Warmer day mortality in Yellowknife and Whitehorse: are there already demonstrable climate change impacts?

Tom Kosatsky, md
Acting Director
Environmental Health Services, BCCDC

IUCC, Yellowknife 2009
Figure 1.2 Global temperature record, since instrumental recording began in 1860, and projection to 2100, according to the IPCC

Source: reference 1
Paris heat-wave, summer 2003
Daily mortality in Paris during summer 2003

Source: Institut de Veille Sanitaire, France
Outside of “heat waves” there is also a relationship between warmer weather and overall same and next day mortality

The diagram shows a scatter plot with daily mortality on the y-axis and mean temperature on the x-axis. The data points are scattered across the graph, with a trend line indicating a relationship between daily mortality and mean temperature. The y-axis ranges from 100 to 350, and the x-axis ranges from -10 to 30.
Outside of “heat waves” there is also a relationship between warmer weather and overall same and next day mortality: this phenomenon has been seen in Northern cities too.
Daily deaths in Finland, 2000–2005, by mean daily temperature. Circles indicate mean counts of deaths in each 1°C interval; line shows regression-based smoothed values (Nayha, 2007)
Summer Deaths by 4-Day Apparent Tmax, Stockholm and Helsinki, 1990-2000 (Baccini, 2008)
North/South temperature/mortality gradient (Keatinge, 2003)

Fig. 1. Mortality at different mean daily temperatures. Pooled data for each region at age 55+, 1971–1997. The areas of circles are proportional to the number of days at each temperature.
Temperature and mortality: mechanisms

• Cardiovascular disease
  – reduced cardiovascular reserve

• Respiratory disease

• Infectious diseases
  – infectious intestinal disease
  – vector-borne diseases

• External causes
  – accidents / violence

• Heat stroke / hyperthermia

All causes can be affected by temperature
Risk factors for heat related death

- Elderly
- Pre-existing disease (cardiovascular, etc.)
- No air conditioner in home or residential institution
- Social isolation ➢ living alone, not leaving house at least once per day
- Use of certain drugs, e.g. tranquillisers
- Housing ➢ building type, living on top floor
- Urban heat-island
Satellite imagery-based heat capture index, Montreal

(the redder, the hotter)
Temperature/mortality relationships for selected Canadian communities
Daily Deaths (all ages, all cause)
Vancouver North Metropolitan Area (LHAs: 38, 44, 45, 161-166)
Associated with Temperature at Vancouver Airport, 1986-2008

mean temperature (on day 0 and day -1)
daily deaths
Daily Deaths (all ages, all cause) for Peace River (LHA: 59, 60) Associated with Temperature at Fort St. John Airport, 1986-2008
Daily Deaths (all ages, all cause) for Prince George (LHA: 57)
Associated with Temperature at Prince George Airport, 1986-2008
Distribution of mean daily temperatures, year-round

Yellowknife, daily mean temperature (°C), 1980-2005

Whitehorse, daily mean temperature (°C), 1986-2008

BC Centre for Disease Control
Relative number of daily deaths vs. daily temp compared to reference (deaths at mean temperature over study period): same, next day effect

Yellowknife 1980-2005

Whitehorse 1986-2008
Warmer day mortality in Yellowknife and Whitehorse: are there demonstrable climate change impacts already?

• **Little evidence based on a 25 year temperature/mortality record**
  - Small, young populations/low study power?
  - Lack of appreciable heat island effect?
  - Less indoor summer living?
  - Greater social support?

• **What to expect in future?**
Mean changes in daily cardiovascular deaths (%) and 95% posterior intervals due to a 10°F increase in temperature by year and season, US cities Barnett, 2007
Potential climate tipping points
The double impact of melting permafrost

Permafrost is thawing
Average ground temperature near Fairbanks, Alaska, degrees C

Permafrost thaws when T ≥ 0°C
ACIA 2004
Warmer day mortality in Yellowknife and Whitehorse: should climate change impacts be expected?

- Given adaptive capacity, and public health preparedness, gradual warming presents a minimal direct threat.
- Indirect climate change impacts (habitat change, coastal erosion, economic migration) are likely of greater importance.
- And, if the climate tips, all bets are off.
Thank you

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tom.kosatsky@bcccdc.ca