

CHAPTER 2

Methods

A photograph showing a group of people in a meeting or office setting. They are gathered around a table, looking at documents and a tablet. The scene is lit with warm, golden light, possibly from a window. The image is partially covered by a blue header at the top.

YORK REGION CLIMATE CHANGE AND HEALTH VULNERABILITY ASSESSMENT

2.0 Methods

Various topic areas were considered as part of step one - **framing and scoping the assessment**. As the goal of the assessment was to inform future adaptation planning and help develop greater resiliency to climate change, it was necessary to explore a wide range of topic areas. The scope was based on topics identified in the Ministry of Health (MOH) toolkit, key resources such as the Health Canada climate change and health assessment⁴ and vulnerability assessments completed by other health units in Ontario.^{8,9}

The final scope of health topics covered in this assessment include the following:

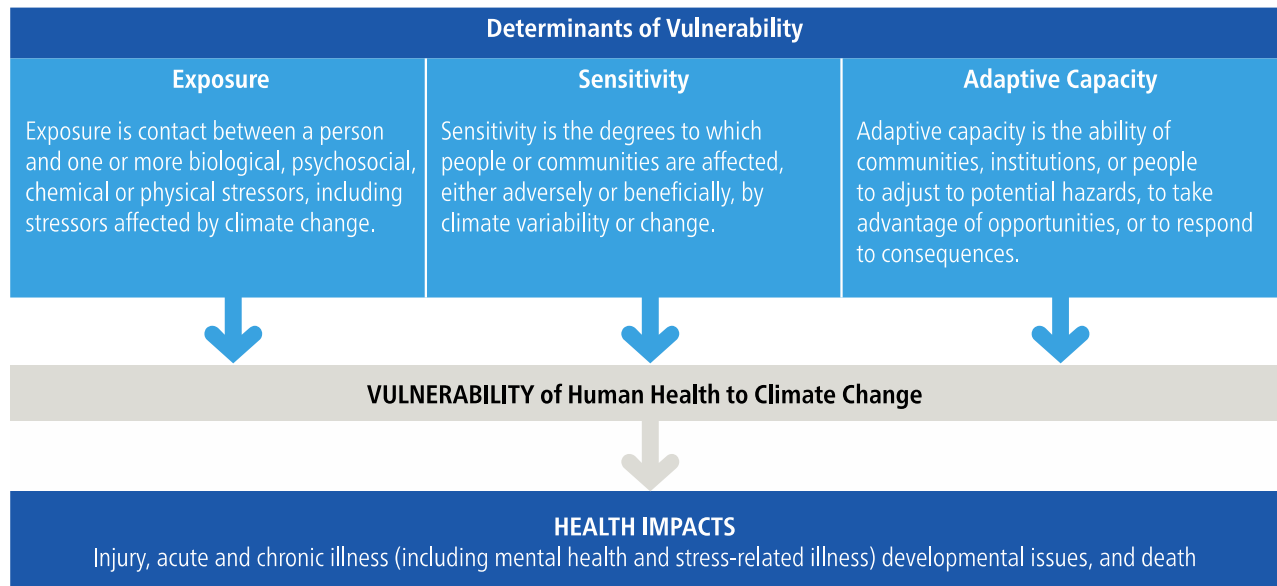
- Extreme temperatures
- Extreme weather events
- Air quality
- Vector-borne disease
- Water safety
- Food safety and food security

Step two - **assessing current health outcomes and programs**, was completed by summarizing key impacts from available research and relevant York Region data. This provided a baseline understanding of climate pathways impacting health, health outcomes and existing programs that support adaptive capacity within York Region.

Step three - **estimating future health outcomes from climate change**, was generally out of scope due to data and resource limitations in the available scientific evidence and resources. Future health impacts from climate change noted in the literature were included if relevant and generalizable to the context of York Region.

When assessing climate change impacts on health, three determinants of vulnerability were considered: Exposure, sensitivity and adaptive capacity (Figure 2.1).

Figure 2.1. Determinants of vulnerability for climate change health impacts.

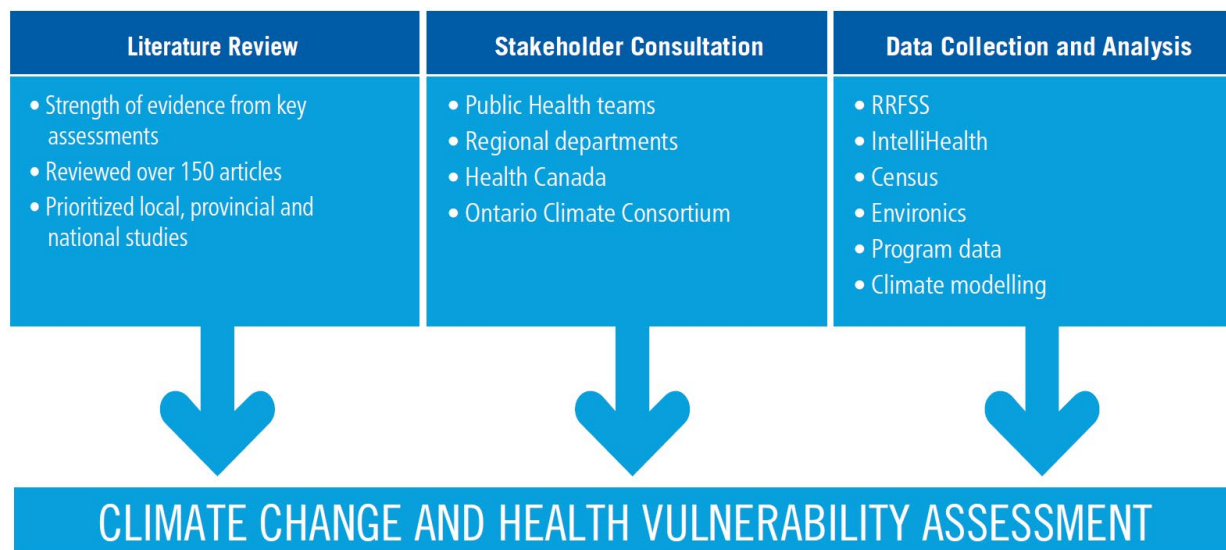


Source: Gamble JL, Balbus J et al. Ch. 9: Populations of concern. In The impacts of climate change on human health in the United States: a scientific assessment [Internet]. Washington: U.S. Global Change Research Program; 2016. Fig ES10, Determinants of vulnerability; p.250. Available from: <https://health2016.globalchange.gov/>. **Reproduced** with permission from the copyright holder.

In the report, the determinants are considered for each topic area and provide insight into the specific climate change health impacts in York Region. The focus of these components is on community impacts within York Region.

Multiple sources of information were reviewed and assessed to inform these components and to help better understand the health impacts of climate change in the Region. Information was collected by reviewing relevant academic and grey literature, public and private datasets and gathering feedback from stakeholders (Figure 2.2). The intent of the assessment is to present relevant information to support adaptation planning. Tables at the end of each chapter provide a summary of existing measures and opportunities to consider that can inform future adaptation planning activities.

Figure 2.2. Examples of research, data and information that informed the vulnerability assessment process.



Literature review

York Region Public Health conducted a literature review of scientific articles and grey literature. The literature review was not intended to be comprehensive; rather, it was completed to provide a better understanding of critical issues and factors contributing to vulnerability for each topic area. Additionally, the literature review focused on identifying articles that included climate change health impacts investigated in or significant to York Region.

Relevant grey literature was reviewed from Ontario health units, Public Health Ontario, the Public Health Agency of Canada, Health Canada, United States Environmental Protection Agency and Centers for Disease Control and Prevention (CDC) and the World Health Organization (WHO). Grey literature sources such as the Health Canada assessment⁴, the U.S. Climate Change and Health scientific assessment,⁵ and the IPCC AR5 report² assessed the strength of evidence based on more comprehensive literature reviews and/or development of consensus from expert opinions.

The [National Institute of Environmental Health Sciences Climate Change and Health Portal](#) was used to search for peer-reviewed studies published between 2007 and 2014 that were relevant to topic areas covered in this assessment, and geographic regions comparable to York Region, such as the Northeastern United States. Article abstracts were then reviewed for relevance to health impacts in York Region.

Additional searches through Google Scholar filtered for studies from 2015 to 2017. Emphasis was placed on publications that assessed climate change impacts in Ontario or studies from similar temperate conditions in North America such as the Northeast U.S. Health Canada was also consulted regarding the assessment process, and provided relevant and more recent articles to

help support the assessment. In total, approximately 150 articles from grey literature and academic studies were reviewed.

Local datasets relevant to York Region

While the literature review provided a stronger understanding of the key issues and evidence for climate change and health impacts, few studies were available to provide a sufficient local context. As a result, multiple datasets were explored to provide a greater perspective on vulnerabilities in York Region. This included reviewing federal, provincial and local municipal datasets relating to climate factors, vulnerable populations and adaptive capacity.

Stakeholder engagement

In addition to the literature and local data reviewed, Regional staff was consulted on various topics. This involved consulting with public health teams most relevant to the topic areas (Safe Water, Food Safety, Nutrition, Vector-Borne Disease, Healthy Environments, Healthy Living staff involved with vulnerable populations and Health Emergency Planning). Other departments within York Region were also consulted regarding issues such as impacts to water and natural systems. The consultations provided important information regarding existing capacities and additional datasets that could be considered for the assessment, as well as expert opinion regarding potential climate change impacts in York Region.

2.1 SCOPE OF THE ASSESSMENT

Geography

This report assessed climate change impacts in all of York Region's nine local municipalities. However, due to limitations of the spatial resolution of climate projection data, climate modelling data could not be distinguished between sub-regions. For certain topics, differences between rural/agricultural and urban/suburban areas are highlighted to illustrate differing impacts.

While international climate change impacts can contribute to local health outcomes (e.g., travel of residents and transportation of goods spreading vectors and diseases; contaminated food imported from international sources), these impacts were deemed out of scope for this assessment.

Timeframes

Multiple time periods were used for this assessment; where possible, the most current dataset was used. As climate models are well established, climate driver information was available for the 2050s and 2080s. In particular, climate change projections into the 2050s were primarily used as future planning will likely be revisited within this timeframe.

Due to limitations of resources and available evidence, health outcomes are generally presented as baseline data and health risk factor data ranging from 2000 to 2018 depending on topic areas.

Population projections were limited to the 2030s and 2040s due to limited reliability of population projection data beyond that date. Where possible, information on vulnerable populations, such as future population projections, was used to provide context on how populations may grow and shift within York Region.

Climate change projections

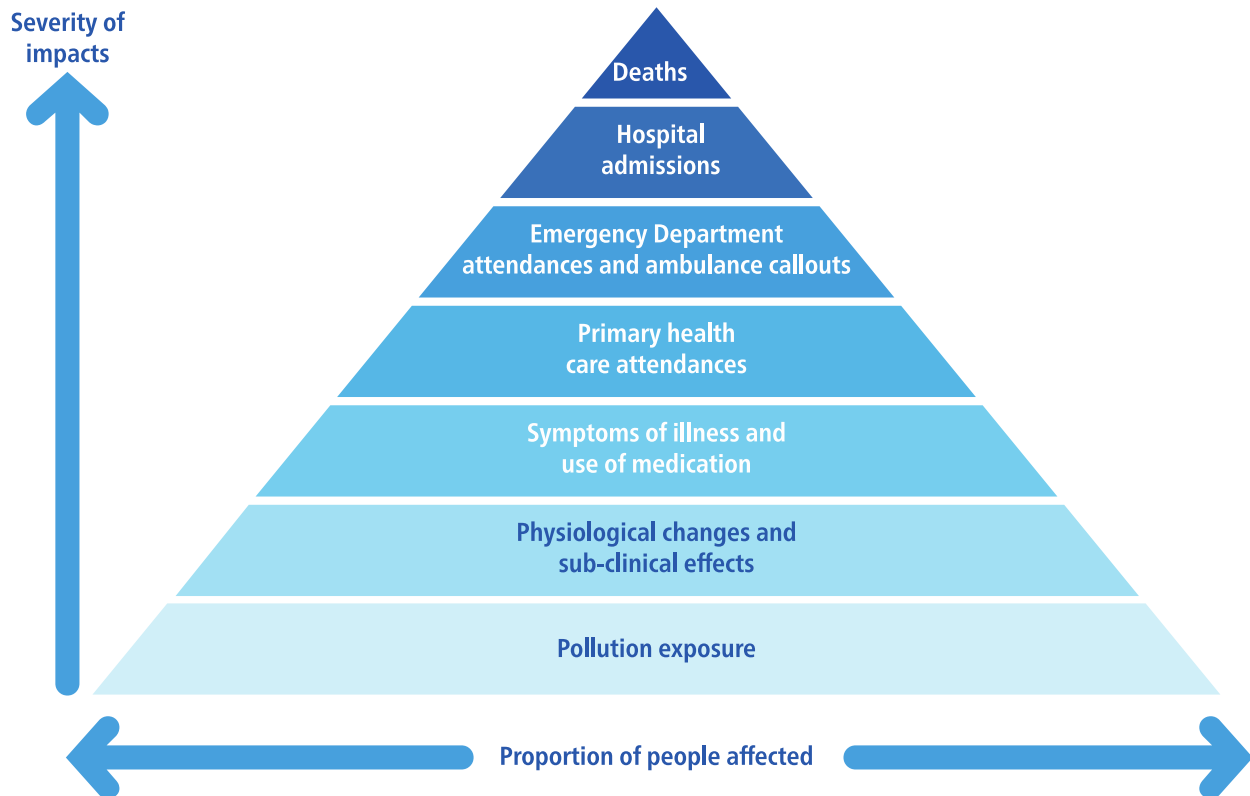
Climate drivers considered in this report are based primarily on the Ontario Climate Consortium (OCC) assessment of future climate change trends in York Region¹⁰ and additional information from the MOH toolkit.¹¹ The OCC assessment uses Representative Concentration Pathway (RCP) 8.5^d scenario and involves multiple projection models (Ministry of the Environment, Conservation and Parks Climate Change Data Portal Dataset; York University Laboratory of Mathematical Parallel Systems Dataset; University of Wisconsin Dynamically Downscaled Regional Climate Models; and Specialists in Energy, Nuclear and Environmental Sciences Consultants' Toronto Region dataset). Additional projection information from the MOH toolkit or academic studies was also considered, which used the RCP 8.5 pathway scenario. Due to the spatial resolution of climate models (25 km² or 50 km²), geographical differences in climate projections across York Region were not included.

Health outcomes

Health outcomes were included based on the literature review and information in the MOH toolkit.⁶ The following datasets were considered in the assessment: Emergency department visits (e.g., heatstroke, or injuries); emergency department triage (e.g., heat or air quality related symptoms); and diseases of public health significance, which are part of provincial Integrated Public Health Information System (iPHIS) surveillance programs (e.g., enteric diseases and vector-borne diseases). It is important to note these datasets likely underestimate the burden of illness. As illustrated in the pyramid of effects (Figure 2.3) mortality and morbidity cases relating to hospital visits or diseases of public health significance are reflective of more severe impacts and a smaller portion of the population. Local hospital data analyzed focused on morbidity, while mortality and hospital admissions were mostly based on published studies that analyzed health outcomes related to weather variables or vulnerable populations.

^d RCP 8.5 is the greenhouse gas concentration scenario created by the IPCC based on the assumption emissions continue as usual. RCP 8.5 continues to show growing emissions continuing until the end of the twenty-first century.

Figure 2.3. Pyramid of effects.



Source: Adapted from Melody SM, Johnston FH. Coal mine fires and human health: what do we know? *Int J Coal Geol.* [serial online]. 2015; 152(B):1-14. Fig 5, The air pollution pyramid; p. 6. Available from: <https://www.sciencedirect.com/science/article/pii/S0166516215300707>. Reproduced under the terms of the [Creative Commons Attribution-NonCommercial-No Derivatives License \(CC BY NC ND\)](#).

While there are limitations with these datasets, they were selected as they provide a baseline of health outcomes that can also inform future surveillance and monitoring plans. As noted previously, estimating future health outcomes was out of scope for this report due to available resources and uncertainties in the literature.¹¹

Populations assessed

This report focused primarily on individuals residing in York Region. For certain health topics, individuals working or visiting York Region were also considered (e.g., individuals working outside and visitors to recreational beaches). To better understand the impacts of climate change, the assessment also considers populations most vulnerable and with limited adaptive capacity. Vulnerable populations were identified in the MOH toolkit⁶ and academic literature. Populations may be vulnerable because of social determinants of health (SDOH) such as socioeconomic status, demographic factors, and/or behavioural factors. Available data on York Region populations related to climate impacts were included from multiple sources, particularly the 2016 Census Survey, the Canadian Community Health Survey (CCHS), and the Rapid Risk Factor Surveillance System (RRFSS) survey.

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206. World Health Organization. Operational framework for building climate resilient health systems. [e-book]. Geneva:World Health Organization; 2015 [cited 2019 Jul 31]. Available from:

https://apps.who.int/iris/bitstream/handle/10665/189951/9789241565073_eng.pdf

207. Masson-Delmotte V, Zhai P, Pörtner D, Roberts J, Skea PR, Shukla A, Pirani W, editors. IPCC, 2018: Global warming of 1.5°C. an IPCC special report on the impacts of global warming of 1.5°C above pre-industrial levels and related global greenhouse gas emission pathways, in the context of strengthening the global response to the threat of climate change, sustainable development, and efforts to eradicate poverty[report online]. New York: Intergovernmental Panel on Climate Change(IPCC); 2019 [cited 2019 Sept 6]. Available from:

https://www.ipcc.ch/site/assets/uploads/sites/2/2019/06/SR15_Full_Report_Low_Res.pdf