

# Management of Physical Infrastructure Systems in Cities to Protect Public Health from Climate-Related Hazards

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## Research Rationale

Climate-related hazards will lead to morbidity and mortality unless decision-makers implement preventive measures to protect the health of vulnerable groups. Existing research, however, has not holistically explored the role of physical infrastructure systems in the pathways between climate-related hazards and health risks. The Climate-Hazard-Infrastructure-Pathways (CHIP) Model is developed to address this gap and highlight how infrastructure systems can influence exposure to climate-health risks. The research then presents evidence from three case study cities illustrating examples of the best practice infrastructure responses that they have developed to protect public health along several of the pathways identified in the Climate-Hazard-Infrastructure-Pathways Model.

## Climate Hazard, Infrastructure and Health Pathways Model

The Climate-Health-Infrastructure-Pathways Model presented below was developed through a scoping review of epidemiological and disaster risk literature, and provides a conceptual map illustrating the role of physical infrastructure systems in the pathways between climate-related hazards and health risks:

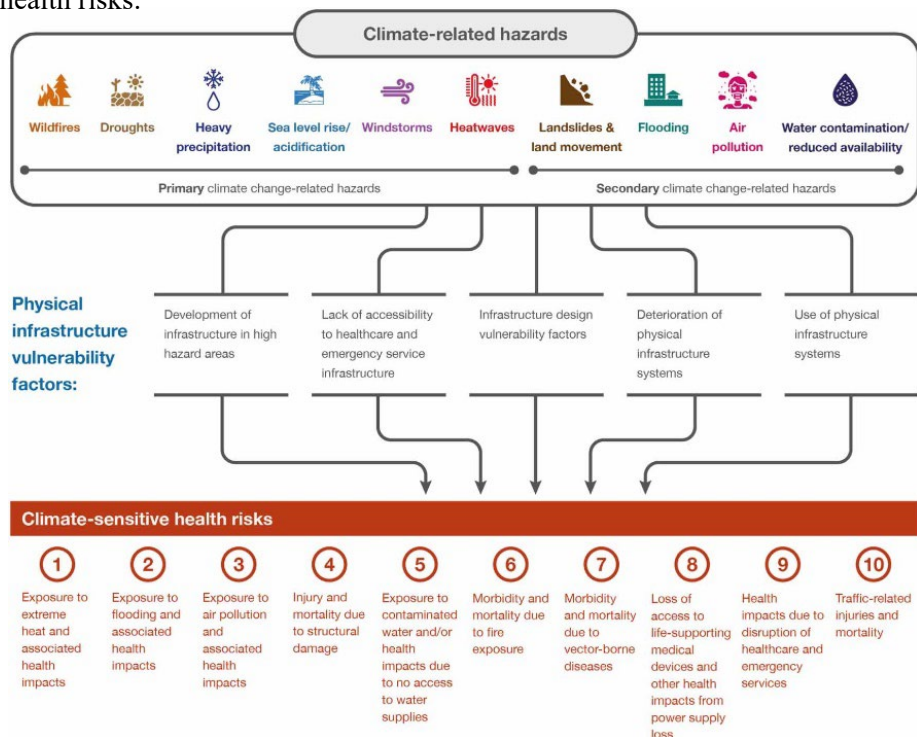


Figure 1: Conceptual Climate-Health-Infrastructure-Pathways Model

### Pathway 1: Exposure to extreme heat

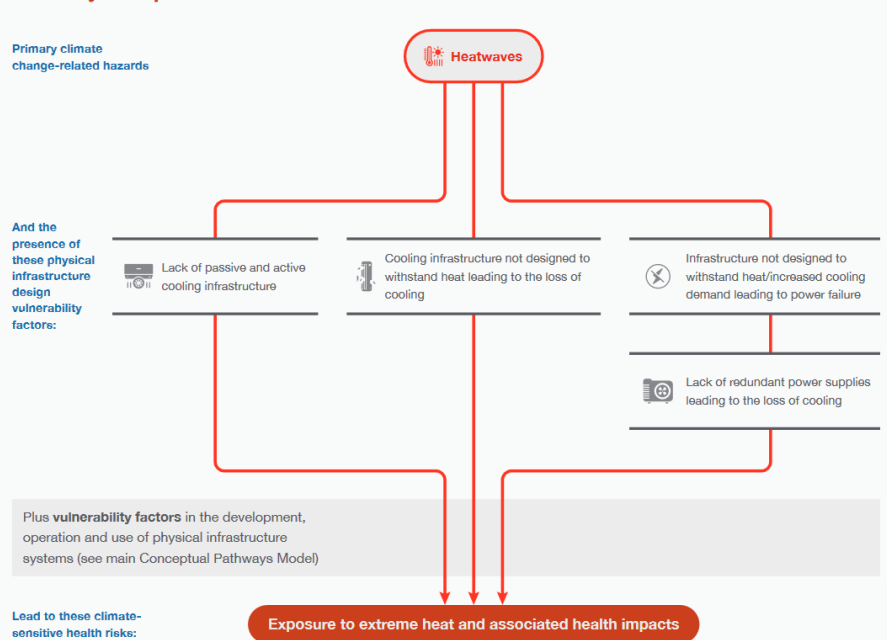


Figure 2: Expanded Pathway 1: Exposure to Extreme Heat

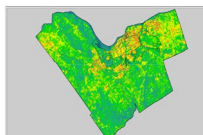


## Research Methodology

The research uses complex adaptive systems thinking to map out how several cities leading climate change action manage physical infrastructure systems to protect public health along the ten pathways identified in the CHIP Model.


## Research Findings

The section below provides examples of the best practice infrastructure risk management mechanisms developed by the case study cities to protect public health from the climate-related hazards captured in the CHIP Model.

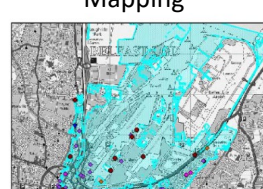

### Ottawa: Exposure to Extreme Heat (Pathway 1)

<p><b>Key Information:</b> Heat risk maps, social/health vulnerability data, health surveillance data</p>  <p>Ottawa Heat Risk Map</p>	<p><b>Example Risk Reduction Measures:</b> Social housing cooling retrofits, cool spaces, green infrastructure, planning promoting cool materials</p>  <p>Cooling Centres in Ottawa</p>	<p><b>Key Stakeholders:</b></p> 
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### London: Exposure to Air Pollution (Pathway 3)

<p><b>Key Information:</b> Outdoor and/or indoor air quality monitoring of pollutants (PM 2.5, NOx, ozone, mould), vulnerable receptor data</p>  <p>School Air Quality Map Lambeth</p>	<p><b>Example Risk Reduction Measures:</b> School and Healthy Hospital Streets, housing retrofit referral schemes, air quality warnings to vulnerable residents, Air Quality Positive Planning</p>  <p>Healthy Hospital Street</p>	<p><b>Key Stakeholders:</b></p> 
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### Belfast: Disruption of Healthcare and Emergency Services due to Flooding (Pathway 9)

<p><b>Key Information:</b> Integrated River and Sewer System Modelling &amp; Critical Infrastructure Mapping</p>  <p>Flood Risk and Critical Asset Mapping</p>	<p><b>Example Risk Reduction Measures:</b> Upgrading the capacity of sewage networks to reduce flood risk to healthcare estates, tidal flood defences protecting emergency service infrastructure, flood modelling informing healthcare and emergency planning</p>	<p><b>Key Stakeholders:</b></p> 
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## Discussion

The research findings illustrate that partnership working, multiple sources of data, and the development of multiple infrastructure measures are required to protect public health along the pathways identified in the Climate-Hazard-Infrastructure-Pathways Model. Furthermore, the development of infrastructure risk reduction measures to reduce climate-related health risks can require the use of appraisal mechanisms that go beyond quantifying direct economic savings and capture the health benefits of these infrastructure measures. Despite these challenges, the research case studies illustrate the best practice infrastructure responses that can be developed by cities to reduce climate-health risks.