

An international study led by CSIC reveals a direct link between hot nights and global mortality

- The international study, led from Galicia by the Biological Mission of Galicia (MBG-CSIC), analyzes for the first time worldwide the impact of hot nights on mortality, with the participation of more than 40 institutions around the globe, including IDAEA-CSIC and EBD-CSIC.
- The effects of nighttime air temperature on mortality were analyzed in 178 locations across 44 countries between 1990 and 2018 (including 42 provincial capitals in Spain), using two thermal indices (excess and duration of hot nights).
- Results show an increased risk of mortality associated with hot nights in almost all climates and regions, except in Northern Europe, where the association was only suggestive.



Hot night in Madrid / José González Buenaposada, iStock

Barcelona, September 2, 2025. The [Spanish National Research Council \(CSIC\)](https://www.csic.es/), through research institutes in Galicia, Catalonia and Andalusia, advances in its research on the health effects of heat with the publication, in the journal *Environment International*, of

an international study that reveals an association between hot nights and the risk of mortality at a global scale.

The study, *“Short-term association between hot nights and mortality: a multicountry analysis in 178 locations considering hourly ambient temperature”*, is part of the global [Multi-Country Multi-City \(MCC\) Collaborative Research Network](#). It involved more than 40 institutions from different countries (including Brazil, Germany, France, China, USA...), with Spain represented by CSIC (through the [Biological Mission of Galicia](#), the [Institute of Environmental Assessment and Water Research](#) and the [Doñana Biological Station](#)) and the University of Valencia.

“The increase in hot nights in recent decades and the projections of further increases due to climate change highlight the crucial need to understand their impact. This knowledge is essential to define public health strategies and guide adaptation initiatives. Despite their importance, research on the implications of hot nights remains limited,” the research team explains.

In this context, the study was conducted to analyze whether nighttime heat, which occurs when temperature exceeds certain thresholds for several hours, had a specific impact on health. To this end, more than 14 million deaths were analyzed in 178 cities across 44 countries between 1990 and 2018, using hourly temperature data and advanced statistical models. Cities were selected according to data availability, with Spain represented by 42 provincial capitals (in Galicia, A Coruña, Ourense and Pontevedra). The largest attributable fraction in Spain was found in Granada (3.56%), followed by Madrid (3.45%) and Córdoba (3.44%) in excess nighttime heat. In Galicia, Ourense recorded 1.61%, and Pontevedra and A Coruña 0.87%.

Overall, excess nighttime heat was geographically consistent, delineating some of the physiographic and landscape units of the affected countries, mainly showing latitudinal effects and continental influence. The highest values were observed in the central and southeastern Mediterranean basin, with a median daily excess nighttime heat of 30 °C up to >70 °C.

The analysis revealed that hot nights are associated with an increase in mortality of up to 3%, making it one of the most affected regions in the world, and that nighttime heat has an effect independent from daytime heat, thus requiring specific preventive measures.

The study therefore provides evidence that hot nights specifically contribute to heat-related mortality risk. In this sense, the research team advocates modeling the sub-hourly impact of thermal characteristics on nighttime mortality, which could improve decision-making for long-term adaptation and preventive public health strategies.

“Nighttime heat prevents the body’s physiological recovery after daytime heat stress, affects sleep quality, and may worsen cardiovascular, respiratory and neurological diseases. In cities with an urban heat island effect, nighttime exposure may be even more intense. In this respect, it is worth noting that in Spain Mediterranean cities such as Madrid, Valencia, Barcelona and Seville show a high frequency of tropical and equatorial nights, and that the most vulnerable populations include the elderly, people with chronic diseases, and those living in urban areas with poor ventilation or limited access to air conditioning,” explains **Dominic Royé**, Ramón y Cajal researcher at MBG-CSIC and first author of the study.

In view of these results, the research team calls for including nighttime heat in early warning systems, developing urban climate shelters and increasing green areas, ensuring adequate thermal conditions in homes, hospitals and nursing homes, and designing prevention plans that consider nighttime heat as a specific risk.

“Hot nights not only prevent rest, but also aggravate the thermal stress accumulated during the day. This study shows that we must pay attention to nighttime heat as a real health risk factor,” the researcher states.

“Tropical nights have increased substantially in recent years due to climate change. This summer we have seen it in an unprecedented way, and the situation is intensifying, increasing the risk for the most vulnerable people,” adds **Aurelio Tobías**, researcher at IDAEA-CSIC and study co-author.

“This study confirms that nighttime heat has a direct impact on health, independent from daytime heat. It is essential that public policies incorporate this dimension to better protect vulnerable populations,” says **Veronika Huber**, from EBD-CSIC and study co-author.

“Further research will be needed to study the relationship between daytime and nighttime heat effects in cities of other climates and to examine vulnerable subgroups. In addition, it remains unknown how excess nighttime heat and its duration are related, and whether short periods of very high nighttime temperatures are more harmful to human health than prolonged elevated temperatures,” the researchers conclude.

Royé, D., Sera, F., Tobías, A., Hashizume, M., Honda, Y., Kim, H., ... & Van Dung, D. (2025). **Short-term association between hot nights and mortality: a multicountry analysis in 178 locations considering hourly ambient temperature.** *Environment International*, 109719.
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Communication IDAEA-CSIC

comunicacion.idaea@cid.csic.es