

Mapping Vulnerability to Heat Waves in India

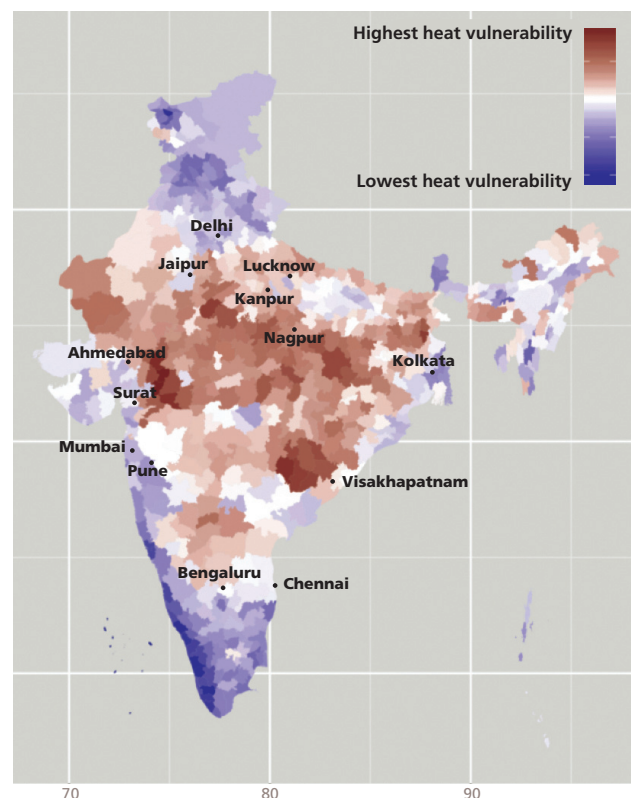
Heat waves—prolonged periods of abnormally hot weather—can be deadly events, especially for vulnerable populations, such as the elderly, the chronically ill, and infants. Historically, heat waves have been responsible for large numbers of deaths; the most notorious recent events are the European 2003 and Russian 2010 heat waves, in which tens of thousands died. And, as a result of climate change, these events are projected to become more frequent, more intense, and lengthier, according to the Intergovernmental Panel on Climate Change. Most evidence on heat wave deaths has been accumulated from North America and Europe, but now countries in the global south, such as India, are also facing extreme heat waves. In 2015, thousands reportedly died in a heat wave that gripped India just before the monsoon season.

Prevention programs aimed at reducing heat-related deaths have been shown to be cost-effective. Indeed, several cities and countries around the world have adopted heat wave preparedness plans; however, in India, this effort has been limited to only a few cities. A more comprehensive preparedness strategy is particularly important, given the high proportion of India’s large population that remains impoverished and lacks access to clean water and electricity. Assessing heat vulnerability and how this varies geographically can inform prioritization of targeted adaptation strategies, thus conserving limited resources.

As a preliminary step toward protecting the Indian public from the health threat posed by heat waves, RAND researchers built a tool for measuring and mapping population vulnerability to heat waves: the Heat Vulnerability Index (HVI). Using district-level data on demographic, social, economic, health, and environmental factors gathered from publicly available sources, RAND analysts created the HVI and mapped it for each district in India. The resulting standardized HVI classifies districts according to their degree of heat vulnerability, with the highest scores denoting the greatest heat vulnerability (shown in red on the map) and the lowest scores denoting the lowest heat vulnerability (shown in blue on the map).

The highest-HVI districts were in the central part of the country, most of them in central India in the states of Madhya Pradesh and Chhattisgarh. With a higher

Heat Vulnerability Index Map of India, by District



This fact sheet is based on Azhar G, Saha S, Ganguly P, Mavalankar D, and Madrigano J, “Heat Wave Vulnerability Mapping for India,” *International Journal of Environmental Research and Public Health*, Vol. 14, No. 4, March 30, 2017, EP-67084 (available at www.rand.org/t/EP67084).

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tribal population, these states have historically been at the lower end of various health, education, economic, and population growth indicators.

While the use of air conditioning has been observed to have the greatest impact in reducing heat wave deaths in the United States, it is unlikely to be a solution for India, at least in the short term, because of its high cost, its low availability, and the frequent lack of reliable and continuous power supplies. Therefore, suitable local adaptation strategies need to be considered. These may include

- heat wave warnings and public messaging through radio, television, text messages, and automated phone calls
- advising those in vulnerable areas to wear comfortable, light clothing
- housing designs featuring shaded windows, underground water storage tanks, and proper insulation, as well as access to drinking water.

This is the first examination of heat vulnerability across India. It provides a preliminary screening to target heat health and climate adaptation efforts. Recommended next steps include the following:

- incorporating exposure and health outcome data to validate the HVI
- examining vulnerability to heat at the subdistrict level to target adaptive strategies
- using the HVI to inform updates to disaster management and response plans across the country.

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