Increased risk of cardiopulmonary mortality during hot weather: well-designed health impact assessments to inform heat adaptation strategies

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Exposure to hot weather can lead to heat-related illnesses (e.g., heat exhaustion) and/or trigger the exacerbation of pre-existing chronic diseases (e.g., cardiopulmonary diseases).[1] This is particularly concerning because hot weather is becoming more frequent, more intense, and longer-lasting.[2] To protect public health from the adverse impacts of hot weather, it is imperative to develop effective, accessible, and sustainable heat adaptation strategies. To inform the development of these strategies, the epidemiology research community needs to conduct high-quality heat health impact assessments to generate actionable evidence by leveraging the best available climate and health data, adopting recommended epidemiological designs, and judiciously interpreting research findings. The German study by Zhang et al., published in this issue of *The Lancet Regional Health—Europe*,[3] is a salient example of such research endeavours.

By employing an epidemiological design well-suited for estimating the health impacts of short-term exposure to an environmental hazard (i.e., a case-crossover design),[4] Zhang et al. conducted a nationwide study in Germany using data on temperature and mortality in 380 districts from 2000 to 2016, and quantified the risk of all-cause and cause-specific cardiopulmonary mortality during hot weather (measured as air temperature increased from the 75th percentile to the 99th percentile).[3] They observed that, during hot weather, there were increases in the risk of all-cause cardiovascular mortality (relative risk [RR]: 1.24, 95% confidence interval [CI]: 1.23, 1.26) and respiratory mortality (RR: 1.34, 95% CI: 1.30, 1.38) and mortality from ischaemic heart disease (RR: 1.21, 95% CI: 1.19, 1.23), myocardial infarction (RR: 1.16, 95% CI: 1.13, 1.19), heart failure (RR: 1.32, 95% CI: 1.29, 1.36), cerebrovascular disease (RR: 1.25, 95% CI: 1.23, 1.28), chronic obstructive pulmonary disease (COPD) (RR: 1.27, 95% CI: 1.22, 1.31), and pneumonia (RR: 1.49, 95% CI: 1.42, 1.57). They also found that individual- and district-level characteristics (e.g., sex, degree of urbanisation) modified the association between heat and cardiopulmonary mortality.

I applaud Zhang et al. for utilising temperature and mortality data with high spatial and temporal resolutions in this study. In an ideal world, heat health impact assessments would collect personal heat exposure data. However, this is not easy in large-scale epidemiological studies due to technical and other practical (e.g., financial) challenges. Zhang et al. used well-validated, spatially refined gridded data (1 km*1 km) on temperature, which was less subject to heat exposure measurement bias, compared with using temperature data collected from one or two ground monitoring stations to represent the heat exposure of all individuals in a city.[5] As heat health impacts often occur acutely (i.e., on the day of heat exposure or within a few days), using daily health event data rather than weekly or monthly data is generally more accurate in estimating heat health impacts.[6] The good practice of Zhang et al. in utilising the best available temperature and mortality data was a crucial first step in the success of this German study.

Although the risk of all-cause mortality associated with heat is well documented,[7] estimating the risk of cause-specific mortality associated with heat is crucial for identifying the most heat-sensitive chronic diseases (i.e., those exacerbated under heat exposure), understanding the biological mechanisms underlying heat health impacts, and accurately quantifying the health burden attributable to heat. Zhang et al. found that the risk of mortality from heart failure and COPD increased by 32% and 27%, respectively, during hot weather.[3] If disseminated properly to medical professionals (e.g., general practitioners, cardiologists, pulmonologists), this finding could be used to advise patients with these heat-sensitive chronic diseases to consider individual heat adaptation strategies if hot weather is forecast, such as postponing non-urgent in-person medical consultations and proactively using cooling measures (e.g., turning on the air conditioning before the indoor environment becomes too hot).

Zhang et al. also identified subpopulations in Germany with higher heat susceptibility (e.g., females and

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those living in districts with higher degrees of urbanisation).[3] This finding is relevant to policy. Population-based heat early warning systems are a strongly recommended heat adaptation strategy.[8] These heat early warning systems integrate heat susceptibility with weather forecast information and provide recommendations on effective cooling measures. Understanding 'who is most heat-susceptible' and 'where they are located' and including these heat-susceptible sub-populations in the heat early warning systems could enable more targeted interventions during extreme heat events (commonly called heatwaves).

We are facing unprecedentedly hot weather (e.g., 2023 was the hottest year on record[9]). As a research community, our responsibilities in addressing the health impacts of heat include (but are not limited to): (1) generating high-quality, actionable evidence through well-designed heat health impact assessments; (2) disseminating this evidence to the public and relevant policy and practice communities through effective channels, and (3) translating the evidence into effective, accessible, and sustainable heat adaptation strategies for implementation, in collaboration with other stakeholders. I commend Zhang et al. for providing an exemplary model of the first step in this process.

Contributors

ZX: conceptualisation, writing–original draft, writing–review & editing.

Declaration of interests

None declared.

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