The burden of temperature-related neonatal deaths attributable to [illegible]

A global analysis across 29 low- and middle-income countries

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June 6th, 2023

Cross-sectoral ISIMIP and PROCLIAS Workshop

Prague, Czech Republic

Motivation

- Physiological vulnerabilities of fetuses and neonates to heat and cold

- Limited evidence on ambient temperatures and adverse birth outcomes from low- and middle-income countries (LMICs)
  - Low adaptive capacities
  - Limited space cooling
  - Large population growth
  - Largest global burden neonatal deaths (91%)

Source: https://www.gatesfoundation.org

Research Objectives

- Quantify the association between exposure to **ambient temperatures** and risk of **neonatal mortality**

- Estimate the **historical burden** of temperature-related neonatal deaths **attributable to climate change**

Data & methods

Population data

- Demographic Health Survey (DHS)
- Time period: 2001-2019
- Countries: 29 LMICs
- Neonatal deaths (~ 40,000), very early neonatal (~15,000)
- GPS coordinates of principal sampling units

Mean daily ambient temperature data

- ISIMIP3a simulation round
- 3 re-analysis datasets: GSWP3-W5E5, 20CRV3-ERA5, 20CRV3-W5E5
- Factual and counterfactual scenarios (Mengel, et. al, 2021)
- Absolute temperatures into community-specific temperature percentiles

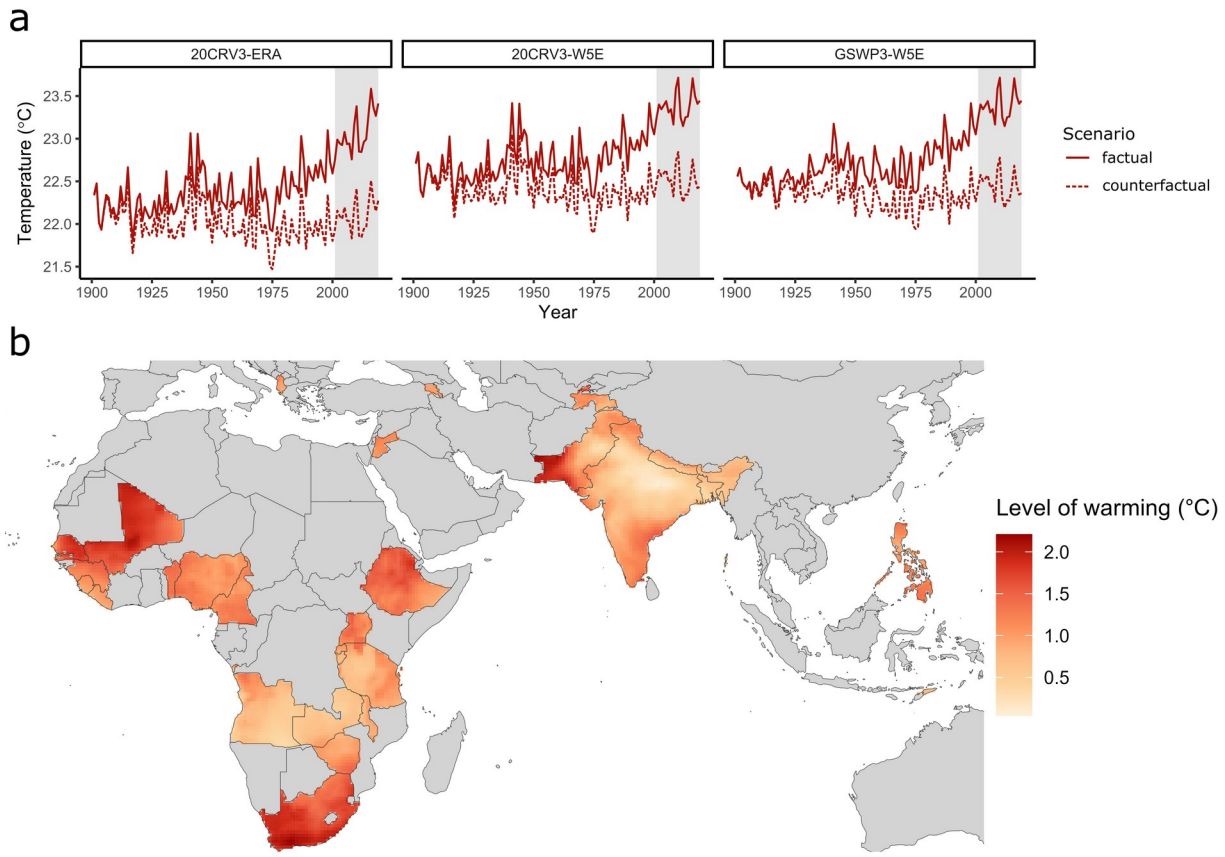
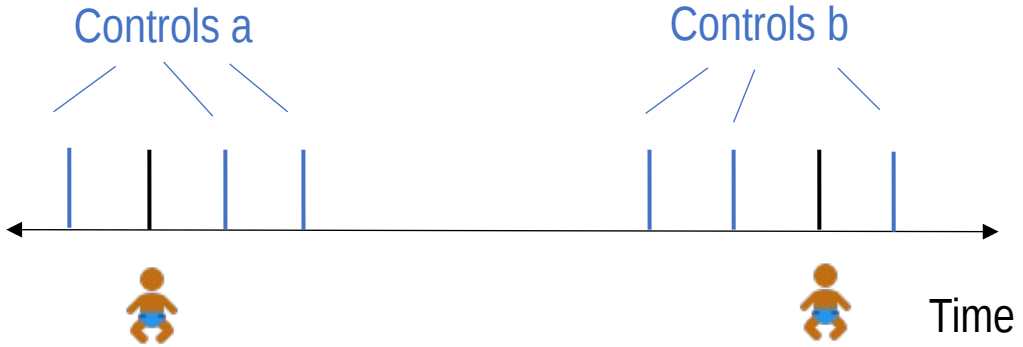


Fig. 1 Annual average temperature in factual and counterfactual scenarios. a, Annual average temperature since 1900 by re-analysis dataset. **b,** Average temperature difference between scenarios during 2001-2019

Data & methods

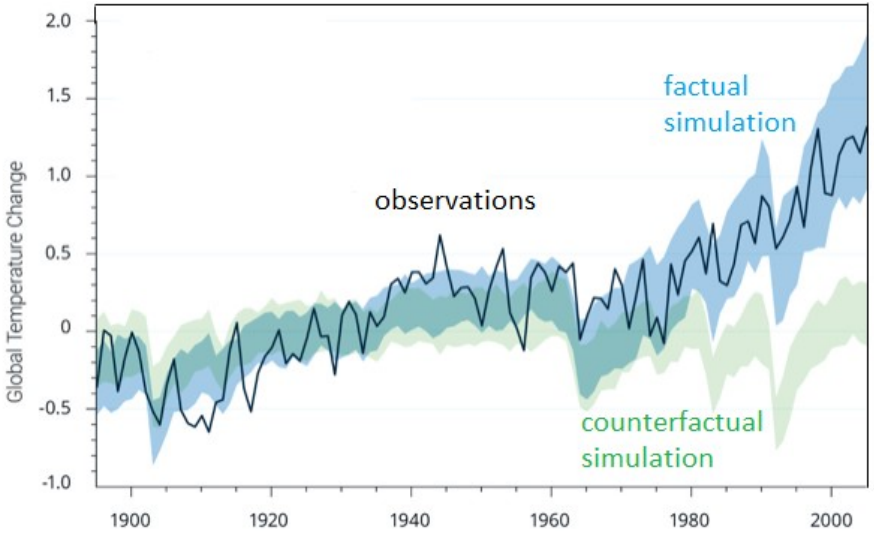
EXPOSURE-RESPONSE FUNCTION

- Time-stratified case-crossover design
- Conditional logistic regression
- Distributed-lag nonlinear models (DLNM) to assess the nonlinear and lagged associations (2 days lag)



IMPACT ATTRIBUTION

- Temperature-related burdens estimated under factual and counterfactual scenarios
- Difference interpreted as excess neonatal deaths attributable to climate change



Source: Adapted from https://ag.purdue.edu

Results

Pooled exposure-response associations for ambient temperatures and neonatal deaths

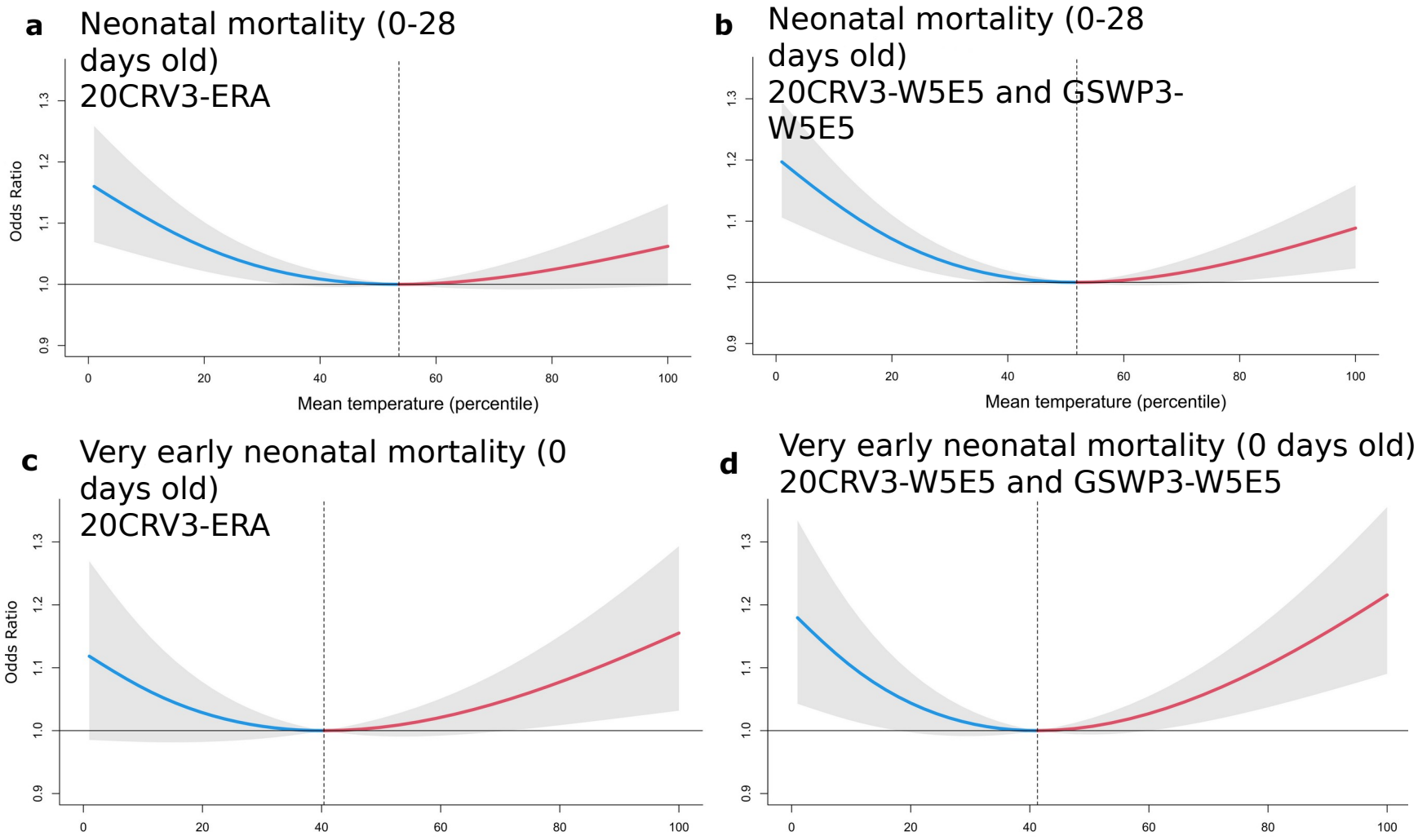


Fig. 2 Overall cumulative exposure-response associations for ambient temperature and neonatal mortality (a,b) and very early neonatal mortality (c,d) for the three factual temperature datasets.

Results

Impact of climate change on heat- and cold-related neonatal deaths (0-28 days old), 2001-2019

- 4.3 % neonatal deaths associated with non-optimal temperatures in factual scenario
- 175, 000 (95% UI: 7 800-354, 000) neonatal deaths from excess heat attributed to climate change
  → 53 % increase (range: 19-79%)
- 457, 000 (95% UI: 170, 000-869,0 00) less neonatal deaths from excess cold due to climate change
  → 33 % decrease

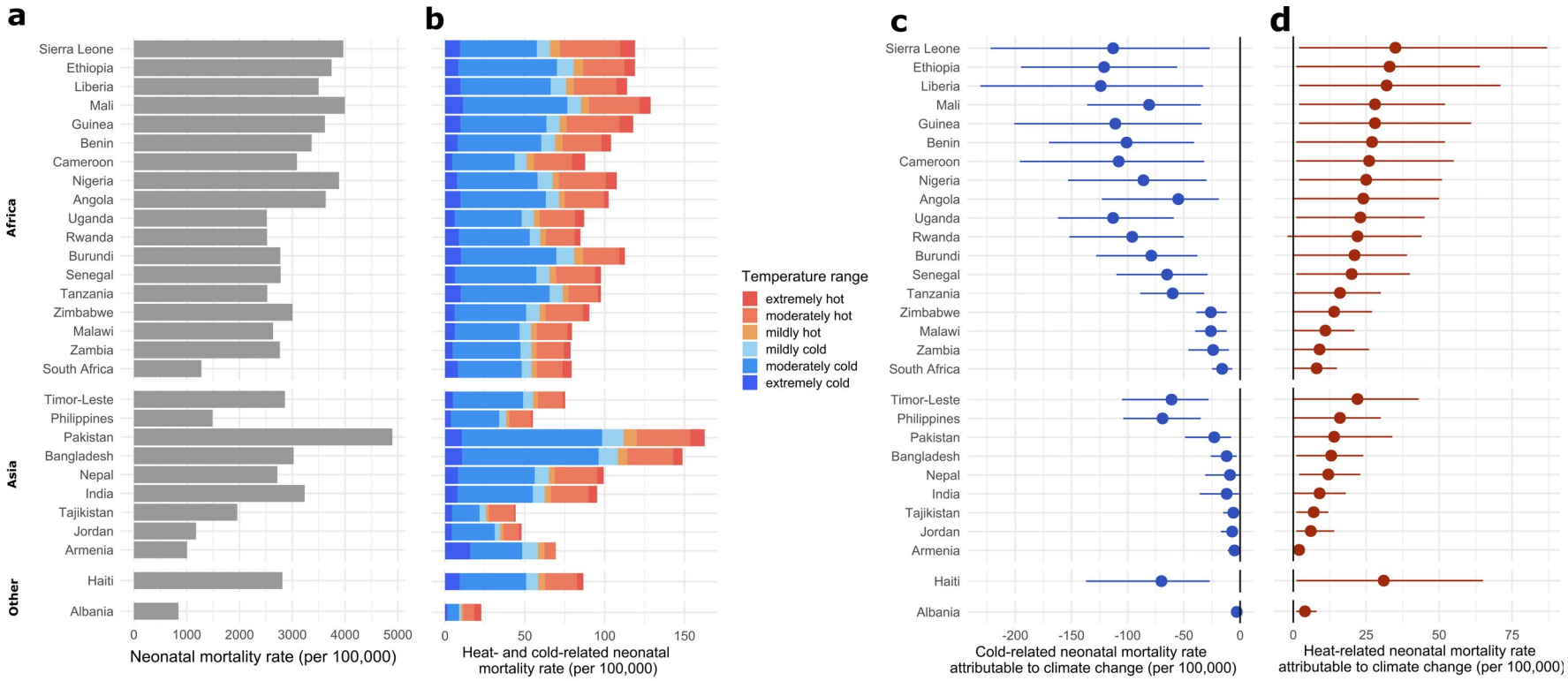


Fig. 4 Temperature-related neonatal death rates and the contribution of climate change, 2001-2019

Results

Impact of climate change on heat- and cold-related neonatal deaths (0-28 days old), 2001-2019

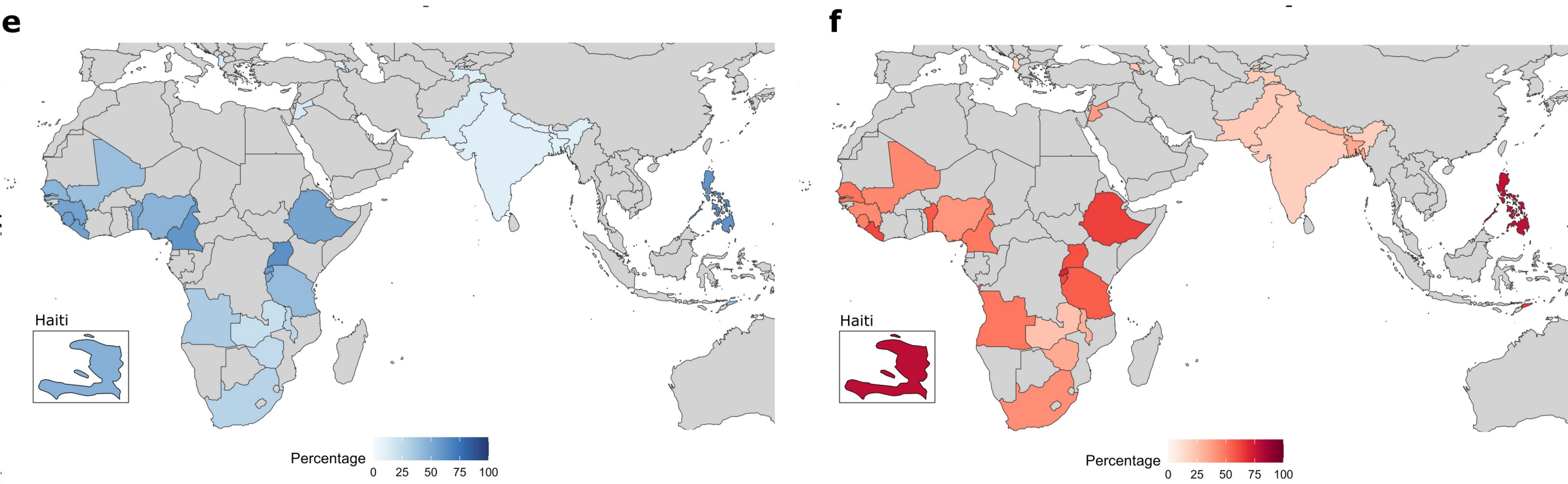


Fig. 5 Contribution of climate change to temperature-related neonatal deaths, 2001-2019. e, Proportion of cold-related neonatal deaths averted due to climate change (% of cold-related neonatal deaths). **f,** Proportion of heat-related neonatal deaths attributed to climate change (% of heat-related neonatal deaths)

Conclusions

- First climate impact attribution study on temperature-related neonatal deaths.
- Continuum of all temperature-related impacts on neonatal mortality.
- Climate change has exacerbated heat-related and alleviated cold-related neonatal deaths.
- Progressively increasing heat-related burden and diminishing cold-related gains expected with current emission trajectories.
- Need of ambitious mitigation and effective adaptation measures to safeguard the health of most vulnerable populations.

Thank you!

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Additional slides

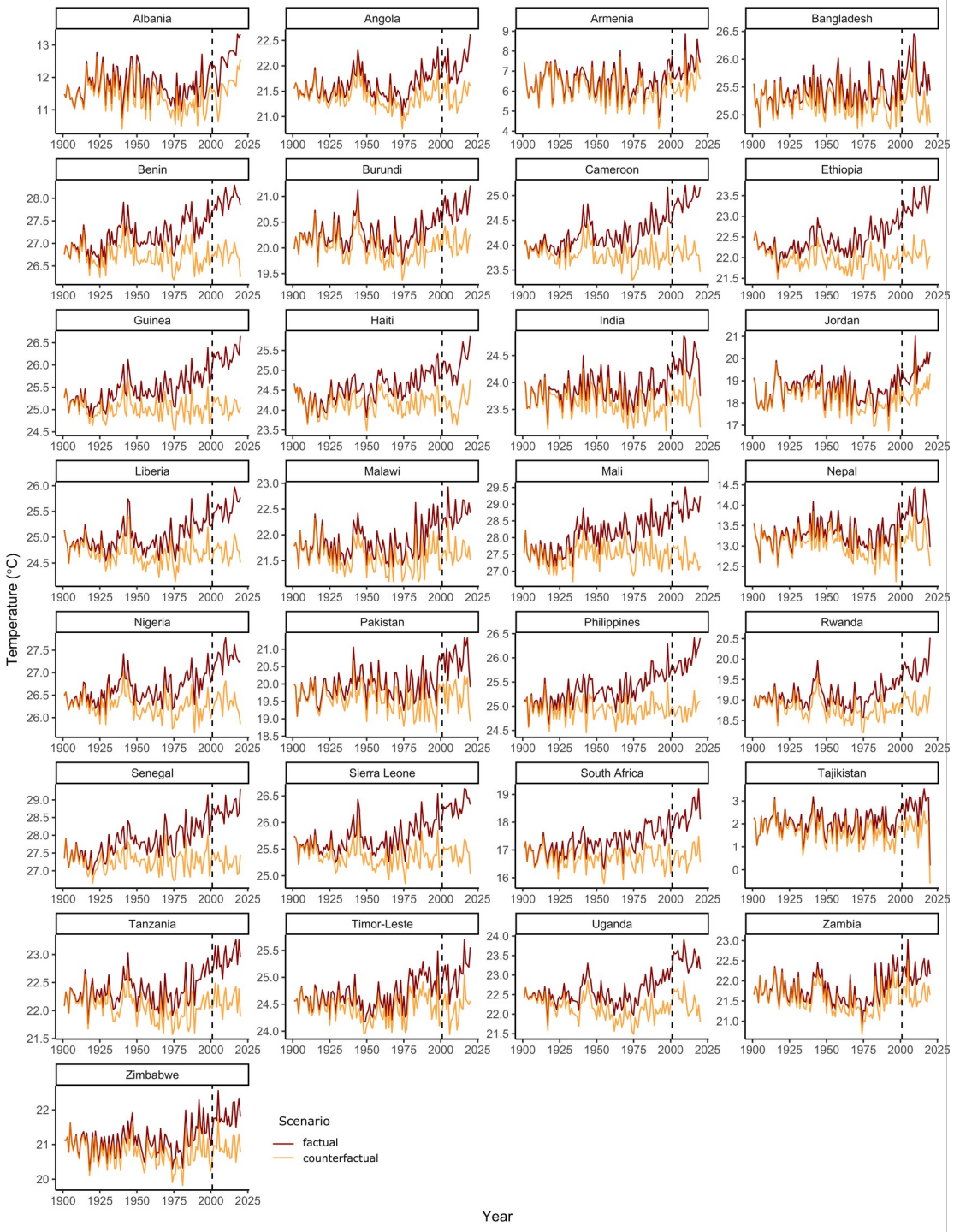

Fig. 5 Annual average temperature since 1900 by scenario and country.

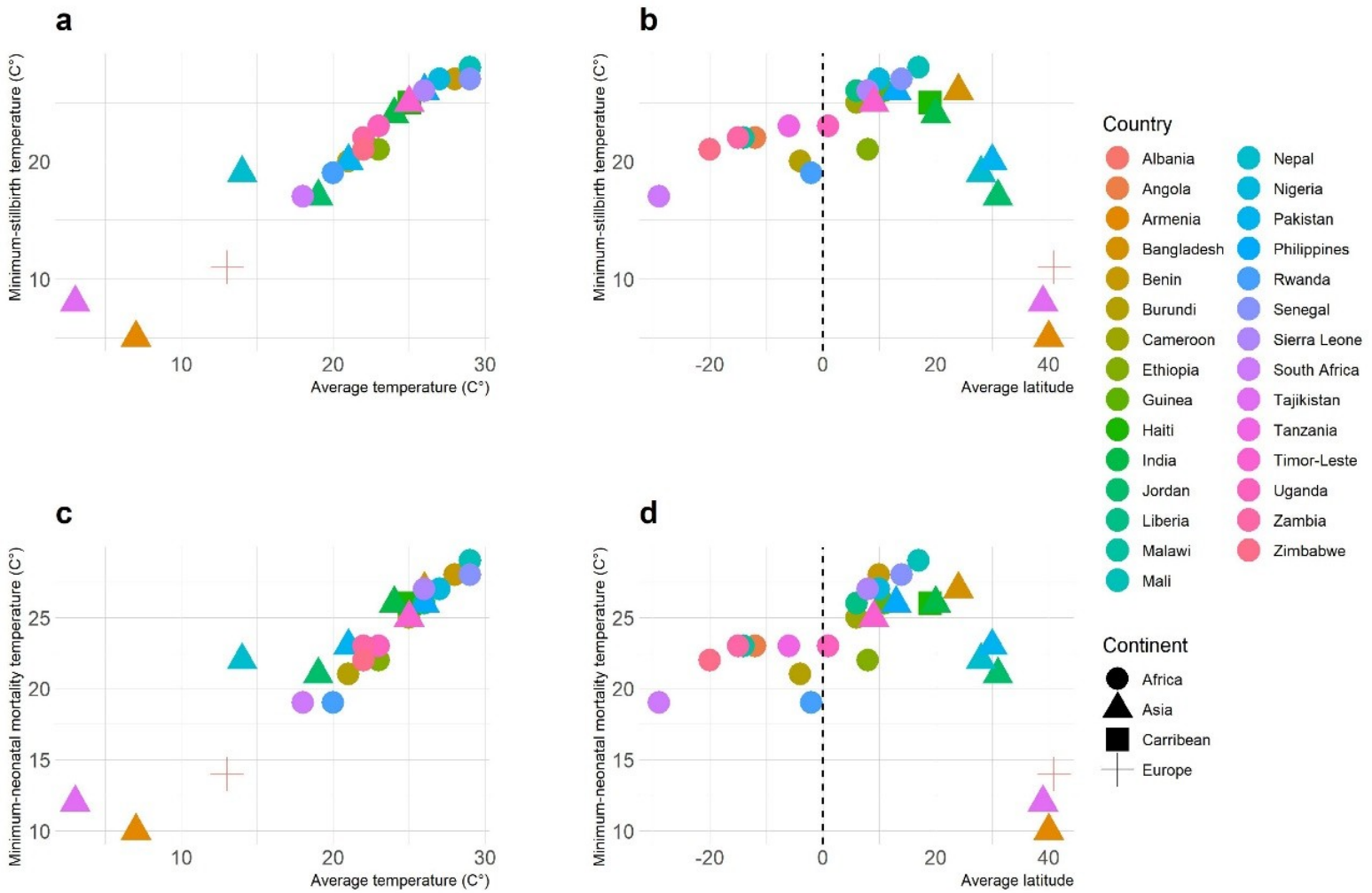

Fig. 6 Annual mean temperature and optimum temperature in the 29 countries. a, Annual mean temperature and minimum very early neonatal mortality temperature (°C). b, Latitude and minimum very early neonatal mortality temperature (°C) c, Annual mean temperature and minimum neonatal mortality temperature (°C). d, Latitude and minimum neonatal mortality temperature (°C)

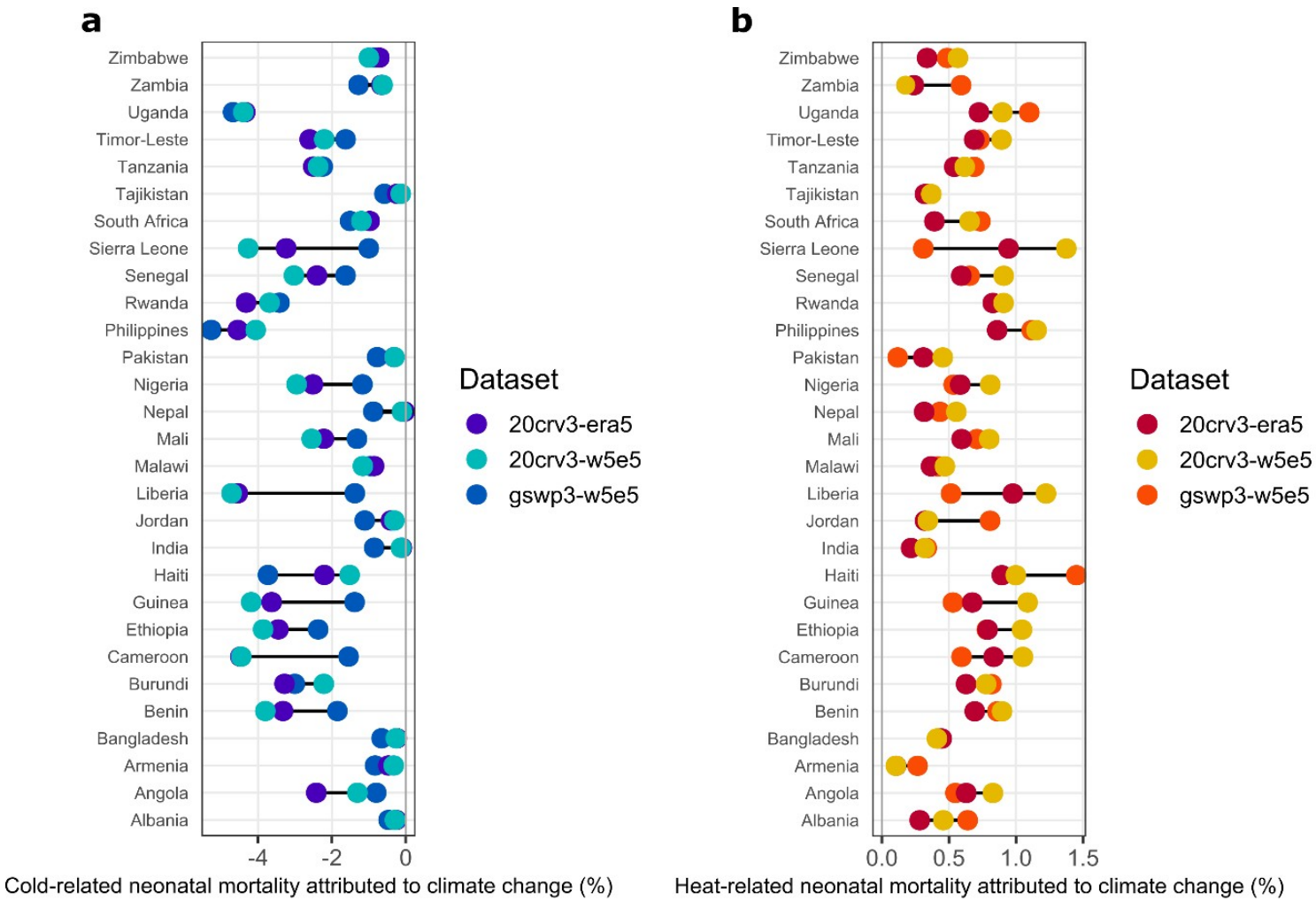

Fig. 7 Temperature-related neonatal mortality attributable to climate change as a share of total neonatal mortality (%) across re-analysis products.