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The influence of humid heat on morbidity of megacity Shanghai in China

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Background: Increased attention has been paid to humid-heat extremes as they are projected to increase in both frequency and intensity. However, it remains unclear how compound extremes of heat and humidity affects morbidity when the climate is projected to continue warming in the future, in particular for a megacity with a large population.

Methods: We chose the Wet-Bulb Globe Temperature (WBGT) index as the metric to characterize the humid-heat exposure. The historical associations between daily outpatient visits and daily mean WBGT was established using a Distributed Lag Non-linear Model (DLNM) during the warm season (June to September) from 2013 to 2015 in Shanghai, a prominent megacity of China. Future morbidity burden related to the combined effect of high temperature and humidity were projected under four greenhouse gases (GHGs) emission scenarios (SSP126, SSP245, SSP370 and SSP585).

Results: The humid-heat weather was significantly associated with a higher risk of outpatient visits in Shanghai than the high-temperature conditions. Relative to the baseline period (2010–2019), the morbidity burden due to humid-heat weather was projected to increase 4.4% (95% confidence interval (CI): 1.1% –10.1%) even under the strict emission control scenario (SSP126) by 2100. Under the high-GHGs emission scenario (SSP585), this burden was projected to be 25.4% (95% CI: 15.8% –38.4%), which is 10.1% (95% CI: 6.5% –15.8%) more than that due to high-temperature weather. Our results also indicate that humid-hot nights could cause large morbidity risks under high-GHGs emission scenarios particularly in heat-sensible diseases such as the respiratory and cardiovascular disease by the end of this century.

Conclusions: Humid heat exposures significantly increased the all-cause morbidity risk in the megacity Shanghai, especially in humid-hot nights. Our findings suggest that the combined effect of elevated temperature and humidity is projected to have more substantial impact on health compared to high temperature alone in a warming climate.