Days with extreme precipitation reduce geographical access to maternal healthcare, causing more home births and fewer skilled deliveries, risking lives

Impact of extreme precipitation events on facility-based births in 21 sub-Saharan African countries

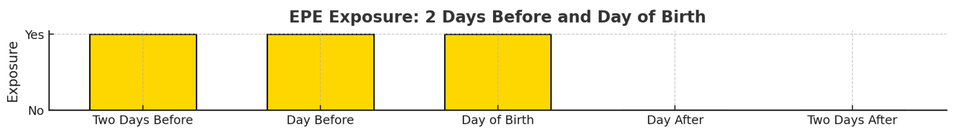
BACKGROUND

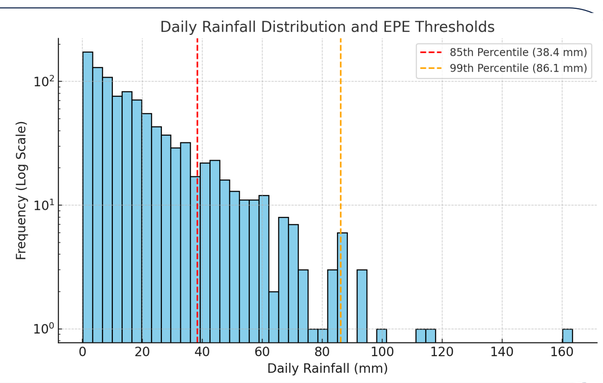
Facility-based births in Africa play a **critical role** in improving **maternal and child health outcomes**, alongside the **availability and quality of health services**. Despite their importance, utilization of these facilities varies, with **geographical access** being a significant contributing factor to this disparity. **Extreme precipitation events (EPEs)** in Africa are expected to change in frequency and intensity, and shift in their geographical distribution. These events can **damage road networks** and **elevate mobility costs**—including increased travel time, higher travel expenses, and greater accident risks—thereby worsening access to healthcare facilities and amplifying existing disparities.

We hypothesize that EPEs reduce geographical access to health facilities, lowering the likelihood of facility-based birth

METHODS

We **defined an EPE** as any day with precipitation exceeding the **85th percentile** of the local historical distribution, and to assess its immediate impact on access, we focused on a **critical window encompassing the day of birth and the two preceding days**.





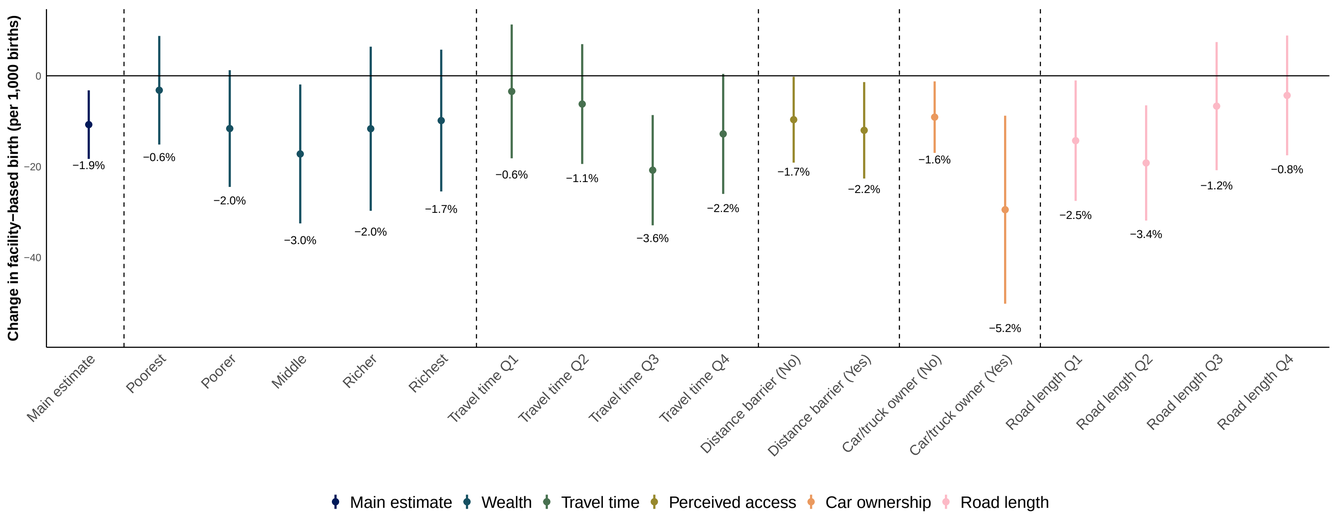
DATA

- **DHS survey:** 21 countries, 260'000 live births born between 2003 and 2021, residence coordinates
- **CHIRPS:** Daily precipitation, 5km X 5km

Regression model with fixed effects
Assumption for causal interpretation
=> Quasi-random timing of both the exact day of birth and EPEs

RESULTS

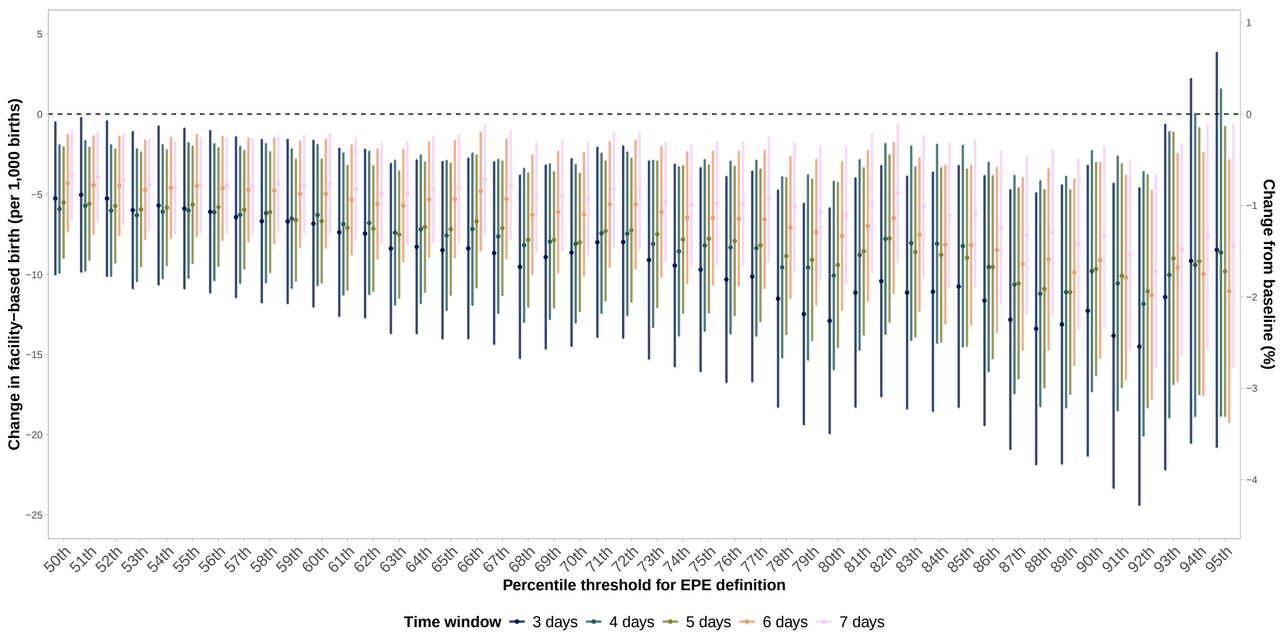
Effect of EPEs on Facility-Based Birth



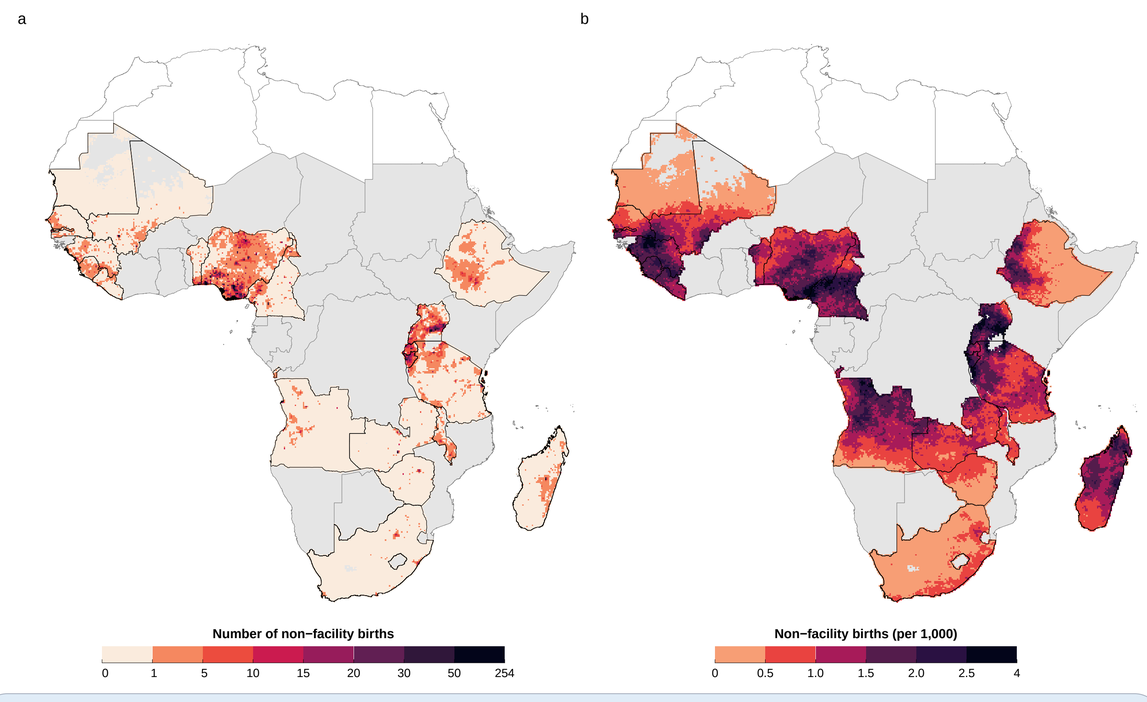
Key Facts

- An additional day of EPE reduce facility-based births **by -11 per 1'000 live births**
  ⇒ shift from skilled to non-skilled birth
- Estimated reductions among poorer- and middle-wealth households appear larger
- Estimated care-seeking changes among car-owning households appear larger
  ⇒ complementary role of road as **mobility heavily depends on a daily well-functioning road**

Effect of EPEs Across Percentile Thresholds and Time Window Exposures



Geographic Distribution of Non-Facility Births Attributable to EPEs in 2015



Key Mechanism

- **Immediate ⇓ geographical accessibility and ⇑ transportation challenges**
- **Fluctuating nature of accessibility on a day-to-day basis**

EPEs in 2015

- **29'084** additional non-facility births are attributable to EPEs in 2015

⇒ with heterogeneity in risk of additional non-facility births across countries

DISCUSSION

Implication for maternal and newborn health

- EPEs can compromise **access to emergency/high quality care** and pose risk for **SDG 3.1**, which aims to reduce global maternal mortality rates.
- Our findings align with **Boerma et al. (2023) five-phase mortality transition model**, which links increased institutional births and reduced wealth-related inequalities to declines in maternal/neonatal mortality, and stillbirths. However, EPEs may disrupt the utilization of these services, particularly among middle and higher-income households. This disruption may exacerbate inequalities and hinder progress in reducing these mortality rates.

Strengths

- **Quasi-experimental design:** We leverage on the quasi-random timing of day of birth and EPE.
- **Daily precipitation data:** We use high-resolution daily precipitation data to capture day-to-day changes in accessibility.
- **Addressing biases:** We address biases from residential sorting and selection into treatment by employing location fixed effect.
- **Attribution:** We present spatial information on the distribution of EPE's impacts across and within the 21 countries.

Preventions

- Climate-resilient road infrastructure
- Public awareness about home-based birth risk
- Availability of robust emergency services, early warning systems and maternity waiting homes

Interventions

- Deployment of mobile health units for skilled birth in disrupted locations

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