

Study suggests heat caused over 47,000 deaths in Europe in 2023, the second highest burden of the last decade

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More than 47,000 people died in Europe as a result of high temperatures in 2023, the warmest year on record globally and the second warmest in Europe. This is the estimate of a study led by the Barcelona Institute for Global Health (ISGlobal) and [published](#) in *Nature Medicine*.

The researchers report that the vulnerability to heat of European societies has progressively decreased over the present century, and estimate that without these societal adaptation processes, the heat related mortality burden over the past year would have been 80% higher.

The study replicates the methodology used last year in [another paper](#) published in *Nature Medicine*, which estimated that heat caused more than 60,000 deaths during the summer of 2022, which represented the highest heat related mortality burden of the last decade.

In a nutshell, researchers used [temperature](#) and mortality records from 823 regions in 35 European countries for the period 2015–2019 to fit epidemiological models to estimate heat related mortality in each European region over the entire year 2023.

In contrast to the summer of 2022, which was characterized by persistent extreme temperatures in the central part of the season from mid-July to mid-August, no large thermal anomalies were recorded during the same weeks in 2023. However, two episodes of high temperatures in mid-July and late August would have accounted for more than 57% of the overall estimated mortality, with more than 27,000 deaths.

Southern European countries the most affected

The results show a total of 47,690 estimated deaths in 2023 across the 35 countries as a whole, of which 47,312 deaths would have occurred in the hottest period of the year (between 29 May and 1 October).

When accounting for the population, the countries with the highest heat related mortality rates were in southern Europe, namely Greece (393 deaths per million), Bulgaria (229 deaths per million), Italy (209 deaths per million), Spain (175 deaths per million), Cyprus (167 deaths per million) and Portugal (136 deaths per million).

This [link](#) shows the details of the mortality estimates for the 35 countries analyzed.

Higher vulnerability for women and people over 80 years

In line with previous studies, the data show a higher vulnerability of women and older people. Specifically, after accounting for the population, the heat related mortality rate was 55% higher in women than in men, and 768% higher in people over 80 years of age than in people aged between 65 and 79 years.

Possible underestimation of the actual heat related mortality burden

The authors of the study caution that these numbers may underestimate the actual heat related mortality burden. Due to the unavailability of daily, homogeneous mortality records during the year of 2023, they had to use weekly counts of deaths from Eurostat.

In a recent [study](#) published in the *Lancet Regional Health—Europe*, the same authors showed that the use of weekly data would lead to an underestimation of the heat related mortality burden, and described a methodology to correct this bias.

Taking this into account, researchers estimate that the likely heat related [death](#) toll in 2023 could have actually been of the order of 58,000 deaths in the 35 countries studied, although a more accurate estimate could only be obtained if improved mortality databases were made available to the scientific community.

Societal adaptation to heat prevents up to 80% of

mortality

One of the aims of the study was to assess whether there has been a decrease of the vulnerability to heat in Europe, a process that is generally understood as an adaptation to rising temperatures.

To do this, the researchers fitted the same type of model to temperature and mortality data from the periods 2000–2004, 2005–2009, 2010–2014 and 2015–2019. They then plugged 2023 temperatures and mortality numbers into each of the four models to estimate the number of deaths that would have occurred in each period if temperatures had been as high as they had been in 2023.

Using this method, it was estimated that if the temperatures recorded in 2023 had occurred in the period 2000–2004, the estimated heat related mortality would have exceeded the number of 85,000 deaths, that is, 80% higher than the result arising from the vulnerability to heat in the period 2015–2019. For people over 80 years, the number of deaths would have more than doubled, from 1,102 to more than 2,200 heat related deaths.

"Our results show how there have been societal adaptation processes to high temperatures during the present century, which have dramatically reduced the heat-related vulnerability and mortality burden of recent summers, especially among the elderly," says Elisa Gallo, researcher at ISGlobal and first author of the study.

"For example, we see that since 2000, the minimum mortality temperature—the optimum temperature with the lowest mortality risk—has been gradually warming on average over the continent, from 15°C in 2000–2004 to 17.7°C in 2015–2019.

"This indicates that we are less vulnerable to heat than we were at the

beginning of the century, probably as a result of general socio-economic progress, improvements in individual behavior and [public health measures](#) such as the heat prevention plans implemented after the record-breaking summer of 2003."

Beyond physiological limits of adaptation

"In 2023, almost half of the days exceeded the 1.5°C threshold set by the Paris Agreement and Europe is warming at a rate twice as fast as the global average. Climate projections indicate that the 1.5°C limit is likely to be exceeded before 2027, leaving us a very small window of opportunity to act," says Joan Ballester Claramunt, Principal Investigator of the European Research Council (ERC) Consolidator Grant [EARLY-ADAPT](#).

"We need to take into account that inherent limits in human physiology and societal structure are likely to set a bound to the potential for further adaptation in the future," he adds.

"There is an urgent need to implement strategies aimed at further reducing the mortality burden of the coming warmer summers, together with more comprehensive monitoring of the impacts of climate change on vulnerable populations. These adaptation measures must be combined with mitigation efforts by governments and the general population to avoid reaching tipping points and critical thresholds in temperature projections."

A tool for predicting mortality risk by sex and age

Recently, the research group that carried out the study presented [Forecaster.health](#), a web-based tool open to the public that provides predictions of [mortality](#) risk associated with cold and [heat](#) by gender and

age for 580 regions in 31 European countries.

This early warning system is not based solely on meteorological data, but incorporates epidemiological models to estimate the actual health risks for each population group. Forecaster.health is available free of charge and provides forecasts up to 15 days in advance.

More information: Elisa Gallo, Heat-related mortality in Europe during 2023 and the role of adaptation in protecting health, *Nature Medicine* (2024). [DOI: 10.1038/s41591-024-03186-1](https://doi.org/10.1038/s41591-024-03186-1).
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