Heat and health: a forthcoming *Lancet* Series

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Planet Earth is heating up, with heatwaves increasing in frequency, intensity, and duration.[1] In 2019, so far, all-time high temperature records have been toppled in multiple countries. An early and intense heatwave in Europe made June the hottest month on record for the continent with the average temperature 2°C above normal.[2] France reported a new national temperature record of 45·9°C on June 28. On July 24–25, a second major heatwave in a month set new all-time highs on 2 consecutive days in Germany, Belgium, and the Netherlands. India and Pakistan were also scorched by a prolonged severe heatwave this year, with some regions experiencing temperatures above 45°C for several weeks.[3] On June 10, Delhi reached 48°C, its hottest day on record for the month.

Epidemiological evidence shows the heavy toll of extreme heat on human health.[4,5] During the past 20 years in Australia, more deaths have been caused by extreme heat than by all other natural disasters combined.[6] Mortality and morbidity rates during heatwaves are highest among people older than 65 years with chronic medical conditions, such as cardiovascular disease.[7] A lower sweating capacity in older adults makes them more vulnerable to overheating, and cardiovascular disease predisposes them to ischaemic events in extreme heat. Risk of heat-related illness can be further compounded by use of certain prescription medicines.[5]

Hot weather is also costly for businesses. Working in hot conditions can increase the likelihood of occupational heat strain, which can reduce productivity and adversely affect health.[8] In Australia, estimated heat-related reductions in work productivity collectively cost more than AUD$6 billion each year.[9] Heat stress can even disrupt major sporting events, with recent examples including the Africa Cup of Nations in Egypt[10] and the FIFA Women's World Cup in France.[11]

Since 1990, exposure to extreme heat has increased worldwide. 157 million more people were exposed to heatwave events in 2017 than in 2000.[12] Even under the most optimistic future greenhouse gas emission scenarios, climate change will increase exposure to extreme heat. Assuming no additional efforts to adapt, temperature-related excess mortality will disproportionately impact the most disadvantaged in society, particularly in warmer and poorer regions of the world.[13]

There is a pressing need to find improved ways to live, work, and play in the heat, and enable civilisations to continue to thrive. Integrating knowledge from disciplines including epidemiology, physiology, medicine, built environment, and cultural studies will be essential for optimal health preparedness. *The Lancet* will publish in 2020 a new multidisciplinary Series of papers on heat and health. Led jointly from the University of Sydney, Sydney, NSW, Australia, and the University of Washington, Seattle, WA, USA, the Series will synthesise evidence and make recommendations to improve public health responses during heatwaves and support sustainable human adaptation to extreme heat.

Presently, air conditioning (AC) is a rapidly growing personal heat adaptation response. Without doubt, AC is an effective way to mitigate the physiological strain that ultimately leads to negative health effects during heatwaves.[5] AC is also one of the most widely used strategies to generally cope with hot weather. In the USA and Japan, about 90% of homes already have AC and, as household incomes rise, AC use is set to increase in countries such as China and India.[14] Yet the peak energy demand from mass cooling of densely populated urban areas during major heatwaves is a challenge in many countries, with sudden disruptions to power a common threat. Widespread dependence on energy-hungry AC is currently escalating greenhouse

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gas emissions and exacerbating climate change, and thereby inducing a vicious cycle of worsening future heat-related weather extremes.[14] As it stands, those who cannot afford AC—often the most vulnerable—remain exposed to extreme heat. More sustainable cooling solutions are needed.

Sustainable cooling solutions will require air to be moved more, and chilled less, and the accumulation of heat to be reduced by reflecting more thermal radiation and facilitating latent heat loss by evaporation.[15] Urban planners and architects are identifying solutions at landscape and building scales, including more green spaces (land with vegetation) and blue spaces (visible water), improved building design and materials, and adaptation of transport networks to reduce anthropogenic heat.[16] Thermal physiologists are evaluating options for the prevention of body heating by manipulating skin surface convection and evaporation using simple low-resource strategies such as electric fans[17] and self-dousing of skin with water.

The successful implementation of solutions for adaptation to extreme heat across settings, such as workplaces, schools, homes, and care facilities for older people, will require input from ergonomists, teachers, engineers, social workers, and physicians, among others. Understanding how sociocultural factors influence the acceptability of cooling options should be central in a comprehensive approach to reducing future heat–health impacts.

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