

## Heat-related mortality: an urgent need to recognise and record

National mortality records in Australia suggest substantial under-reporting of heat-related mortality. Less than 0.1% of 1.7 million deaths between 2006 and 2017 were attributed directly or indirectly to excessive natural heat (table). However, recent research<sup>1</sup> indicates that official records underestimate the association at least 50-fold.

Understanding the degree to which environmental factors affect human health is important if the impact of climate change is to be fully appreciated. As severe environmental events become more common, correct reporting and attribution is needed for effective evidence-based responses and to guide local, national, and global adaptation.

The issue of under-reporting death from heat parallels cases of lightning strikes, in which the direct cause (eg, a falling tree branch or the collapse of a building on fire) is reported without any reference to the indirect cause (ie, the initial lightning strike that triggered events culminating in death).<sup>2</sup>

Non-biomedical external factors are often omitted on death certificates,

contributing to inaccuracies in cause-of-death estimations in many countries. Other factors contributing to poor quality data include scarcity of resources necessary to maintain or improve the data quality and a lack of physician training in death certificate completion.<sup>3</sup> In response to such weaknesses, many countries are exploring ways to modernise death certification and recording processes.<sup>4</sup>

Given the unpredictable nature and global scale of climatic and other environmental events, such as the Australian heatwaves and bushfires of 2019–20, it is imperative that systems designed to monitor national mortality accurately reflect the impact of large-scale environmental events.

Combining death and temperature data sources to estimate temperature-related mortality or augment death certification data will improve the surveillance of heat-related mortality. However, for more than 2 billion people who live in tropical locations that are most vulnerable to heat, the resources required for valid mortality data are scarce.<sup>5</sup>

Climate change is a concern to many people. But if the effect of extreme temperatures is not recorded, its full impact can never be understood. Death certification needs to be modernised, indirect causes should be

reported, with all death certification prompting for external factors contributing to death, and these death data must be coupled with large-scale environmental datasets so that impact assessments can be done.

We declare no competing interests.

Copyright © 2020 The Author(s). Published by Elsevier Ltd. This is an Open Access article under the CC BY-NC-ND 4.0 license.

\**Thomas Longden, Simon Quilty, Philip Haywood, Arnagretta Hunter, Russell Gruen*  
thomas.longden@anu.edu.au

Crawford School of Public Policy (TL) and Australian National University College of Health and Medicine (SQ, AH, RG), Australian National University, Canberra, ACT 2600, Australia and Centre for Health Economics Research and Evaluation, University of Technology Sydney, Sydney, NSW, Australia (TL, PH)

- 1 Longden T. The impact of temperature on mortality across different climate zones. *Clim Change* 2019; **157**: 221–42.
- 2 Shearman KM, Ojala CF. Some causes for lightning data inaccuracies: the case of Michigan. *Bull Am Meteorol Soc* 1999; **80**: 1883–91.
- 3 Johns LE, Madsen AM, Maduro G, Zimmerman R, Konty K, Begier E. A case study of the impact of inaccurate cause-of-death reporting on health disparity tracking: New York City premature cardiovascular mortality. *Am J Public Health* 2013; **103**: 733–39.
- 4 Millares-Martin P. Death certification in England must evolve (considering current technology). *J Forensic Leg Med* 2020; **69**: 101882.
- 5 Bloomberg MR, Bishop J. Understanding death, extending life. *Lancet* 2015; **386**: e18–19.



For Australian mortality data see <https://www.qld.gov.au/law/births-deaths-marriages-and-divorces/data/national-data>

	Number of deaths
Number of deaths in Australia between January 2006 and October 2017	1 717 224
Number of deaths in Australia attributed to heat using the technique applied in Longden (2019) <sup>1</sup>	36 765
Number of deaths with exposure to excessive natural heat (ie, ICD-10 X30) as the underlying cause of death	179
Number of deaths with exposure to excessive natural heat (ie, ICD-10 X30) as a contributory factor to death	340
Number of deaths with heatstroke and sunstroke (ie, ICD-10 T67) as the underlying causes of death	0
Number of deaths with heatstroke and sunstroke (ie, ICD-10 T67) as contributory factors to death	366
Number of deaths with chronic ischaemic heart disease (ie, ICD-10 I25) as the underlying cause of death and exposure to excessive natural heat (ie, ICD-10 X30) as a cause of death	108

ICD-10=International Statistical Classification of Diseases and Related Health Problems 10th revision.

**Table: Deaths in Australia between January, 2006, and October, 2017**