

Heat waves in Europe

Ambient thermal conditions are an important type of environmental exposure and are responsible for a quantifiable burden of mortality and morbidity. A range of epidemiological methods has been used to estimate the effect of the thermal environment on mortality and morbidity and thus estimate temperature-attributable mortality.

Daily time series studies are considered the most robust method for quantifying the effects of temperature on mortality. Such studies have shown that the temperature-mortality relationship in temperate countries is consistently non-linear across the temperature range. Thus the temperature mortality relationship in temperate countries is often described as v-shaped or u-shaped. The optimum or threshold temperature varies between populations and is assumed to be a function of the population adaptation to the local climate.

Heat-waves are rare events that vary in character and impact even in the same location. Arriving at a standardised definition of a heat-wave is difficult; the World Meteorological Organisation (WMO) has not yet defined the term, and many countries do not have operational definitions for health warnings or other purposes.

The essential components of a heat wave should include high temperatures in the area of interest and some component of duration. A heat wave is a sustained exposure to high temperatures over several days. A heat-wave can be defined based on an absolute or a relative threshold of weather variables or as a combination of both. An absolute threshold fails to address the differences between populations in response to temperature, and also within a single population over time.

Studies of heat waves in urban areas have shown an association between increases in mortality and increases in heat, measured by maximum or minimum temperature, heat index (a measure of temperature and humidity), or air mass. During the 5-day heat wave in Chicago in 1995, in which maximum temperature reached 40°C, deaths increased by 85% (all ages). Excess mortality is often highest in the over 75 age group. Much of the mortality attributable to heat waves is a result of cardiovascular and respiratory diseases, and, in general, very few deaths are certified as due to heat stroke.

A major heat wave affected Europe during August 2003. The table summarises the preliminary findings officially reported from several countries of the effects of this heat wave on total mortality. The estimates compare observed deaths in a defined period with those expected in the absence of the heat wave. Estimates are sensitive to the method used to calculate the "expected" mortality. Further, countries experienced different exposures in terms of magnitude, duration and levels of weather variables, such as humidity, which makes direct comparison of impacts between countries difficult. Similar temperatures can have different impacts depending on the duration of the event, or the acclimatization status of the population which is related to the time in the season when the heat wave occurred, the occurrence of earlier heat waves, as well as the long term climate.

Table. Provisional estimates for mortality attributed to the August 2003 heat wave event, by country [See Kovats et al. 2004 for original sources].

Country	Heatstroke deaths +	Excess deaths(%**), all ages	Time period	Method for estimating baseline mortality
England and Wales	§	2045 (16%)	4 to 13 August	Average of deaths for same period in years 1998 to 2002
France	§	14802 (60%)	1 to 20 August	Average of deaths for same period in years 2000 to 2002
Italy	§	3134 (15%)	1 June to 15 August	Deaths in same period in 2002
Portugal	7	2099 (26 %)	1 to 31 August	Deaths in same period in 1997-2001
Spain	59	Evaluation in progress		

Key:

+ coded under ICD10 X30 or ICD9 E900

§ not reported

** % excess death =[observed-expected]/expected * 100

Recommended reading

- Kovats S, Wolf T, Menne B (2004) Heatwave of August 2003 in Europe: provisional estimates of the impact on mortality. *Eurosurveillance Weekly*, 8(11), 11 March 2004. <http://www.eurosurveillance.org/ew/2004/040311.asp#7>
- Koppe C, Kovats RS, Jendritzky G, Menne B (2004) *Heat-waves: impacts and responses*. Copenhagen, WHO Regional Office for Europe (Health and Global Environmental Change Series, No. 3).
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Biography

Sari Kovats is a Lecturer in the Department of Public Health and Policy in the London School of Hygiene and Tropical Medicine (LSHTM). She has worked for many years on the health impact assessment of climate change and climate variability. Currently, she is a partner in the EU-funded CCASSH project (coordinated by WHO Rome office) on developing adaptation strategies to reduce the health the impacts of climate change in Europe.