Temperature

ISSN: 2332-8940 (Print) 2332-8959 (Online) Journal homepage: www.tandfonline.com/journals/ktmp20

Heat impacts on child mortality differ across seasons and countries

C. Brimicombe, D. Jackson & I. M. Otto

To cite this article: C. Brimicombe, D. Jackson & I. M. Otto (17 Jun 2025): Heat impacts on child mortality differ across seasons and countries, Temperature, DOI: 10.1080/23328940.2025.2514959

To link to this article: https://doi.org/10.1080/23328940.2025.2514959

Published online: 17 Jun 2025.

TEMPERATURE
https://doi.org/10.1080/23328940.2025.2514959

Taylor & Francis
Taylor & Francis Group

FRONT MATTER: DISCOVERY

Heat impacts on child mortality differ across seasons and countries

We know from the literature that during periods of high heat exposure there is often a rise in mortality rates for those we would call vulnerable groups to heat, these people who have a limited ability to thermoregulate and keep their core body temperature at a level that allows their body to function properly [1]. These groups include under 5s, over 65s, pregnant, post-partum and breastfeeding persons, outdoor workers, some indoor professions and those with preexisting medical conditions. Most often in literature we can see that the focus is on a combination of results across multiple countries, multiple age groups and multiple seasons and stating this is the effect of heat. In our study, *"Effects of ambient heat exposure on risk of all-cause mortality in children younger than 5 years in Africa: a pooled time-series analysis,"* [2] we aimed to debunk this.

Most often, the argument is that heat must not affect colder regions such as Canada or Sweden because it is hotter in regions such as the Sahara Desert or Fiji [3]. We must realize that heat is relative, which means what is considered extreme heat in each region can be different, depending on the average climate of the region and the acclimatization of individuals to the climate. There is a limit of heat survivability, but this is different for different individuals.

With this in mind, we used climate science literature to design a study which placed an emphasis on *"heat exposure"* in different seasons noting these seasons are different depending on where we are. We applied this understanding to the Health and Demographic Surveillance Sites (HDSS) consolidated mortality dataset for three different age categories in the under 5s for thirteen different countries in Africa, combined by us into six different climate regions, these climate regions were Guinea, The Sahel, Senegal and The Gambia, Ethiopia and South Africa.

Another important point that our study raises is that heat is much more than the temperature alone. For this study, we used the Wet Bulb Globe Temperature (WBGT), an occupational heat stress metric that considers the incidence of solar radiation on the body, temperature, relative humidity, and wind speed [4]. The WBGT was originally created as a heat stress metric by the US Navy to protect them against extreme heat. It is the most common international heat stress metric for occupational health and has been used across many professions from athletics to factory workers [5]. We also make the case that it is important for more studies to use this heat metric for the age group of children under 5, with few studies using this metric for this age group previously.

We considered the influence of heat in the hottest season across the entire year and in the colder and monsoonal seasons. We compared mortality trends for the three age groups for both heat above the median exposure and the 95th percentile as an indication of high heat compared to the median, that is most common heat exposure. Our results demonstrated that the response of mortality in the under-5s to the influence of heat was different across seasons, and this response was also different in all six regions and for the different age groups. This is in contrast to the literature, in which season is included as a fixed effect, which is supposed to detrend for seasonal responses (Figure 1).

Basing heat health interventions on trends using only pooled responses across many countries, climate regions, ages, and seasons, we will miss key information that could be used by policymakers and healthcare professionals to inform better-targeted implementation that makes better use of the resources available to them to act upon heat.

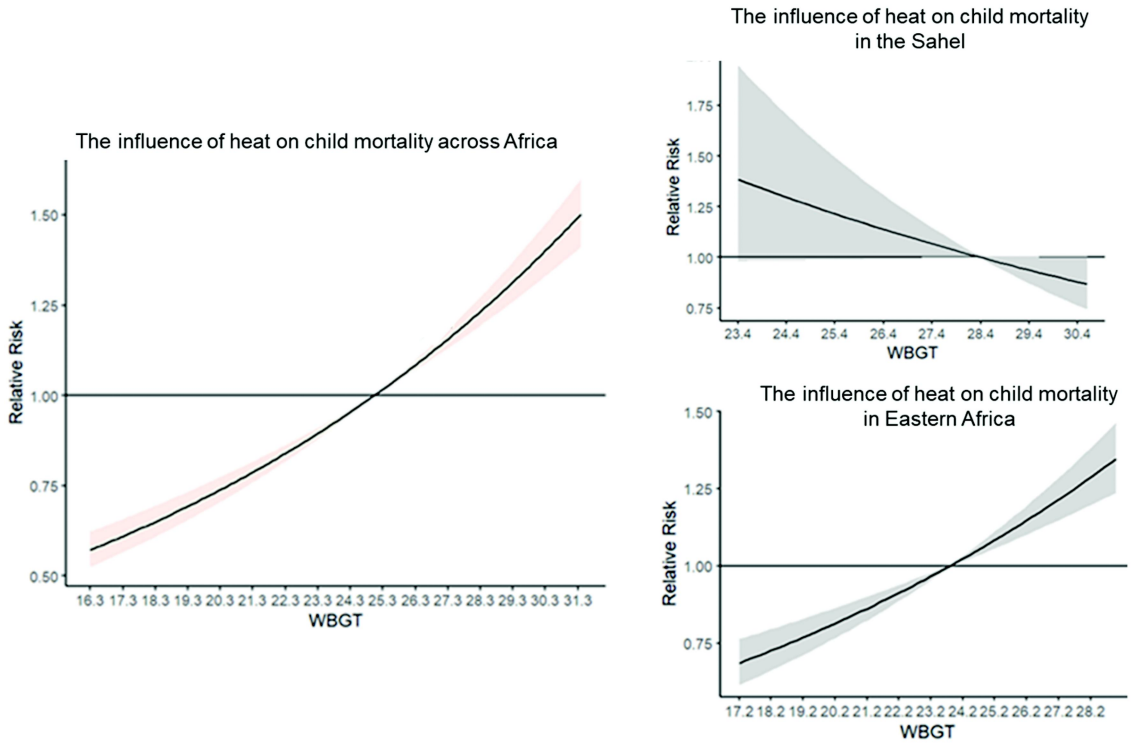

Figure 1. The dose-response curve for child mortality response to monthly average of maximum wet bulb globe temperature for 2 of the 6 different regions (the Sahel and Eastern Africa), in comparison to the dose-response across all regions, with a fixed effect for site of study.

In the future, we will take this work forward to several different projects with different collaborators, expanding this work further. We will be carrying out more studies that consider the effect of seasonality on extremes in heat. We will continue to highlight the use of heat indices in contrast to temperature in epidemiological studies. We will carry out studies that focus on the impact of heat on maternal, newborns and children and assess any interventions in a range of different countries and settings. We recommend better supportive multidisciplinary collaboration and training for the next generation of multidisciplinary heat researchers, supported by dedicated funding streams developed with a diverse pool of the research community [6]. We also advocate for the maintenance of open data sources and use of data such as the health and demographic health surveillance sites used here which can be accessed by all those within research.

References

[1] Otto IM, Reckien D, Reyer CPO, et al. Social vulnerability to climate change: a review of concepts and evidence. Reg Environ Chang. 2017;17(6):1651–1662. doi: 10.1007/s10113-017-1105-9

[2] Brimicombe C, Wieser K, Monthaler T, et al. Effects of ambient heat exposure on risk of all-cause mortality in children younger than 5 years in Africa: a pooled time-series analysis. Lancet Planet Health. 2024;8(9):e640–e646. doi: 10.1016/S2542-5196(24)00160-8

[3] Ladell WS. Assessment of group acclimatization to heat and humidity. J Physiol. 1951;115(3):296–312. doi: 10.1113/jphysiol.1951.sp004672

[4] Ioannou LG, Mantzios K, Tsoutsoubi L, et al. Indicators to assess physiological heat strain – part 1: Systematic review. Temperature. 2022;9(3):227–262. doi: 10.1080/23328940.2022.2037376

[5] Brimicombe C, Gao C, Otto IM. Vulnerable to heat stress: gaps in international standard metric thresholds. Int J Biometeorol. 2024;68(12):2495–2506. doi: 10.1007/s00484-024-02783-6

[6] Brimicombe C, Runkle JD, Tuholske C, et al. Preventing heat-related deaths: the urgent need for a global early warning system for heat. PLOS Clim. 2024;3(7):e0000437. doi: 10.1371/journal.pclm.0000437

C. Brimicombe
Wegener Centre for Climate and Global Change, University of Graz, Graz, Austria
Department of Public Health, Environments and Society, London School of Hygiene & Tropical Medicine, London, UK
chloe.brimicombe@LSHTM.ac.uk

D. Jackson
Centre for Maternal, Adolescent, Reproductive, and Child Health, London School of Hygiene & Tropical Medicine, London, UK
School of Public Health, University of the Western Cape, Cape Town, South Africa

I. M. Otto
Wegener Centre for Climate and Global Change, University of Graz, Graz, Austria