Responders Course for Health Professionals

Health Sector Mitigation and Adaptation
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Science Advisor to the Director, Health Canada



Health Sector Adaptation and GHG Mitigation

Learning Objectives

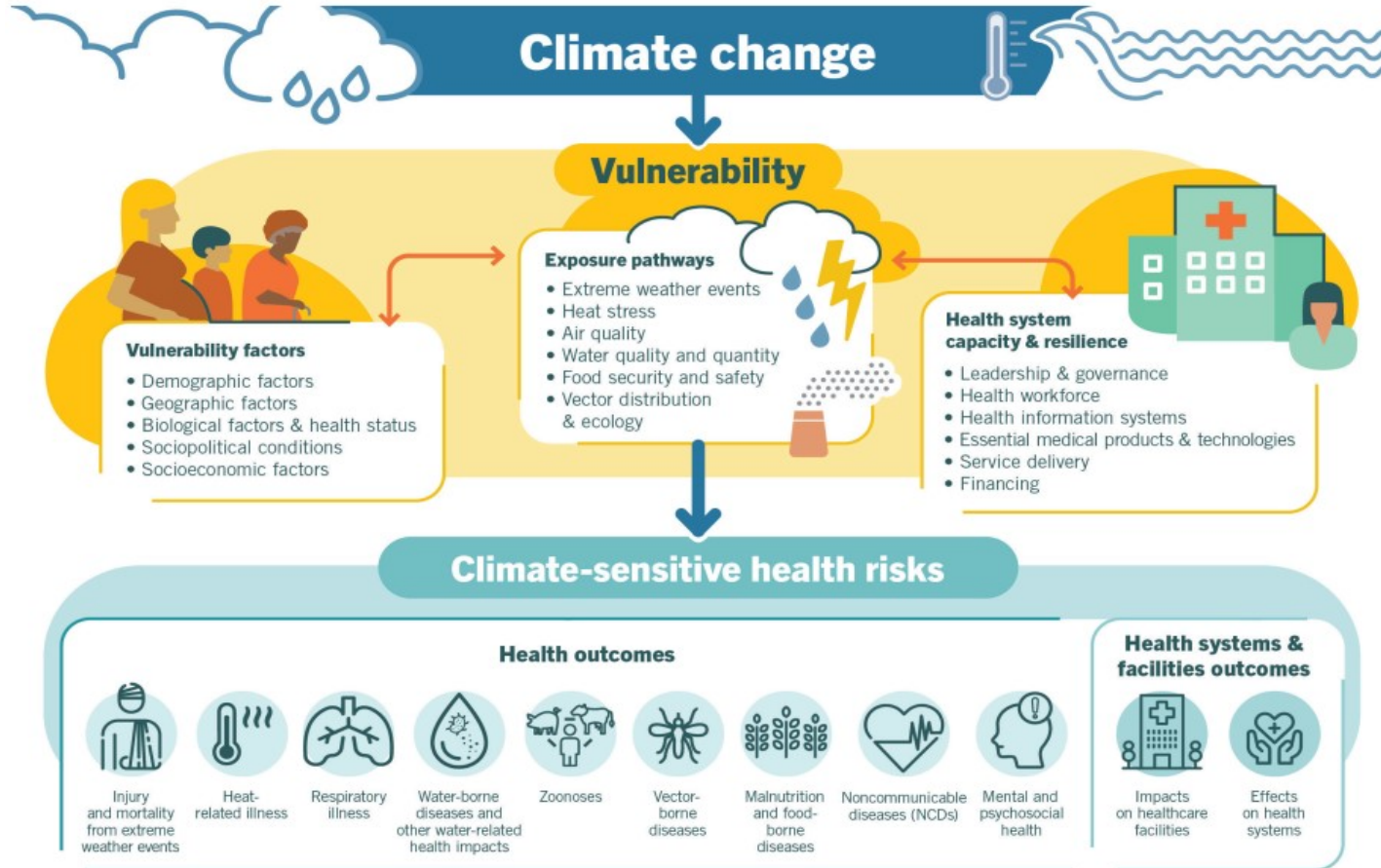
- Describe how to assess the vulnerability of health systems and facilities to climate change impacts using new tools and methods
- Apply the concepts of mitigation and adaptation to the health care sector and explore examples of how health care systems can reduce climate change risks by performing both.
- Identify ways in which health care facilities can become more resilient in the face of increasingly severe and/or frequent climate-related hazards, such as weather extremes.
- Integrating climate change information into health sector programs and operations, for example, using emergency planning skills to plan for and respond to climate-related extreme weather events and disasters, including workforce surge needs, and distinguish the roles of and interactions between agencies involved in emergency care.

Disclosure Information

No Disclosure

Climate Change Threats to Health and Health Systems

Major Health Risks From Climate Change



Climate Variability and Change Impacts on Health Systems and Facilities

Impacts on health facilities related to climate disasters are increasing. From 2005 to 2019 there was an average of 412 facilities destroyed each year by such events.

(UNDRR, 2019)



Climate Hazard Impacts on Health and Health Systems

Extreme Heat (June 25 – July 1, 2021)

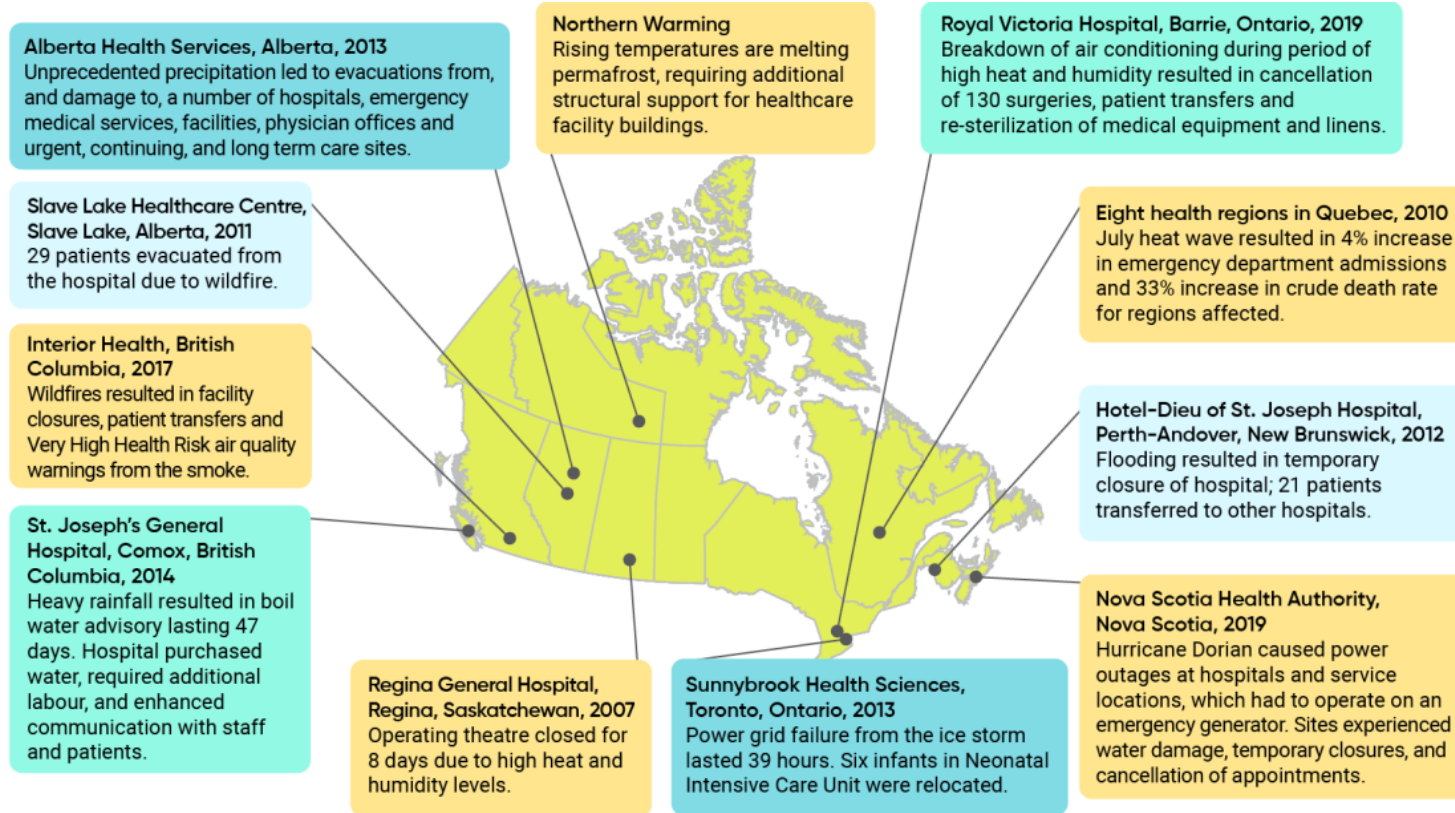
- British Columbia - sixty temperature records fell on June 27th
- Lytton, BC broke national heat record with temperature of 49.6°C (121F).
- Seniors living alone with chronic illnesses most at risk
- Health services severely stressed
- 740 excess deaths reported over 6 days (Henderson et al., 2021)

Superstorm Sandy (Oct 29, 2012)

- 72 direct deaths
- 72% per cent of those who died suffered from at least one chronic condition
- Health system disruptions in New York and New Jersey.
- 6,400 patients were evacuated
- 6 hospitals and 26 residential care facilities in New York City alone were closed. NYU Langone Medical Center incurred almost US\$ 1 billion in damages; remained fully closed for two months.

(American College of Emergency Physicians, 2015; Seltnerich, 2018)

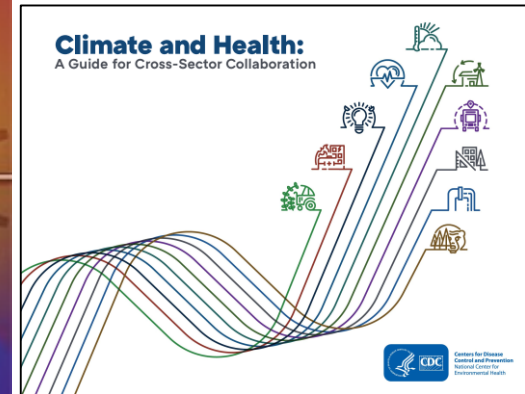
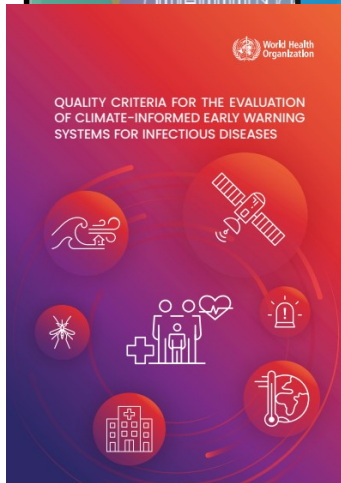
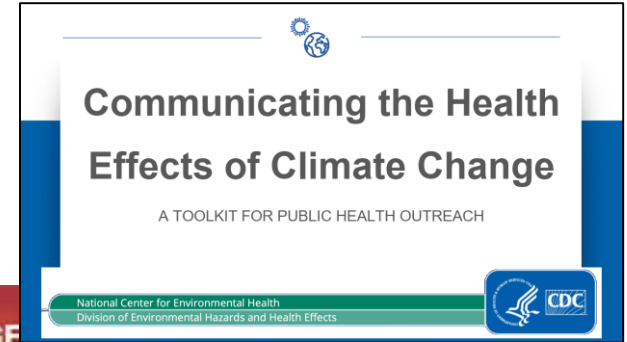
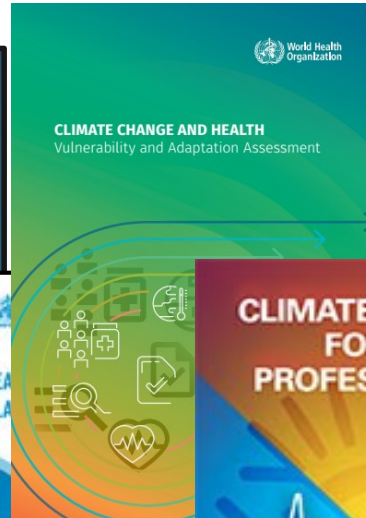
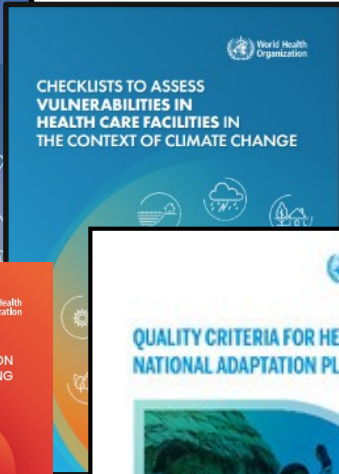
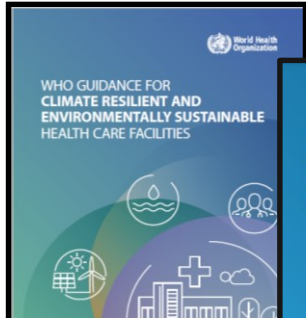
Climate variability and change impacts on Canadian health facilities



Source: Berry & Schnitter, 2022

Assessing Risks to Health and Health Systems

Tools for Preparing Health Systems and Facilities



<https://www.who.int/publications/i/item/quality-criteria-health-national-adaptation-plans>

https://www.cdc.gov/climateandhealth/site_resources.htm

<https://www.who.int/news-room/events/detail/2020/10/13/default-calendar/webinar-climate-resilient-and-environmentally-sustainable-health-care-facilities>

<https://www.who.int/publications/i/item/checklists-vulnerabilities-health-care-facilities-climate-change>

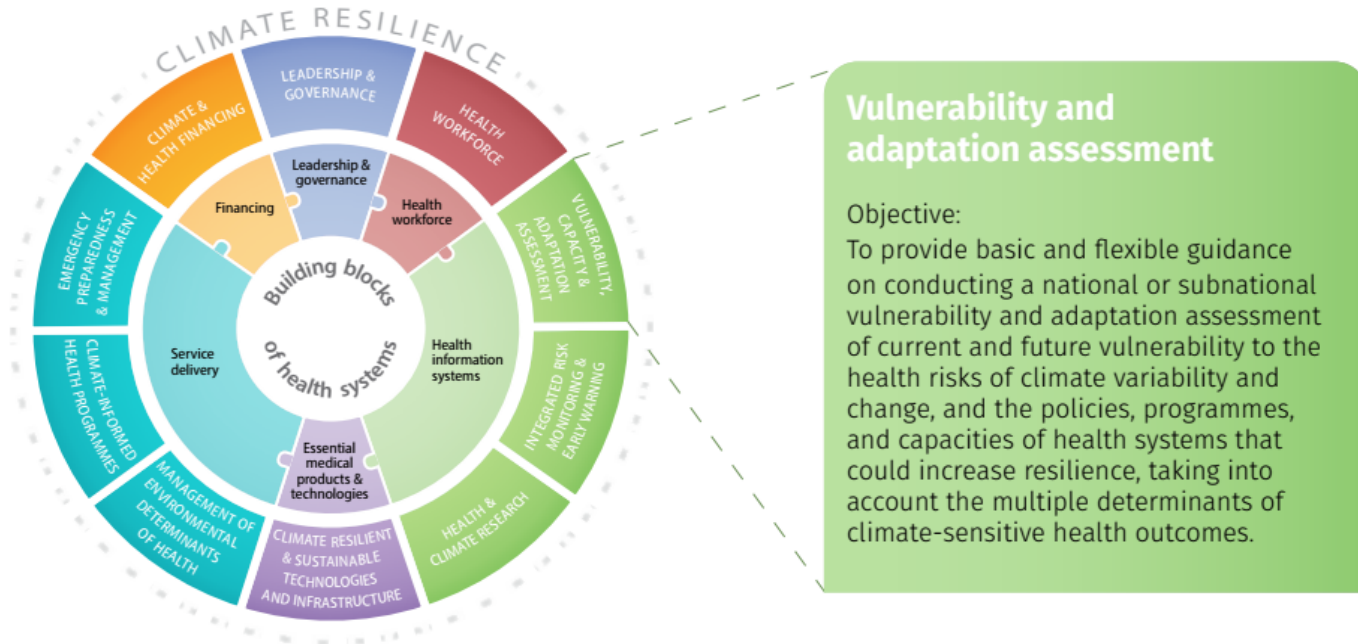
<https://iris.paho.org/handle/10665.2/52930>

<https://www.who.int/publications/i/item/10665345968>

<https://www.cdc.gov/climateandhealth/docs/CrossSectorClimateandHealth.pdf>

Science assessments are an integral part of building individual, community and health system resiliency

Figure 1. Vulnerability and adaptation assessment in the context of the World Health Organization Operational Framework for Building Climate-resilient Health Systems



Source: Operational framework for building climate-resilient health systems. Geneva: World Health Organization; 2015.

Climate Change and Health Vulnerability and Adaptation Assessments

Objectives:

- Improving evidence and understanding of links between weather/climate and health outcomes;
- Identify populations most at risk from climate change impacts;
- Provide robust evidence of current and future projected health risks, including to the health system;
- Identifying adaptation options for adjusting existing policies and programs and for developing new ones to prevent and reduce the severity of future risks;
- Establish a baseline to use to monitor changes in future risks and associated policies and programs;
- Support the development of needed collaborations with decision makers in other sectors (e.g., water, infrastructure, transportation, agriculture, urban planning, energy) to reduce risks to health;
- Support the rationale for investment in adaptations to protect health.

Engaging in a Climate Change and Health Vulnerability and Adaptation Assessment



Step 1: getting started – plan the assessment: →

- Step 1A:** establish a project team and management plan, including representatives from other departments and ministries.
- Step 1B:** identify the questions to be addressed and the policy context.
- Step 1C:** define the health risks, outcomes, geographical region and time period that will be the focus of the assessment.
- Step 1D:** establish a stakeholder process, including populations that could be affected by climate change.
- Step 1E:** identify information and data to inform the assessment.
- Step 1F:** develop a communication plan.



STEP 1

Getting started: plan the assessment



STEP 2

Vulnerability assessment: describe the current burden of climate-sensitive health outcomes and vulnerabilities to climate variability and recent climate change



STEP 3

Capacity assessment: Assess the capacities of health and health-relevant systems



STEP 4

Future risk assessment: qualitatively and/or quantitatively project the health risks of climate change



STEP 5

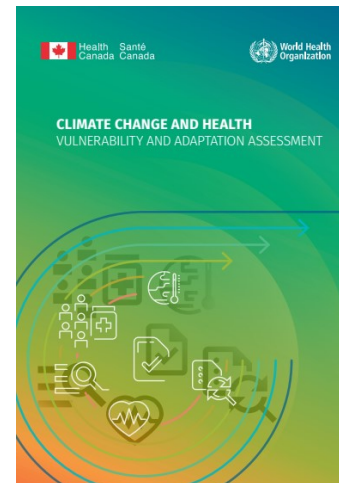
Adaptation assessment: Identify and prioritize policies, programmes and actions to address current and projected health risks



STEP 6

Synthesize the assessment as input into relevant climate change and health policies, plans, and reporting mechanisms

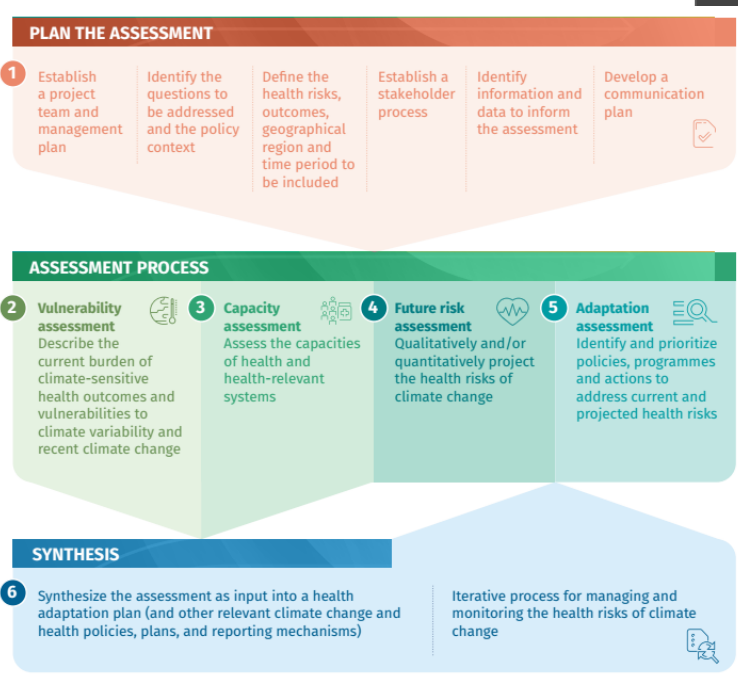
WHO Climate Change and Health Assessment Guidance



WHO, 2021

What is New in the Guidance?

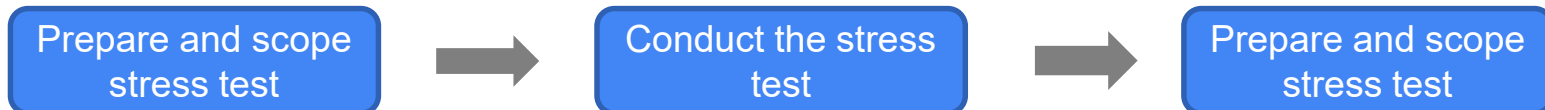
- Benefits of **Indigenous partnerships and knowledge** in vulnerability and adaptation assessments (pg 27)
- **Subpopulations vulnerable** to climate-sensitive health outcomes (pg 32)
- Centring **health equity** in climate change and health vulnerability and adaptation assessments (pg 34, 56)
- Assessing vulnerabilities in **health systems and health care facilities** (pg 37, 39)
- **Criteria for identifying priority adaptation options** (pg 53)
- New assessment step on **synthesizing assessment results** into relevant climate change policies, plans and reporting mechanisms (57)



Climate Stress Testing Health Systems and Facilities

The stress-testing tool is used by health sector decision makers develop and use evidence-based climate scenarios in a table-top simulation to identify potential vulnerabilities to climate change impacts and effective adaptation measures (Ebi et al., 2018).

- Implemented to enhance the ability of health systems to manage potentially disruptive climate-related shocks and stresses.
- Utilizes hypothetical scenarios to “test” essential functions of providing services to protect population health related to current and future climate hazards.
- Identifies options for managing climate-related events and challenges and impacts on health systems.
- Build partnerships with key stakeholders within and external to the health facility to sustain future collaborations (Ebi et al., 2018).



HealthADAPT: Capacity Building Program

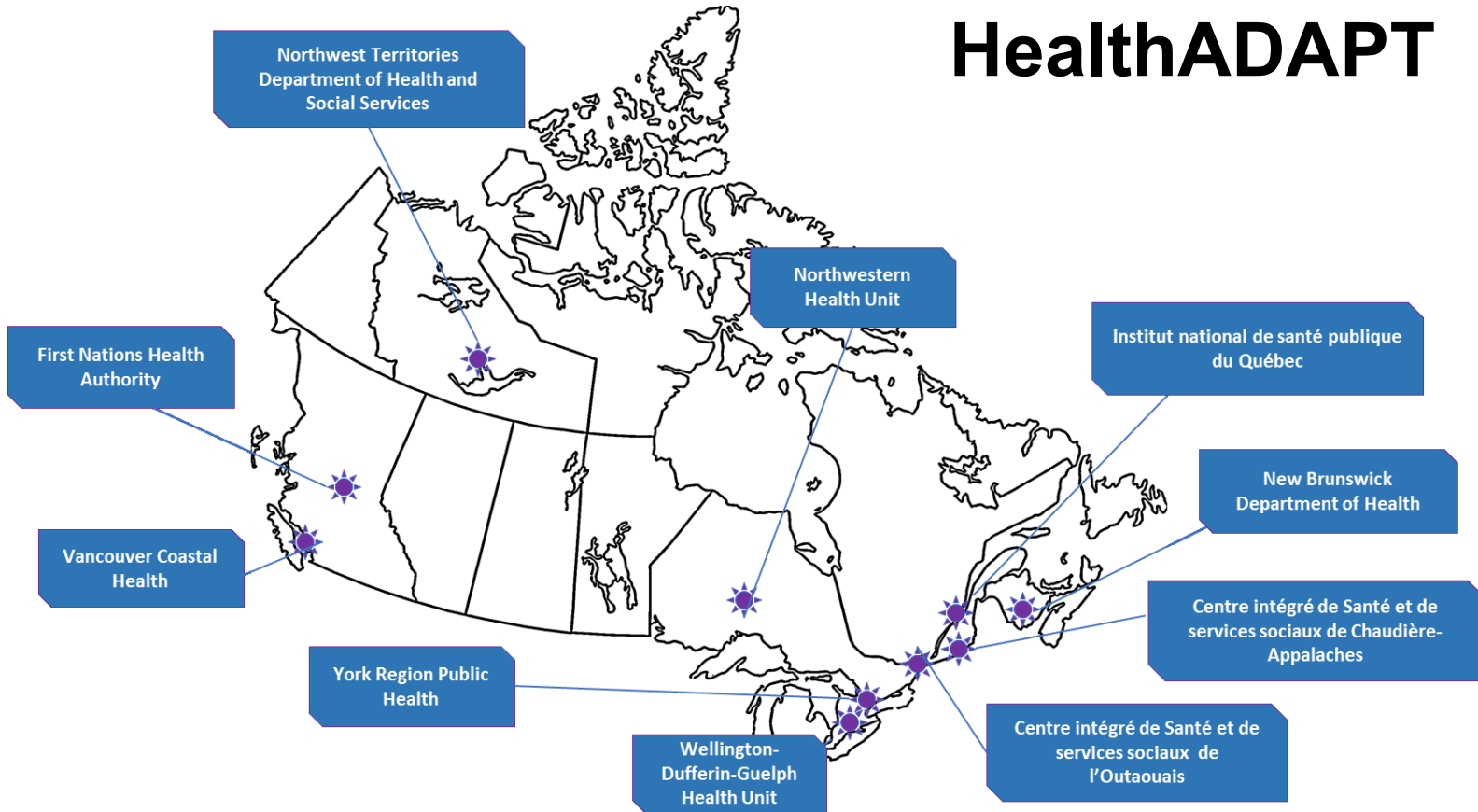
A **multi-year program** introduced in 2019, to support 10 projects at local, regional, and provincial and territorial levels of the Canadian health sector to prepare for and respond to the impacts of climate change.

The projects selected represent the **diversity** across the country, including:

- Indigenous Peoples
- Newcomers
- Urban/rural/coastal communities
- Health sector spectrum (i.e., provincial/territorial ministries of health, regional/local health authorities, public health units)
- Official language communities



HealthADAPT



HealthADAPT: Investigating Health System Risks and Vulnerabilities

Centre intégré de santé et de services sociaux (CISSS) de l'Outaouais

Project title: Prioritization of climate change adaptation measures for all facilities of the Centre intégré de santé et de services sociaux (CISSS) de l'Outaouais

Purpose: Increase CISSS resiliency to the effects of climate change by assessing the vulnerability of its health infrastructures and procedures during emergency situations, and identify and prioritize adaptation measures to address them

Centre intégré de Santé et de services sociaux (CISSS) de Chaudière-Appalaches

Project title: Assessment and support of the capacity of health systems to prevent and limit negative impacts on the mental health and psychosocial well-being of individuals and populations exposed to extreme climate events (ECEs)

Purpose: Assess and support the health systems capacity of 2 CISSS pilot regions (Chaudière-Appalaches and Bas-Saint-Laurent) to prevent the negative impacts on mental health and psychosocial well-being of populations exposed to extreme climate events

<https://www.canada.ca/en/health-canada/programs/health-adapt.html>

HealthADAPT: Indigenous Partnerships

- **First Nations Health Authority:** this project assesses climate change impacts on Indigenous marine food safety and vulnerability of BC Coastal First Nations to develop local and Indigenous specific adaptation strategies.
 - *Combines citizen science, Indigenous Knowledge and research to support adaptation, culturally and locally appropriate means of risk communication and community health, climate resiliency, and food security.*
 - *Adapts traditional food harvesting and sea food storage techniques for climate resilience.*
- **Northwest Territories Dept. of Health Social Services:** this project includes meaningful engagement from all 33 NWT communities, including Indigenous communities.

Mitigation and Adaptation to Protect Health

Mitigation of climate change – A human intervention to reduce the sources or enhance the sinks of greenhouse gases (IPCC, 2014).

Health sector adaptation - includes health officials, in collaboration with those in other fields, taking action to understand, assess, prepare for, and help prevent the health impacts of climate change, particularly on the highest-risk populations. It includes designing, implementing, monitoring, and evaluating specific measures to reduce health risks and includes broader efforts to increase the climate resilience of health systems (Berry et al., 2022).

“In the short-to-medium term (i.e. up to the next 20–30 years) well-planned adaptation measures can avoid many of the projected health impacts.”

WHO, 2015

Who adapts to reduce the health impacts of climate change?

Health system planners and administrators - such as health delivery planners, emergency managers, health facility operators, human resource managers, and financial analysts

Health care practitioners - such as physicians, nurses, nurse practitioners, 911 dispatchers, paramedics, home care workers, pharmacists, occupational therapists, athletic therapists, community support workers and workplace health and safety personnel

Public health officials - such as those involved in environmental health, health communication, food inspection, emergency preparedness, travel medicine, disease prevention, healthy life-styles, communicable diseases, healthy growth and healthy communities

Researchers -
scientists,
knowledge
translation
specialists etc

Civil society partners (medical professional
associations, grass-roots community groups
etc)

**Individuals, including those most at
risk**

**Decision makers
outside of the
health sector** (e.g.,
energy,
transportation,
water, agriculture)

Many health authorities and partners are scaling up efforts to prepare for climate change

COP 26 Health Programme Commitments

Initiatives under the COP26 Health Programme include:

- Building climate resilient health systems.
- Developing low carbon sustainable health systems.
- Adaptation research for health.
- The inclusion of health priorities in Nationally Determined Contributions.
- Raising the voice of health professionals as advocates for stronger ambition on climate change.

<https://www.who.int/initiatives/cop26-health-programme>

Many health authorities and partners are scaling up efforts to prepare for climate change

Examples:

Global Consortium on Climate and Health Education

<https://www.publichealth.columbia.edu/research/global-consortium-climate-and-health-education>

Health Care Climate Council

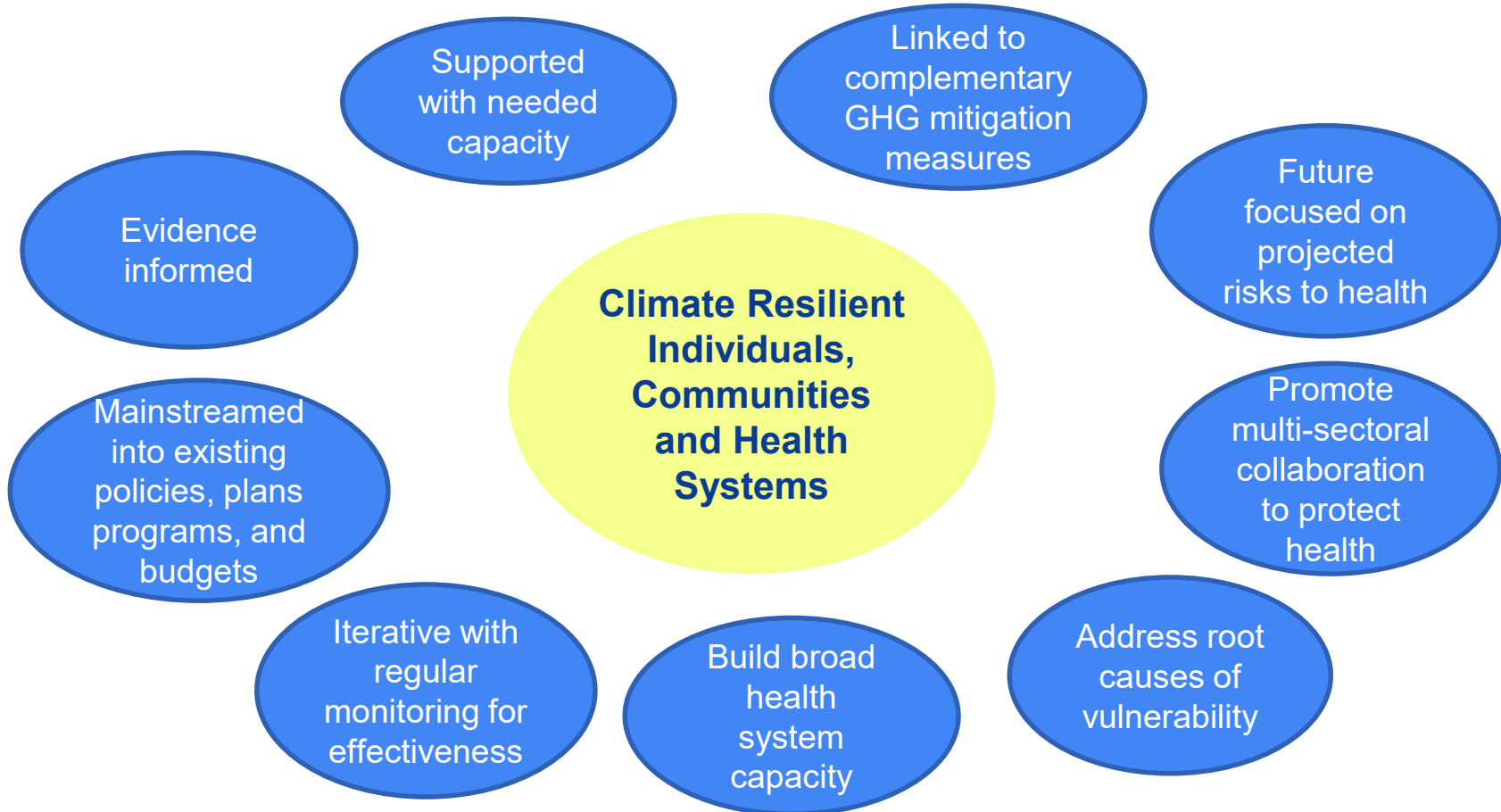
<https://practicegreenhealth.org/tools-and-resources/health-care-climate-council>

BC Green Health Care - <https://bcgreencare.ca/>

Canadian Coalition for Green Health Care

<https://greenhealthcare.ca/>

Effective Health Adaptation to Reduce Health Risks

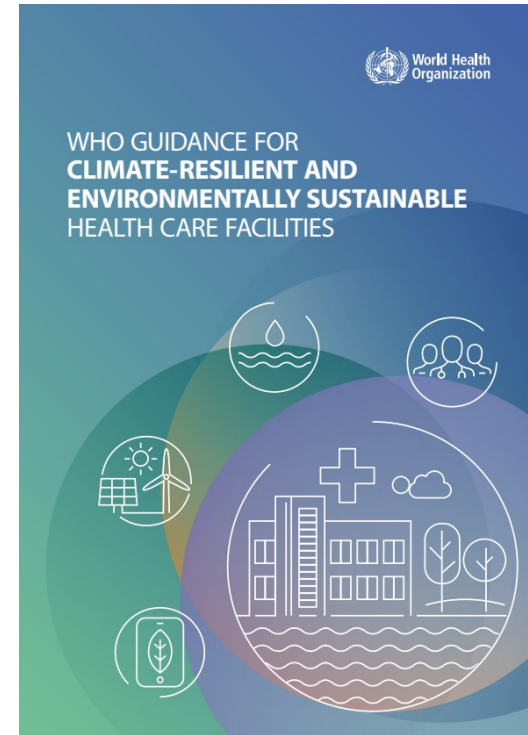


Building Climate Resilient Health Facilities

WHO Guidance for Climate-Resilient and Environmentally Sustainable Health Care Facilities

Climate resilient health care facilities - are those that are capable to anticipate, respond to, cope with, recover from and adapt to climate-related shocks and stress, so as to bring ongoing and sustained health care to their target populations, despite an unstable climate (WHO, 2020)

Environmentally sustainable health care facilities are those that improve, maintain or restore health, while minimizing negative impacts on the environment and leveraging opportunities to restore and improve it (WHO, 2017)



WHO, 2020

Four Fundamental Requirements for Providing Safe and Quality Care in the Context of Climate Change



HEALTH WORKFORCE:

adequate numbers of skilled human resources with decent working conditions, empowered and informed to respond to these environmental challenges.



WATER, SANITATION, HYGIENE AND HEALTH CARE WASTE MANAGEMENT:

sustainable and safe management of water, sanitation and health care waste services.



ENERGY:

sustainable energy services.

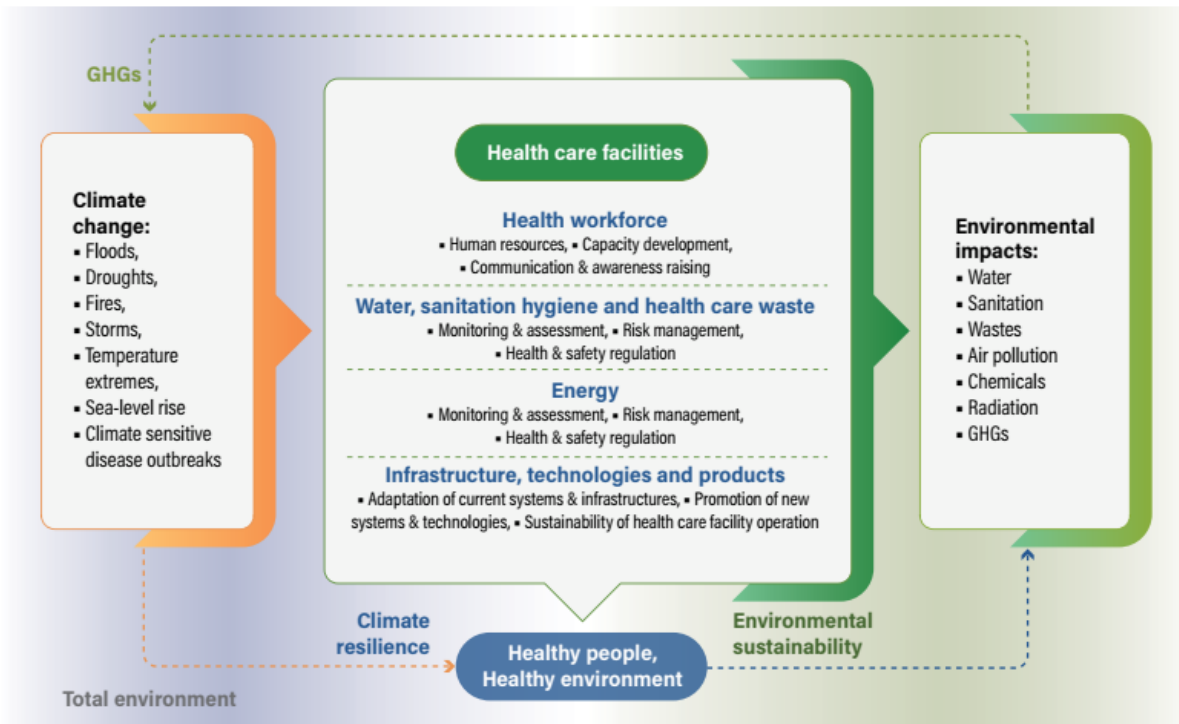


INFRASTRUCTURE, TECHNOLOGIES AND PRODUCTS:

appropriate infrastructure, technologies, products and processes, including all the operations that allow for the efficient functioning of the health care facility.

Framework for building climate-resilient and environmentally sustainable health care facilities

Figure 4. Framework for building climate resilient and environmentally sustainable health care facilities



Adapting Health Systems to Climate Change Risks

| | |
|--|---|
| Financing | <p>Adequate funds are needed to maintain core health system functions, including in a crisis.</p> <p>In addition to funds for core health and public health services (water, sanitation, environmental hygiene, disaster and health emergency preparedness), it is necessary to plan for insurance or replacement costs for health facilities and equipment lost or damaged due to extreme weather events.</p> |
| Health workforce | <p>A well-performing health workforce is needed to achieve the best health outcomes possible.</p> <p>This includes sufficient numbers and a mix of qualified, competent and productive staff to deliver health promotion and protection and take account of location and seasonal demands for staff (e.g. cyclone season may demand higher numbers of staff in coastal zones).</p> <p>It also includes capacity development to build skills, ranging from health policy and management to newer disciplines such as application of meteorological information to health policy.</p> |
| Service delivery | <p>Health service delivery should combine inputs to provide effective, safe, good-quality health interventions in an efficient and equitable manner.</p> <p>Health services may need to prepare for shifts or additional burdens, requiring revisions of organizational and management processes and the timing and location of service delivery.</p> |
| Essential medical products and technologies | <p>A range of medical products and technologies is needed to protect populations from climate-sensitive health conditions.</p> <p>These include medical equipment and supplies for emergency response, permanent and emergency health facility services, and technologies in health-supporting sectors such as water, sanitation and environmental hygiene.</p> |

Adapting Health Systems to Climate Change Risks

Health information systems

Health information systems that ensure the production and application of reliable and timely information on health determinants, health systems performance and health status are essential for managing climate-related health risks.

Resources include data collection, analysis, communication and reporting, hazard and vulnerability assessments, early warning systems, overall information infrastructure (hardware and networks), and coordination mechanisms to link relevant information (e.g. from meteorological or hydrological services) to inform health decisions.

Leadership and governance

Political will to take action to address the health risks of climate change is essential. This includes developing strategic policy frameworks, implementing adaptation plans, and ensuring effective monitoring and management.

It is necessary to build coalitions between relevant sectors and partners, including national and international climate policy mechanisms.

Public advocacy and risk communication are needed to ensure public understanding and support.

The delivery of public health depends on individual and community use of public health services and acquisition of public health education.

Partnerships across stakeholder groups and levels are necessary to engage members of society as actors in their own health protection.

Health Emergency Planning to Respond to Climate Change Impacts

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Health Facilities Preparation for Extreme Heat

Recommendations for Retirement and Care Facility Managers

The number of heat waves and extreme heat events is increasing. Extreme heat is a health risk. People in non-air conditioned buildings during power outages are at greater risk. Below are recommendations for effective health facility management of staff and patients.

Cooling Measures for Existing Buildings and Outdoor Spaces

Key Actions

- **Monitor indoor heat:** Follow your regional requirements (thermometers, thermohygrometers, WBGT).
- **Block direct sun:** Use window awnings, shutters, thermal curtains/blinds, and outdoor umbrellas.
- **Increase air flow:** Encourage cross breeze (electric fans, open windows).
- **Dehumidifiers:** Effective in areas with high humidity, but give off heat.
- **Electric Fans:** Effective in dry heat, but efficiency decreases with high humidity.
- **Air conditioners:** Effective during extreme heat.

Considerations for Management of Staff and Supplies

Key Actions

Staff Education and Protection

- Educate (or refresh) staff annually on signs and symptoms of heat illnesses such as dehydration, heat exhaustion, and heat stroke (classic and exertional).
- Ensure staff is trained in and follow first aid procedures appropriately. (Refer to Health Canada's First Aid Manual).
- Develop and educate your staff on heat emergency plans.
- Follow your emergency surge procedure to ensure adequate capacity (staff and supplies) and working within ACGIH TLV[®] Guidelines for work-rest cycles in the heat, as outlined in your personal cooling options.

Facility Maintenance

- Follow your existing regional requirements to keep the facility cool and comfortable.
- Evacuate rooms if extremely high temperature occurs (determine on a case by case basis).

Patient / Resident care

- Ensure cooling supplies are available for your patients and residents (e.g. cooling jackets, ice water, fans).
- Provide cooling options/areas, available for several hours each day, (designated cool room, cool bath, hands/forearms with cool water).
- Keep medications cool (storage below 20°C for room temperature is typical).
- Ensure meals with high water content are prepared and that spoiled food is discarded.

Considerations for Care Management During Extreme Heat

Key Actions

- Review clinical management of patients and residents most at risk either due to reduced mobility, chronic (pulmonary, cardiovascular, renal), and certain medications, social isolation, inadequate housing, or urban heat island, air pollution. (Refer to Health Canada's Acute Care Fact Sheet).
- Increase frequency of patient observations, especially of those at high risk.
- Advise staff to closely monitor early indicators of heat illnesses and initiate appropriate treatment (cooling, hydration, medical attention, and blood pressure).
- Consider indoor/outdoor temperatures when planning group activities.

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Community Care During Extreme Heat

Heat Illness: Prevention and Preliminary Care

This fact sheet is for Health Care Workers working outside of facilities in the community and in patient/client homes.

Heat Illness and High Risk Individuals

Recognizing Risk

Populations most at risk for heat illness and death during extreme heat:

- People who are confined to bed, or have reduced ability for self care
- People with pre-existing conditions have greater risk of heat illnesses. These include cardiovascular, pulmonary, renal and psychiatric conditions.
- People who are alone without a social support network in hot home environments.

Planning for the Summer and Extreme Heat

Knowledge Check and Action Plan for Management and Staff

- Ensure your organization has an updated extreme heat emergency plan.
- Plan to coordinate with other agencies.
- Know your partners and maintain coordination plan with other services during extreme heat.
- Educate and train staff on extreme heat and heat illnesses in the early spring.
- Inform staff about extreme heat emergency plans (e.g. staffing, response to client needs).
- Increase staff awareness of public cooling options (e.g. pools, splash pads, shaded green space, libraries, shopping centres).
- During extreme heat, review key fact sheet information with volunteers and staff.
- During extreme heat, review clinical management of patients and residents most at risk either due to reduced mobility, chronic illnesses (pulmonary, cardiovascular, renal), or certain medications. (Refer to Health Canada's Acute Care Fact Sheet.)

Community Care – Assessing for and Educating on Heat Illnesses

Checklist when Visiting Client

URGENT: If client does not answer the door for a scheduled visit:

- Notify your office / supervisor
- Attempt to call the client, if there is no answer:
 - Call the client's emergency contacts to request they check on the client
 - Follow any other steps required by your organization

On entering client's home, check how they are coping with the heat.

- Observe home environment
- Do they show physical signs of being in distress?
 - Slower than usual response to answer the door
 - Appearing unwell or complaining of not feeling well
 - Appearing disoriented

9 1 1 If client is unusually confused and very hot, call 911. This may be heat stroke and is a medical emergency.

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Acute Care During Extreme Heat

Recommendations and Information for Health Care Workers

Recognize Heat Illnesses and Heat Sensitive Diseases

- Heat exposure can result in direct illnesses including: Heat Edema, Heat Rash, Heat Cramps, Heat Syncope (fainting) and Heat Exhaustion. These can be self-limiting, but should always be addressed with treatment.
- Exertional Heat Stroke and Classic Heat Stroke are **medical emergencies** and require immediate action from a health care worker and hospitalization.
- Exposure to heat may also present as exacerbation of Cardiovascular, Renal, Pulmonary or Psychiatric Illnesses.

Key Actions

- Recognize and identify heat as a factor in illness or death.
- Recognize Heat Stroke, and activate emergency medical services.
- Record heat as a contributing factor to illness for improved recognition and monitoring.

Signs and Symptoms of Heat Exhaustion and Heat Stroke

(Items in bold are key diagnostic factors)

| | Heat Exhaustion | Heat Stroke |
|---------------------|---|---|
| Temperature | Care temperature elevated but <40°C (104°F) | Care temperature > 40°C (104°F) |
| Neurological | <ul style="list-style-type: none"> • Anxiety and confusion • Dizziness and light-headedness • Headache | Mental status changes: <ul style="list-style-type: none"> • Delirium/hallucinations • Ataxia (lack of coordination indicating neurological dysfunction) • Confusion, irritability, emotional instability, aggressiveness, seizures • Loss of consciousness |
| Cardiac | • Tachycardia | • Cardiac arrhythmias and tachycardia |
| Skin | <ul style="list-style-type: none"> • Cutaneous flushing (hot, red skin) • Sweating present | Classic Heat Stroke: hot, red, dry skin typically affects sedentary vulnerable people Exertional Heat Stroke: profuse sweating typically associated with high physical activity |
| Other | <ul style="list-style-type: none"> • Nausea, vomiting • Hypotension | <ul style="list-style-type: none"> • Shock • Hypotension |
| Outcome | Untreated and with ongoing heat exposure, heat exhaustion can worsen and become heat stroke. | In later stages, pulmonary edema, hepatic failure, renal failure, rhabdomyolysis (muscle fibre breakdown), death |

Key Risk Factors Associated with Heat-Related Illnesses and Death in Extreme Heat

| | |
|---|--|
| Older adults (especially >75 years) | Living circumstances (confined to bed, social isolation, reduced income, malnutrition, reduced access to cooling options) |
| Those having chronic diseases including: | Neurological disease (Parkinson's disease) |
| Cardiovascular disease (hypertension, coronary artery disease, heart conduction disorders) | Respiratory illness (chronic obstructive pulmonary disease (COPD), asthma) |
| Mental and behavioural disorders (due to psychoactive substance use, alcoholism) | Renal disease (renal failure) |
| Mental illness (dementia, depression, schizophrenia, Alzheimer's) | Metabolic conditions (diabetes, obesity) |

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Recommendations for Retirement and Care Facility Managers

The number of heat waves and extreme heat events is increasing. Extreme heat is a health risk. People in non-air conditioned buildings or in buildings during power outages are at greater risk. Below are recommendations for effective health facility management to protect your staff and patients.

Cooling Measures for Existing Buildings and Outdoor Spaces

Key Actions

- **Monitor indoor heat:** Follow your regional requirements (thermometers, thermohygrometers, WBGT).
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- **Increase air flow:** Encourage cross breeze (electric fans, open windows).
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Considerations for Management of Staff and Supplies

Key Actions

Staff Education and Protection

- Educate (or refresh) staff annually on signs and symptoms of heat illnesses such as dehydration, heat cramps, heat exhaustion, and heat stroke (classic and exertional).
- Ensure staff is trained in and follow first aid procedures appropriately. (*Refer to Health Canada's Acute Care Fact Sheet.*)
- Develop and educate your staff on heat emergency plans.
- Follow your emergency/surge procedure to ensure adequate capacity (staff and supplies) and ensure personnel are working within ACGIH TLV® Guidelines for work-rest cycles in the heat, as outlined in your region, with use of personal cooling options.

Facility Maintenance

- Follow your existing regional requirements to keep the facility cool and comfortable.
- Evacuate room(s) if extremely high temperature occurs (determine on a case by case basis).

Patient / Resident care

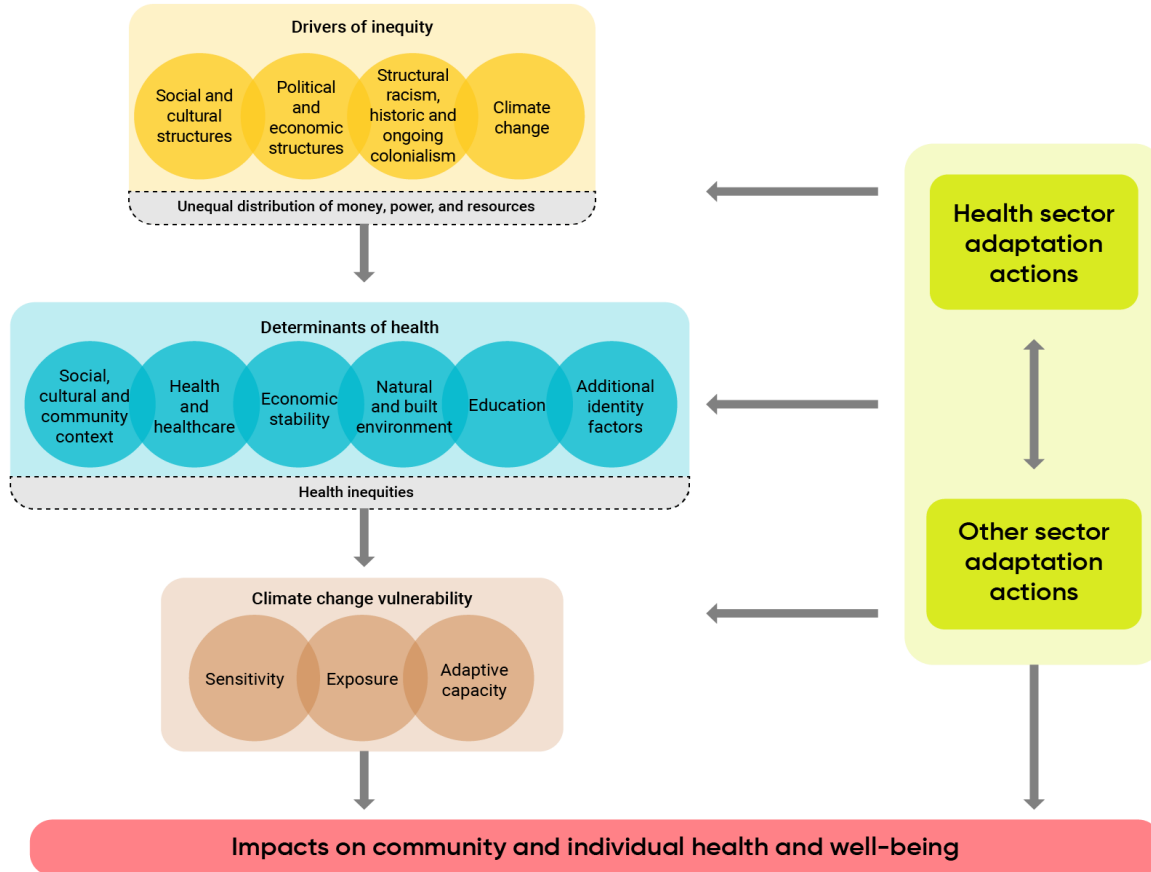
- Ensure cooling supplies are available for your patients and residents (e.g. cooling jackets, ice water baths) and appropriate support to avoid injury.
- Provide cooling options/areas, available for several hours each day, (designated cool room, cool showers, fan, place to bathe hands/forearms or sponging with cool water).
- Keep medications cool (storage below 26°C for room temperature is typical).
- Ensure meals with high water content are prepared and that spoiled food is discarded.

Considerations for Care Management During Extreme Heat

Key Actions

- Review clinical management of patients and residents most at risk either due to reduced mobility, chronic illnesses (pulmonary, cardiovascular, renal), and certain medications, social isolation, inadequate housing, or environmental factors (urban heat island, air pollution). (*Refer to Health Canada's Acute Care Fact Sheet.*)
- Increase frequency of patient observations, especially of those at high risk.
- Advise staff to closely monitor early indicators of heat illnesses and initiate appropriate treatment (Check patient and room temperature, monitor fluid intake and output, pulse rate, and blood pressure).
- Consider indoor/outdoor temperatures when planning group activities.

Climate Change and Health Equity Framework



Adaptation and Mitigation Design to Promote Health Equity

Health adaptation and GHG mitigation measures that do not account for differential impacts on higher risk populations but exacerbate health inequities while properly designed measures can strengthen determinants of health and promote health equity

BlueLA carshare programme (Los Angeles, US)

Provides members with access to a fleet of electric vehicles; prioritizes service to disadvantaged communities, accounting for low-income residents in areas with high air pollution exposure. Provides discounted cost memberships to low-income individuals.

Over the first year 2000 registered residents had access to 80 electric vehicles and use resulted in an estimated 260 tonnes of avoided carbon dioxide (SUMC, 2019a; SUMC 2019b).

Promoting Health System Environmental Sustainability

Gundersen Health System – improved energy-efficiency by 56% in last 10 years, including by utilizing renewable energy – solar, wind, geothermal, biomass, landfill gas, and anaerobic digestion. The energy efficiency improvements save Gundersen \$3 million/year.

Mass General Brigham (formerly Partners HealthCare) – instituted an initiative to minimize the number of single-occupancy vehicles resulting in over 50% of staff use public transportation; provides monthly MBTA pass subsidies of 35-50%; operates a “connected work program” where 22% of 4,200 employees at Assembly Row work remotely.

Boston Medical Centre – developed a rooftop farm above Boston Medical Center’s (BMC) power plant which harvests close to 6,000 pounds of fresh local produce per year for the hospital and is used as an educational platform to create food resiliency in the city of Boston. Other benefits include reduction in the hospital's carbon footprint, increase in sustainable space, and reduction of energy use (e.g., to transport food)

(Health Care Climate Council, 2020)

The Way Forward – Getting Ahead of the Climate Change Curve

- **Be proactive** in our risk management efforts – cannot get caught in an ineffective cycle of responsive or crisis adaptation
- **Focus on managing future climate risks** – not just historical risks
- **Seek to achieve co-benefits of our actions** – like increasing health equity, reducing chronic diseases, improving mental health
- **Employ iterative adaptation evaluation** – we can't afford to be ineffective as climate impacts increase – we may have fewer time and resources for health adaptation planning in the future

RESILIENT

INNOVATE

EQUITABLE

EVALUATE

How are you preparing for climate change?

- How will you regularly integrate new information about risks, vulnerabilities and adaptations into your activities?
- Will you be ready to respond to more climate and health surprises?
- How can you best foster key partnerships that will increase capacity to protect health?
- How will you safeguard the health of staff as risks increase?



ANNEX

Stress-Testing Scenario: Cascading Emergencies in Rural New Brunswick, Canada in 2058¹

Context:

The scenario takes place in a rural coastal community in northeastern New Brunswick in 2058. The community has recently been impacted by the remnants of a Category 2 Hurricane which has resulted in a prolonged power outage (currently in its 5th day). Three days after the hurricane an extreme heat event began. The community has two long-term care centres and one small hospital with an emergency department, which was constructed in 2020 – incorporating the results of a regional health system climate-resilience assessment into its design. The community and outlying area has an older population, many of whom rely on home care services to help support living independently.

Flooding, and high winds have resulted in damage to transportation infrastructure, including that needed by some to reach health care facilities, and widespread power outages. Though by the 3rd day precipitation has stopped, an extreme heat event has begun and is forecasted to continue for the coming days.

¹ Source: With permission of Paddy Enright and Emin Nawaz

ANNEX

Climate Conditions:

- Temperatures have risen on average by 2-4°C in the summer and 1-6°C in the winter over the past 40 years.
- Average annual total precipitation has increased by 15% between 2010 and 2058.
- Seasonal weather events have become more dramatic, including more intense storms, and more severe floods.
- Sea levels have risen by about 25 cm in New Brunswick since 2020, and a further rise of 50-60 cm is anticipated by 2100.
- Warmer seasonal temperatures and annual mean temperatures have resulted in an increase in extreme heat days, this summer (2058) there have been a total of 27 days where temperatures exceeded 30°C.

ANNEX

Health System Conditions:

- The affected community is in New Brunswick in a rural and coastal area located in the north of the province with a population of 2000 residents.
- The community has a median age of 63 with 72% of the population experiencing at least 1 chronic condition and 30% experiencing 3 or more.
- The community's hospital was constructed in 2020 incorporating the results of a climate-resilience assessment conducted by the regional health authority.
- Beyond the design of the hospital, the regional health authority's climate-resilience assessment helped establish stronger connections with emergency response partners and included disaster risk management activities at the local, provincial and federal levels. Health system decision-makers know the role of their partners in preparing for and responding to an emergency and how to access their assistance. However, the community has not faced a similar event in recent memory.
- The hospital has an emergency room and provides some day surgeries. The hospital has 100 beds, many of which are currently occupied by patients waiting to be transferred to long-term care.
- The community has two long-term care facilities, one accommodates 125 residents, the other 100, both are full.
- The local health system and community partners operate an extensive home-care network supporting many community members by providing access to home-based health services and allowing them to live independently as long as possible.

Day 1-3

Beginning in the late afternoon of September 4th, 2058 a Category 2 Hurricane made landfall in southern New Brunswick bringing with it torrential rains as it moved north. The area surrounding the health system in northern New Brunswick received over 150mm of rain over a 3-day period. The rainfall resulted in widespread flooding and high winds caused damage to power lines across the province. Based on the results of a climate-resilience assessment the local hospital was built in an area with limited exposure to flooding – however several roadways of local and regional significance are impassable due to flood damage and fallen trees. This has made it difficult for some hospital staff to reach work, causing others to work significant overtime. All elective procedures have been cancelled, lengthening wait times for many patients. Due to power outages the hospital has been operating with emergency generators, but in order to conserve fuel (the supply of which is limited locally) non-essential power consumption has been reduced.

The community's long-term care facilities have been partially flooded with extensive damage to their basements. One facility's back-up generators have been damaged. Organizational and community officials are seeking alternative power sources. Patients in most need of care are being transferred to the hospital.

Impacts to regional transportation infrastructure have had significant repercussions for home-based care, with no homecare providers providing services on day 1 and 2. Few patients received home-based care on day 3, though rains and high winds have ceased. Calls to emergency services have increased by 35% and wait times for ambulances have tripled due to increased call volume and reduced accessibility to many areas due to storm damage.

ANNEX

Day 4 -5

Though rains and high winds have stopped, power outages remain across the region and the daily high temperature is forecasted to reach 33°C, the highest temperature of the summer. Nighttime temperatures are forecasted to remain above 26°C. Similar temperatures are forecasted for the following 4 days. Heat alerts have been issued, but due to power outages and transportation issues fewer self-protective measures are available. Concerns have been raised about the wellbeing of patients who rely on homecare and other vulnerable community members (particularly those in outlying areas) who may have limited social contact. Health officials are attempting to organize door-to-door check-ins for those deemed most vulnerable, but are having difficulty due to other the other storm-damage related issues facing the community. There may be an opportunity to leverage the community's strong social-capital to have neighbours check on each other. Public health officials have expressed concern over food safety due to sustained power outages and have identified the need to communicate food safety risks to the community. Health authorities, emergency managers and emergency responders are working with transportation authorities and utility providers to focus recovery efforts on areas where vulnerable groups are most likely to reside.

The hospital remains able to provide critical services but officials fear sustained transportation issues, coupled with the pressure being placed on hospital staff to care for family members, themselves or their homes (which may have been damaged by the storm) will make the hospital unable to cope with any surge in patients.

Wrap-up

The WHO Operational Framework for Climate Resilient Health Systems defines a climate-resilient health system as, “... one that is capable to anticipate, respond to, cope with, recover from and adapt to climate-related shocks and stress, so as to bring sustained improvements in population health, despite an unstable climate.” When incorporating a stress-testing approach into your own organization’s future planning, use this scenario to consider your health facility or system’s ability to anticipate, respond to, cope with, recover from and adapt to the impacts experienced.

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