

Recent Trends in Temperature, Vulnerability and Heat-Attributable Mortality in Europe

Joan Ballester

Climate and Health Program (CLIMA)
Barcelona Institute for Global Health (ISGlobal)
www.joanballester.eu

H. Achebak (ISGlobal), F.R. Herrmann (Geneva Univ),
J.M. Robine (INSERM), X. Rodó (ISGlobal)

Data and Model

- Daily summer temperature and mortality data.
- Spain: Circulatory and respiratory mortality, 47 major cities, 1980-2015.
- Europe: All-cause mortality, 147 regions in 16 countries, 1998-2012.
- Standard quasi-Poisson regression model (DLNM).
- Control for (i) day of week, (ii) seasonality, and (iii) long-term trends.
- Multi-location association estimated with random-effects meta-analysis.

Temporal changes

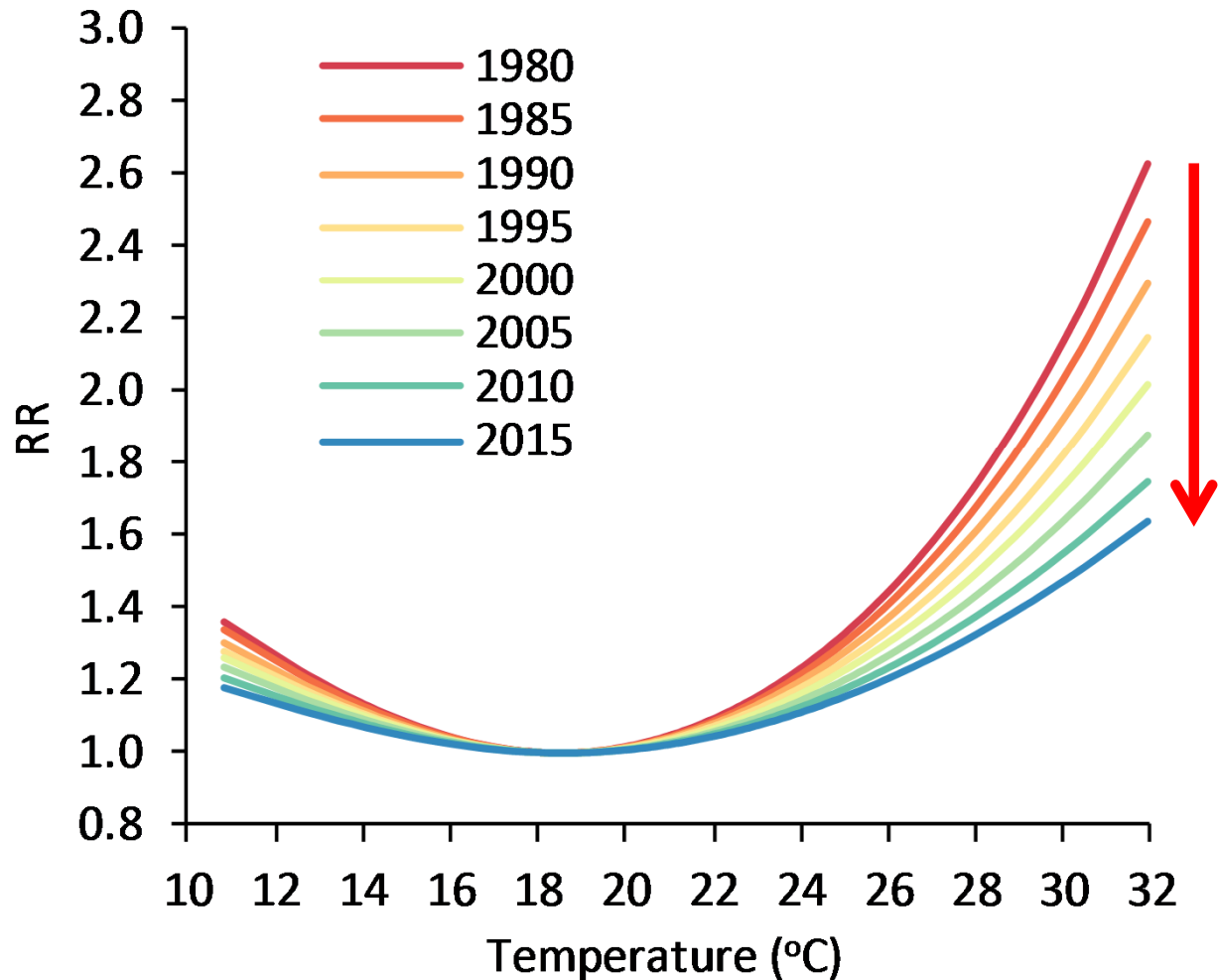
- Standard DLNM for moving subperiods of X consecutive years:
5yr-DLNM: 1998-2002, 1999-2003, ..., 2008-2012.
10yr-DLNM: 1998-2007, 1999-2008, ..., 2003-2012.

$\text{Log E}(Y_t) = \text{intercept} + \text{cb} + \text{dow} + \text{S1}(\text{dos}, \text{df} = 2) : \text{factor}(\text{year}) + \text{S2}(\text{time}, \text{df} = 1 \text{ per decade})$

- DLNM with interaction between time and the crossbasis matrix:
t-DLNM: 1998-2012.

$\text{Log E}(Y_t) = \text{intercept} + \text{cb} + \text{dow} + \text{S1}(\text{dos}, \text{df} = 2) : \text{factor}(\text{year}) + \text{S2}(\text{time}, \text{df} = 1 \text{ per decade}) + \text{int}(\text{time} * \text{cb})$

Is Adaptation to Heat Occurring in Spain?

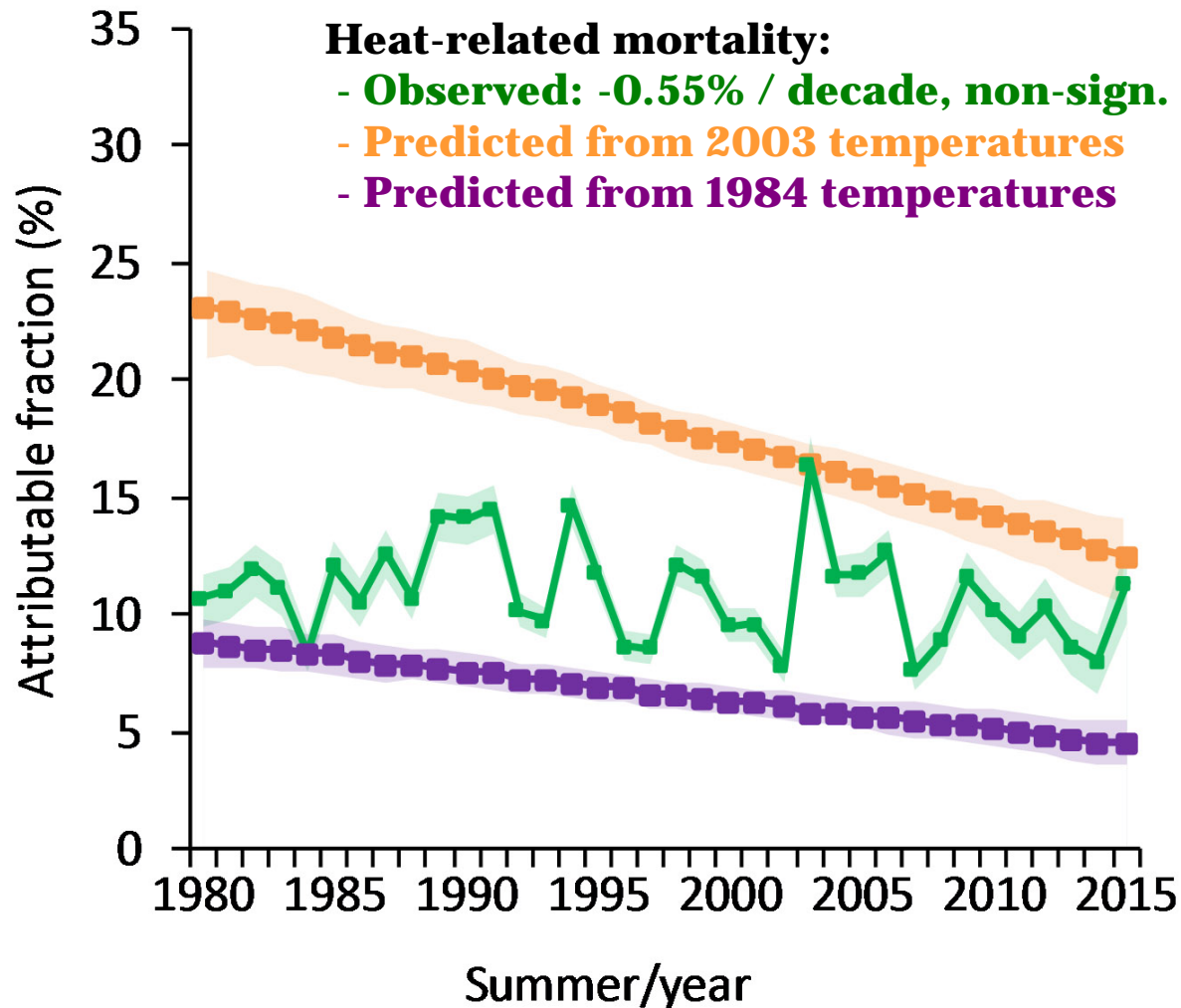


Spain is reducing the vulnerability to heat at a nearly constant rate.

No change associated with the National Heat Prevention Plan (2004).

Achebak, Devolder, Ballester (2018)

Is Heat-Related Mortality Increasing in Spain?



Heat-related mortality **is not increasing.**

The decline would have been larger without the observed 1°C warming, both in a **colder** and **warmer** climate.

Achebak, Devolder, Ballester (2018)

(unpublished results)

Thanks!

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Achebak H, Devolder D, Ballester J (2018) Heat-related mortality trends under recent climate warming in Spain: A 36-year observational study. *PLoS Medicine* **15**, e1002617.

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