

IS THERE AN ADDITIONAL HEALTH EFFECT DUE TO SUSTAINED HEAT DURING HEAT WAVES?

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Background and Aims: studies assessing the health effects of heat typically divide into two categories: episode analysis and continuous-temperature analysis. In the former, the focus is on the increased risk during extreme events of protracted heat, usually defined heat waves. In the latter, temperature is instead modelled as a continuous variable. Few studies have included terms for both factors in a time series analysis, assuming an additional effect during heat waves beyond that explained by temperature. General wisdom dictates that this additional burden, due to sustained heat, is substantial. However, its estimate critically depends on model assumptions and flexibility.

Methods: we address this issue using data from 108 communities in the United States during 1987–2000. The additional wave effect was quantified including an indicator variable defined by combinations of temperature thresholds and days of duration, and then as a smooth function of consecutive heat-wave days. The model also included a main temperature effect estimated through distributed lag nonlinear functions of temperature, summarized for this context as the relative risk between the median city-specific temperature during heat wave days and the 75th percentile of the year-round distribution. City-specific main and added wave effects were pooled through meta-analytic techniques.

Results: the added wave effect was small (0.2%–2.8% excess relative risk, depending on wave definition) compared with main temperature effect during waves (4.9%–8.0%). Using a smooth function of consecutive heat wave days, the added wave effect is null for short episodes and increases only after 4 consecutive days.

Conclusions: the additional health effect during heat waves in United States is limited to very long episodes, and, on average, the excess risk from heat during and outside heat waves is well summarized and predicted by a continuous function of temperature, if non-linearity and lagged effects are allowed for.