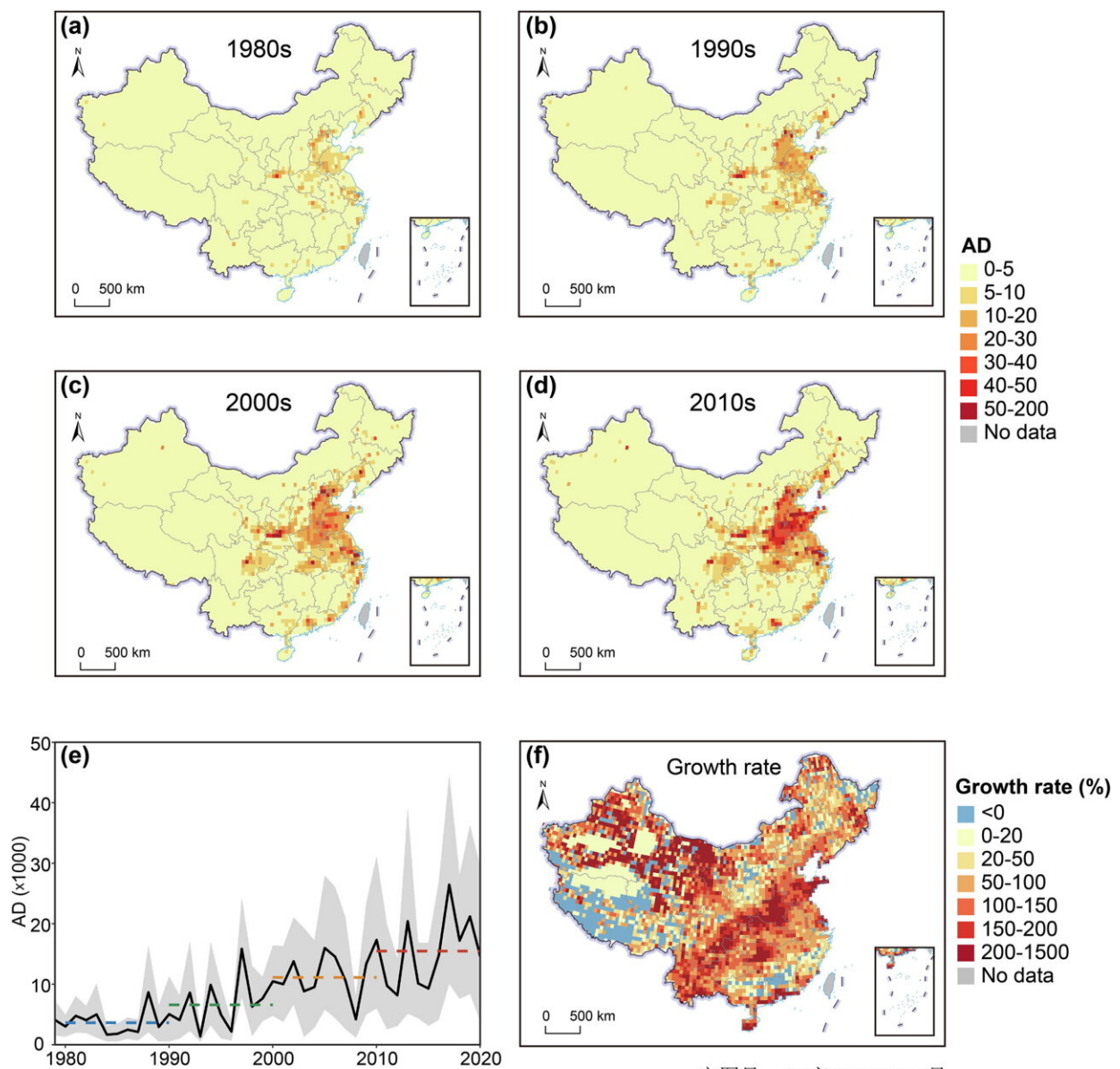


# Examining the spatiotemporal variation of mortality burden attributable to heatwaves in China, 1979-2020

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Health risks of heatwaves were characterized by rapid growth, nonlinear temporal evolution and extremity. Nationally, the number of annual attributable deaths was an average of 3,679 in 1980s but increased to 15,500 in 2010s. Taking a 5-year moving average, it took 2.8 years for every increase of 1,000 annual heatwave-related deaths from 1980s to 2000s, but just one year for the same increase to occur in 2010s. Also, the attributable deaths reached a highest record of 26,486 in 2017, followed by the second 21,219 in 2019 and the third 20,431 in 2013. Regionally, east and central China had the largest number of attributable deaths in general, accounting for more than 50% of deaths nationwide. Among the provinces, deaths ascribed to heatwaves were highest in Shandong, followed by Henan, Hebei and Jiangsu. (a-d) The number of attributable deaths to heatwaves in grid during the past four decades. (e) Attributable deaths to heatwaves in China from 1979 to 2020. The solid line shows the estimated number of attributable deaths to heatwaves; gray areas show the 95% confidence intervals; the horizontal dashed line shows the average annual deaths in 1980s, 1990s, 2000s, 2010s. (f) Changes in attributable deaths to heatwaves in 2010s relative to the baseline period of 1980-2009. AD, attributable deaths to heatwaves. Credit: Huiqi Chen/Science China Press

This study is led by Dr. Cunrui Huang (Vanke School of Public Health, Tsinghua University). Heatwaves impose heavy disease burden by increasing the risk of mortality and morbidity, which has been exacerbated worldwide under climate change. "In China, evidence documenting the impact of heatwaves on the number of attributable deaths, spatiotemporal variations and their driving factors is still limited, hindering the understanding of dangerous heatwaves," Huang says.

Huang, together with his group member Chen and meteorological expert Zhao, sought to identify what was the spatial and temporal trends of heatwave-attributable deaths in China over the past four decades. The team performed event-based attributable loss estimation to quantify the

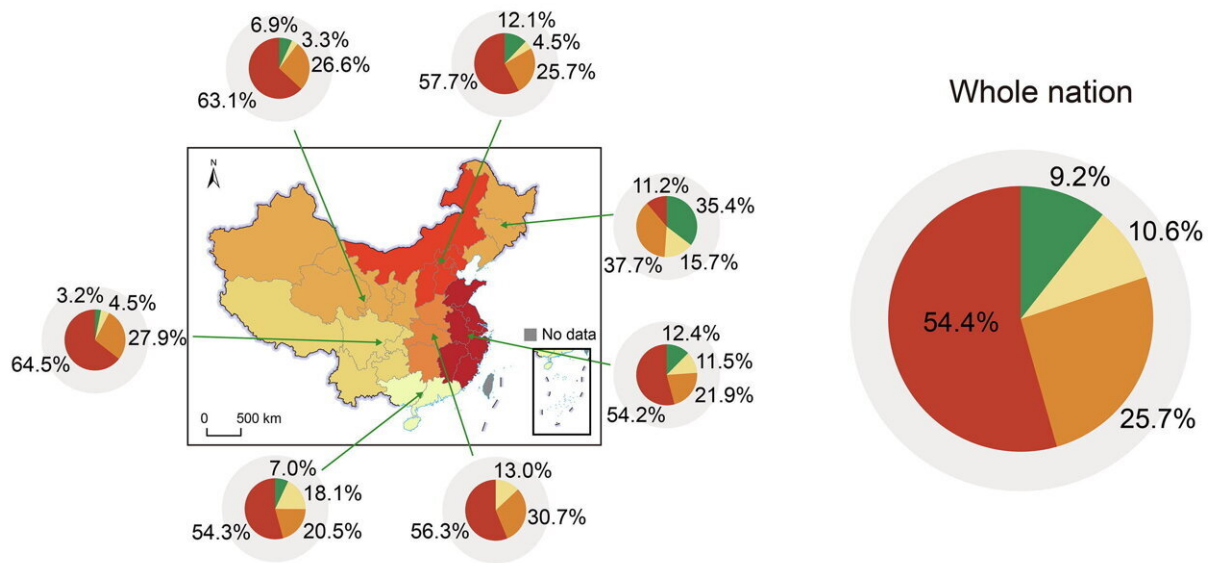
gridded attributable deaths.

The team found that health risks of [climate change](#) were characterized by rapid growth, nonlinear evolution and extremity. The attributable deaths to heatwaves in China have increased dramatically by four times in the past four decades, with the rising trends becoming more apparent in the recent decade but some fluctuations among individual years. Regionally, east and central China had the largest number of attributable deaths in general, accounting for more than 50% of deaths nationwide. Among the provinces, deaths ascribed to heatwaves were highest in Shandong, followed by Henan, Hebei and Jiangsu.

The researchers also decomposed the driving factors to changes in attributable deaths. The increase in attributable deaths to heatwaves in China over time was primarily due to increased heatwave exposure, followed by [population growth](#), population aging and the mounting baseline mortality. Notably, [population aging](#) has played an increasingly important role in attributable deaths over time. This work could provide important information for [policy-makers](#) to develop effective climate mitigation and adaptation measures in response to increasing heatwaves, especially for the most vulnerable elderly populations.

The research was published in *Science Bulletin*.

(a)



(b)



The increase in attributable deaths to heatwaves in China was primarily due to increased heatwave exposure, followed by population growth, population aging and the mounting baseline mortality. Notably, population aging has played an increasingly important role in attributable deaths over time, increased from 10.6% in the period between 1980s and 1990s to 15.8% afterward, reaching as high as 20.8% in the period between 2000s and 2010s. (a) Decomposition of the contribution of driving factors in seven regions (left) and for the whole nation (right) from 1980s to 1990s. (b) Decomposition of the contribution of driving factors in seven regions (left) and for the whole nation (right) from 1990s to 2000s. (c) Decomposition of the contribution of driving factors in seven regions (left) and for the whole nation (right) from 2000s to 2010s. AD, attributable deaths to heatwaves. Credit: Huiqi Chen/Science China Press

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