



## Jeroen de Bont

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The effect of short-term exposure and preterm births from 16 hospitals in Benin, Malawi, Tanzania and Uganda

**Jeroen de Bont**, Peter Waiswa, Kristi Sidney Annerstedt, Maria del Rosario Alsina, Federica Nobile, Nathalie Roos, Jean-Paul Dossou, Effie Chipeta, Lenka Benova, Hussein Kidanto, Andrea Pembe, Cherie Part, Massimo Stafoggia, Veronique Filippi, Petter Ljungman, Claudia Hanson

# Climate change

## Vulnerability

### Vulnerability factors

- Demographic factors
- Geographic factors
- Biological factors & health status
- Sociopolitical conditions
- Socioeconomic factors

### Exposure pathways

- Extreme weather events
- Heat stress
- Air quality
- Water quality and quantity
- Food security and safety
- Vector distribution & ecology

### Health system capacity & resilience

- Leadership & governance
- Health workforce
- Health information systems
- Essential medical products & technologies
- Service delivery
- Financing

## Climate-sensitive health risks

### Health outcomes



Injury and mortality from extreme weather events



Heat-related illness



Respiratory illness



Water-borne diseases and other water-related health impacts



Zoonoses



Vector-borne diseases



Malnutrition and food-borne diseases



Noncommunicable diseases (NCDs)



Mental and psychosocial health

### Health systems & facilities outcomes



Impacts on healthcare facilities

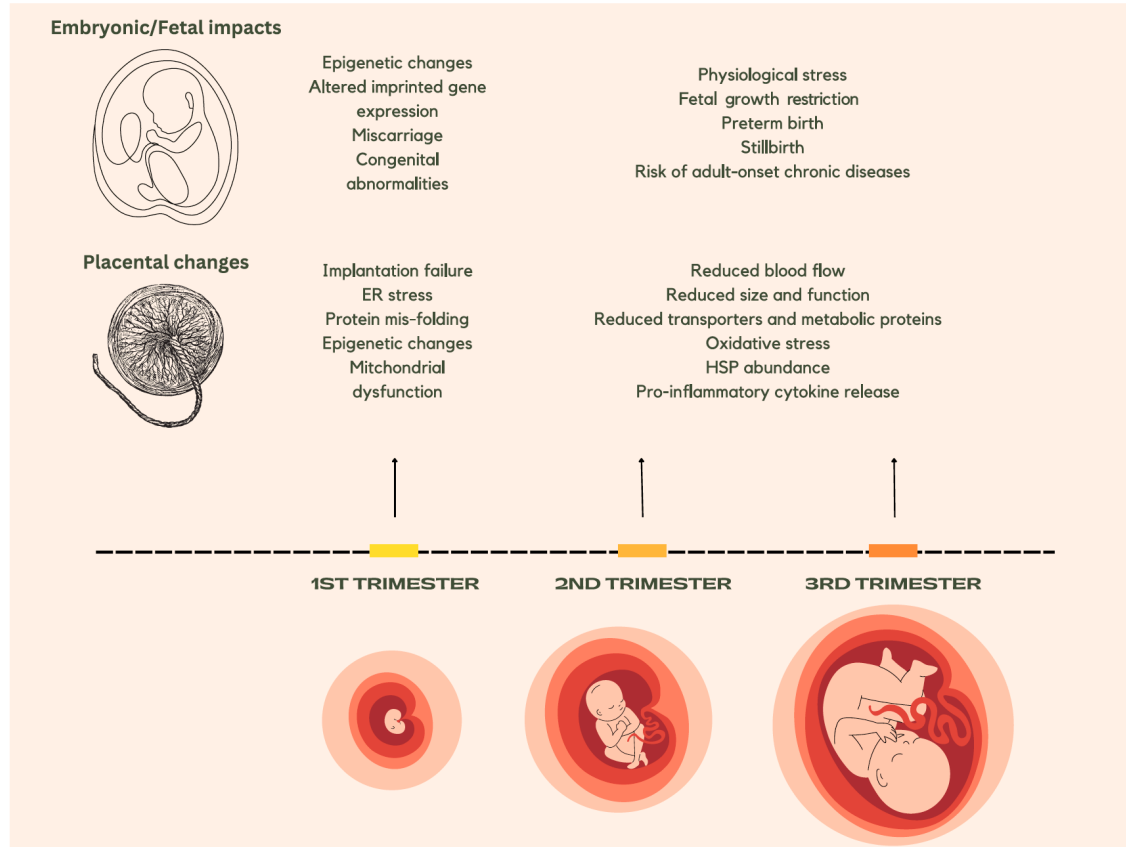


Effects on health systems

Source: WHO

2024-11-17

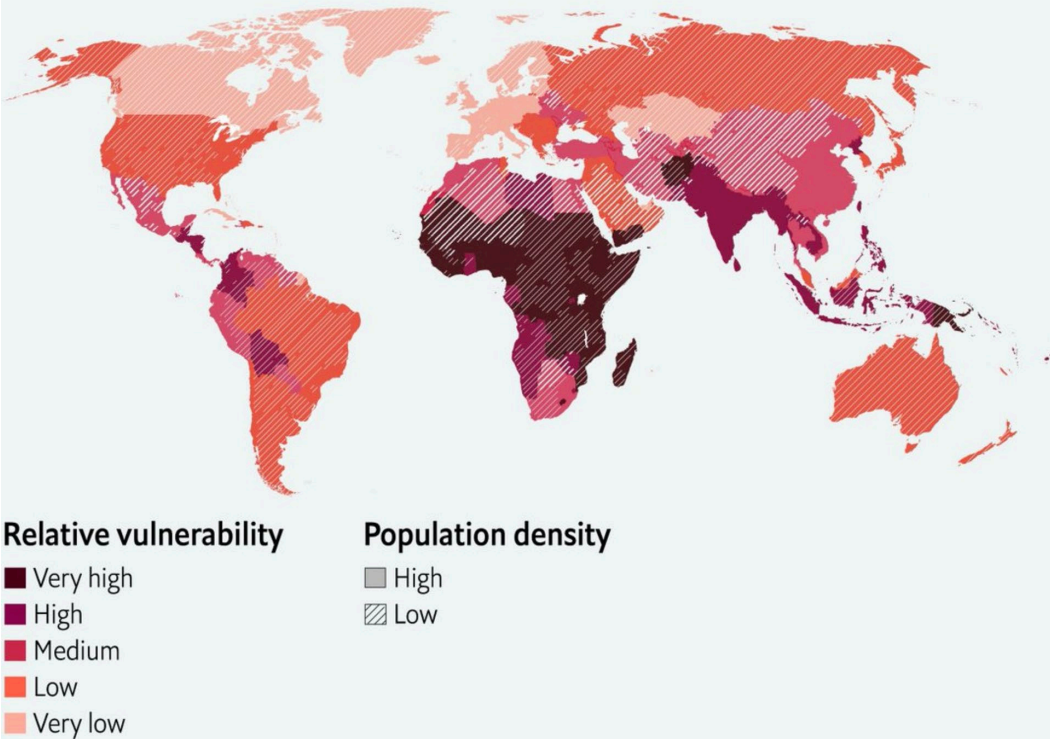
# Heat stress during pregnancy



Source: Bonnell et al. 2023

# Poorer countries are more vulnerable to the impacts of climate change

Relative vulnerability to climate change-related natural hazards



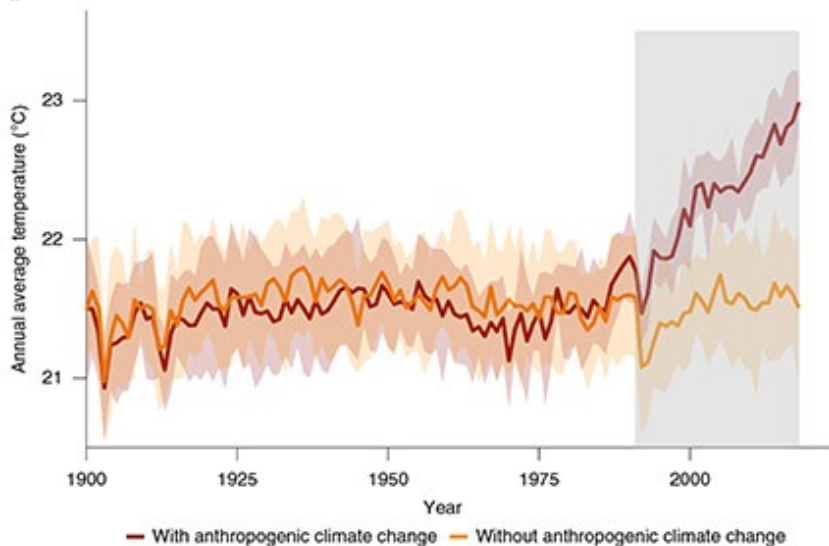
Source: UN Intergovernmental Panel on Climate Change.

Intersection between **extreme environmental exposures** with **unplanned urbanization, poor-quality housing, decline urban green cover**, among others.

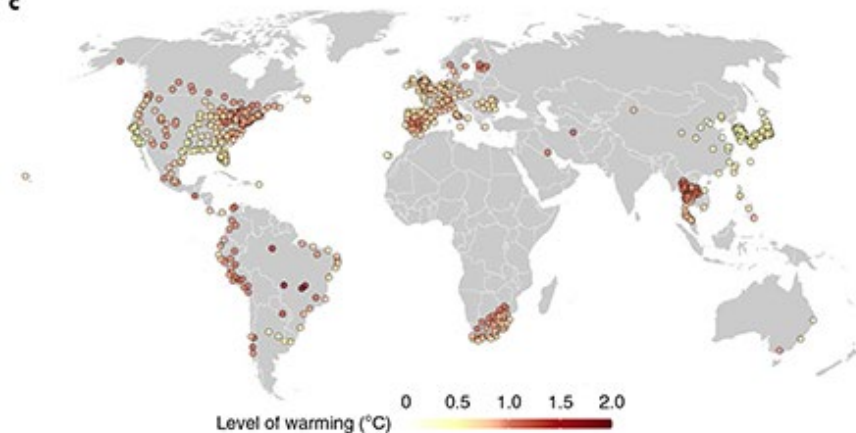
Source: The Economist

2024-11-17

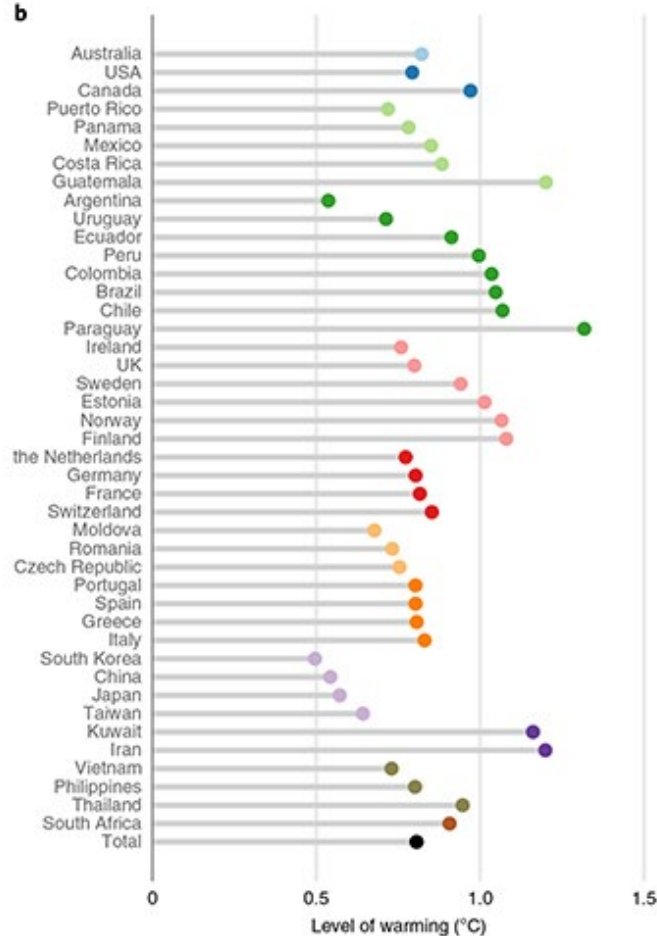
a



c



b



Limited studies  
in the Global  
South such as  
in **Africa**

Source: Vicedo-  
Cabrera 2021

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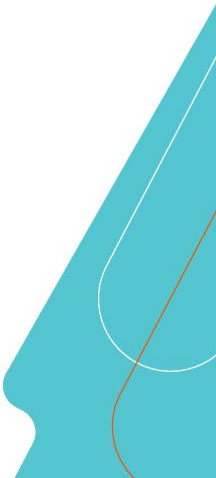
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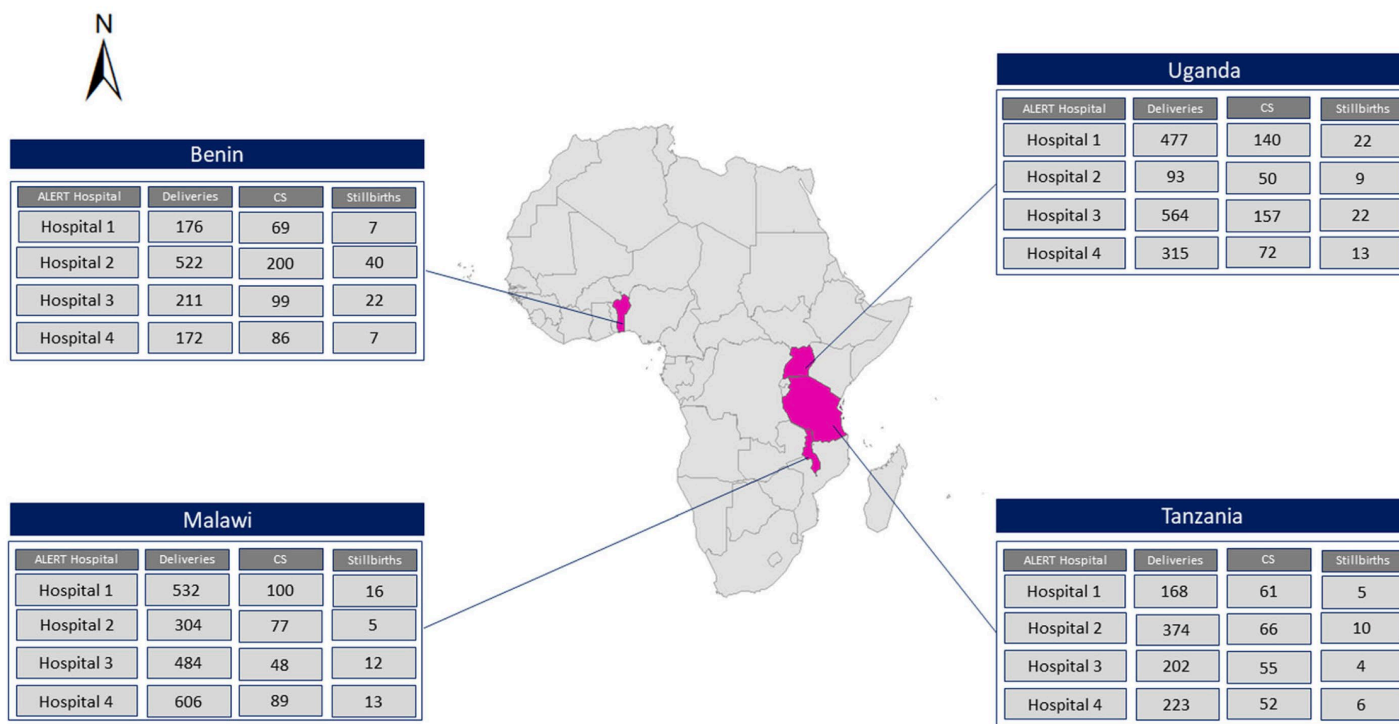


# Methods

We aimed to evaluate the acute effect high ambient temperature on preterm births in four African countries



# Data source – The ALERT study



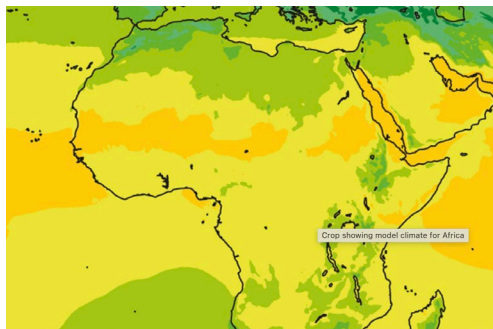
We included 135,130 hospital-based singleton births in four Sub-Saharan African countries.

Source: Akuze 2021

**Fig. 3** Map of the ALERT countries with key indicators for the selected study hospitals. CS: Caesarean section

# Exposure and outcome assessment

## Exposure



Daily mean, max and min temperatures were obtained from European Centre for Medium-Range Weather Forecasts (9x9km) linked to each hospital

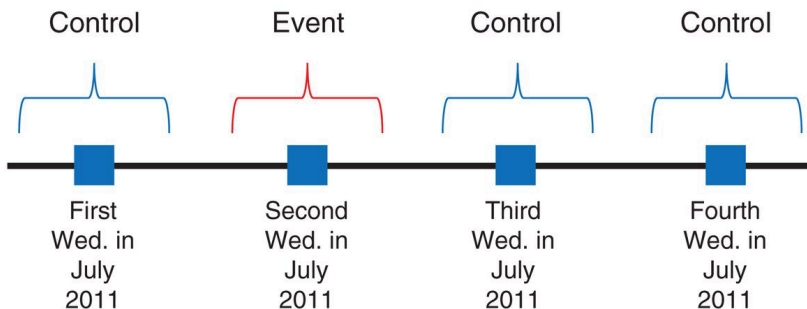
## Outcome

- All preterm births: <37 weeks of gestation
- Moderately preterm: between 32 and 37 weeks
- Very preterm: between 28 and 32.
- No data for extremely preterm



# Statistical analyses

**Study design:** case-crossover design:



**Statistical analyses:** two step approach:

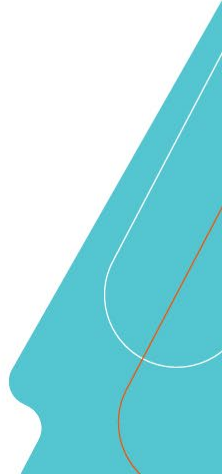
1. We estimated **country-specific associations**;
2. Followed by **meta-analysis** of these associations

A **conditional logistic regression** was applied to estimate country-specific associations.

- **Heat (lag 0-6):** increase from 75<sup>th</sup> to the 99<sup>th</sup> percentile.
- Meta-regression to capture the shape of the association.
- Stratified analyses by potential effect modifiers
- Sensitivity analyses: 6 hottest consecutive months and different lag patterns (0, 0-1 and 0-2)



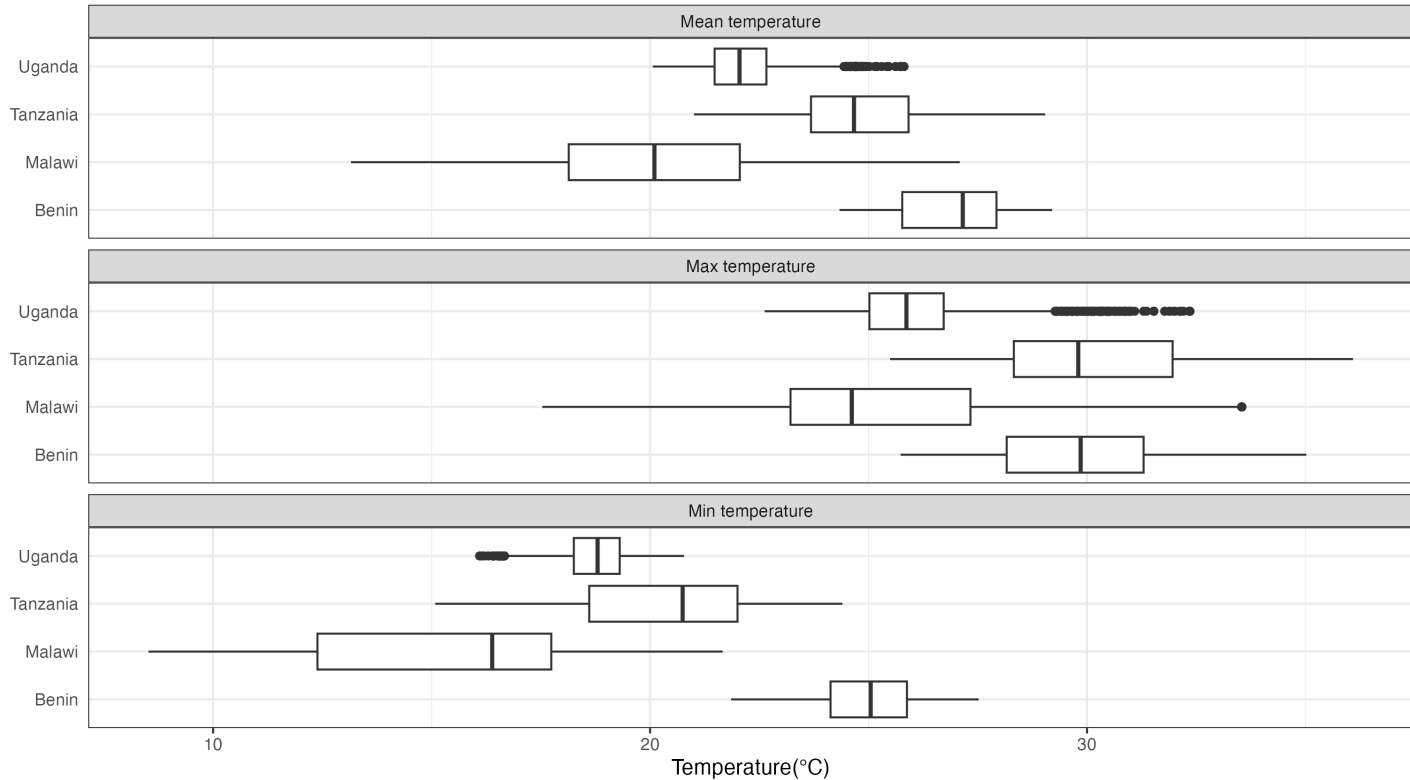
# Results



# Descriptives

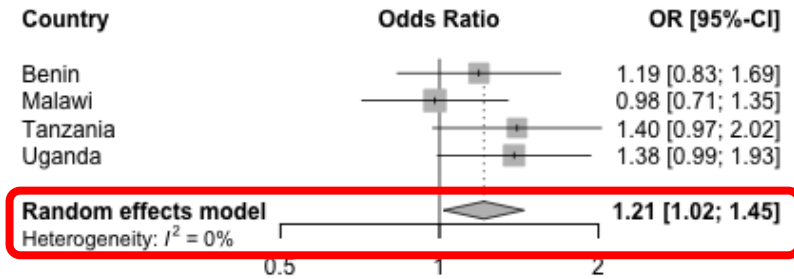
Descriptives	Benin (N=26108)	Malawi (N=49795)	Tanzania (N=23765)	Uganda (N=35462)
<b>Outcome</b>				
Very preterm	583 (2.2%)	479 (1.0%)	252 (1.1%)	602 (1.7%)
Moderately preterm	3849 (14.7%)	4805 (9.6%)	2945 (12.4%)	3333 (9.4%)
All preterm births	4432 (17.0%)	5284 (10.6%)	3197 (13.5%)	3935 (11.1%)
<b>Population descriptives</b>				
Maternal age (>=35 years)	3907 (15.0%)	4348 (8.8%)	3788 (15.9%)	3178 (9.0%)
Referred to hospital during childbirth	13962 (53.5%)	4584 (9.2%)	1129 (4.8%)	4931 (14.0%)
HIV positive	350 (1.6%)	1631 (3.8%)	728 (3.1%)	1134 (3.4%)
Hypertensive disorders	4976 (19.1%)	865 (1.7%)	1127 (4.7%)	1716 (4.8%)
Two or more pregnancies	18930 (72.6%)	27138 (54.5%)	15295 (64.4%)	23552 (66.4%)
Sex (female)	12369 (47.4%)	24094 (48.4%)	11761 (49.5%)	17848 (50.3%)
Low birth weight (<2,500 g)	4917 (18.9%)	6096 (12.3%)	2628 (11.1%)	3114 (8.8%)
Prolonged/obstructed labor	1607 (6.2%)	4185 (8.4%)	2387 (10.0%)	2415 (6.8%)
<b>Delivery mode</b>				
Spontaneous	13437 (51.5%)	40561 (81.5%)	16853 (70.9%)	25524 (72.0%)
Caesarean	12352 (47.3%)	8484 (17.0%)	6746 (28.4%)	9822 (27.7%)
Others	317 (1.2%)	750 (1.5%)	165 (0.7%)	113 (0.3%)
Antepartum hemorrhage	730 (2.8%)	339 (0.7%)	168 (0.7%)	591 (1.7%)

# Descriptives (temperature levels)

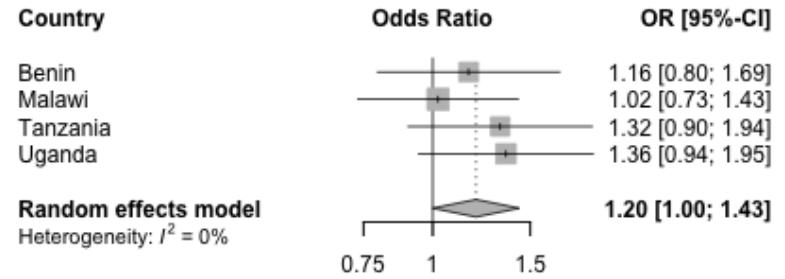


# Mean temperature and preterm birth (Increase from the 75<sup>th</sup> to the 99<sup>th</sup> percentile)

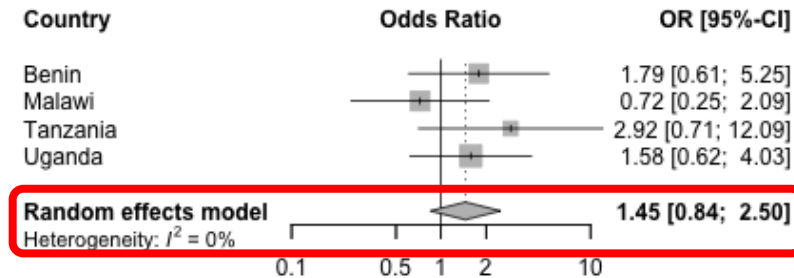
a) All preterm births



b) Moderately preterm birth

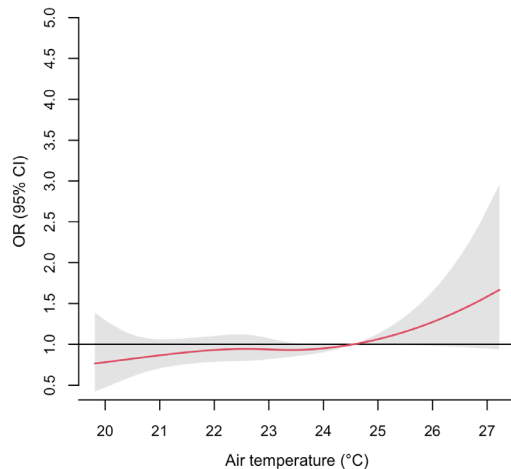


c) Very preterm birth

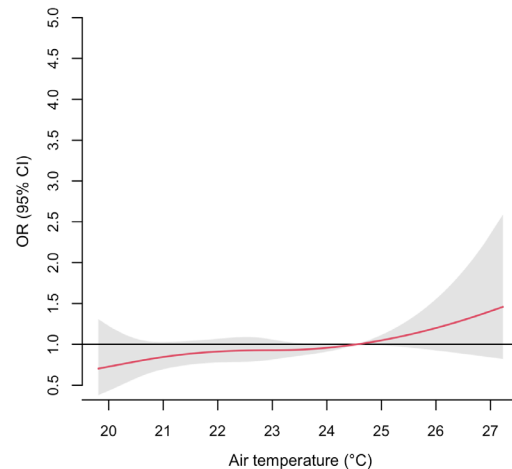


# Heat and preterm births

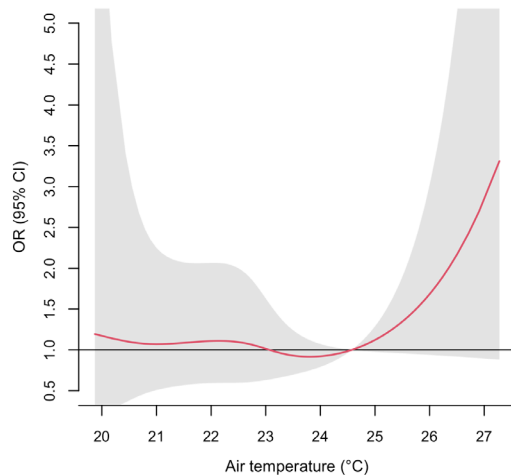
A) Preterm births



B) Moderately preterm



C) Very preterm births

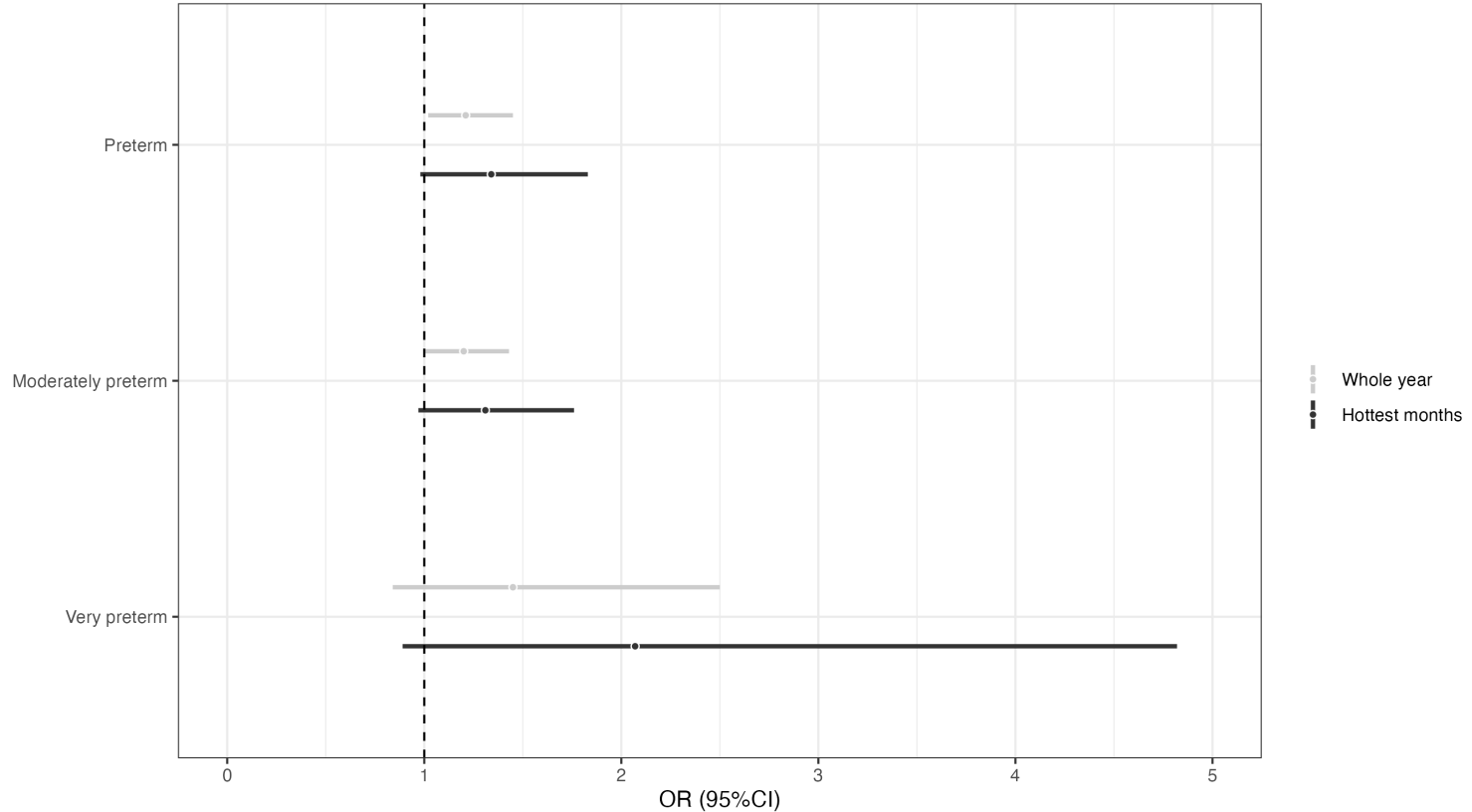




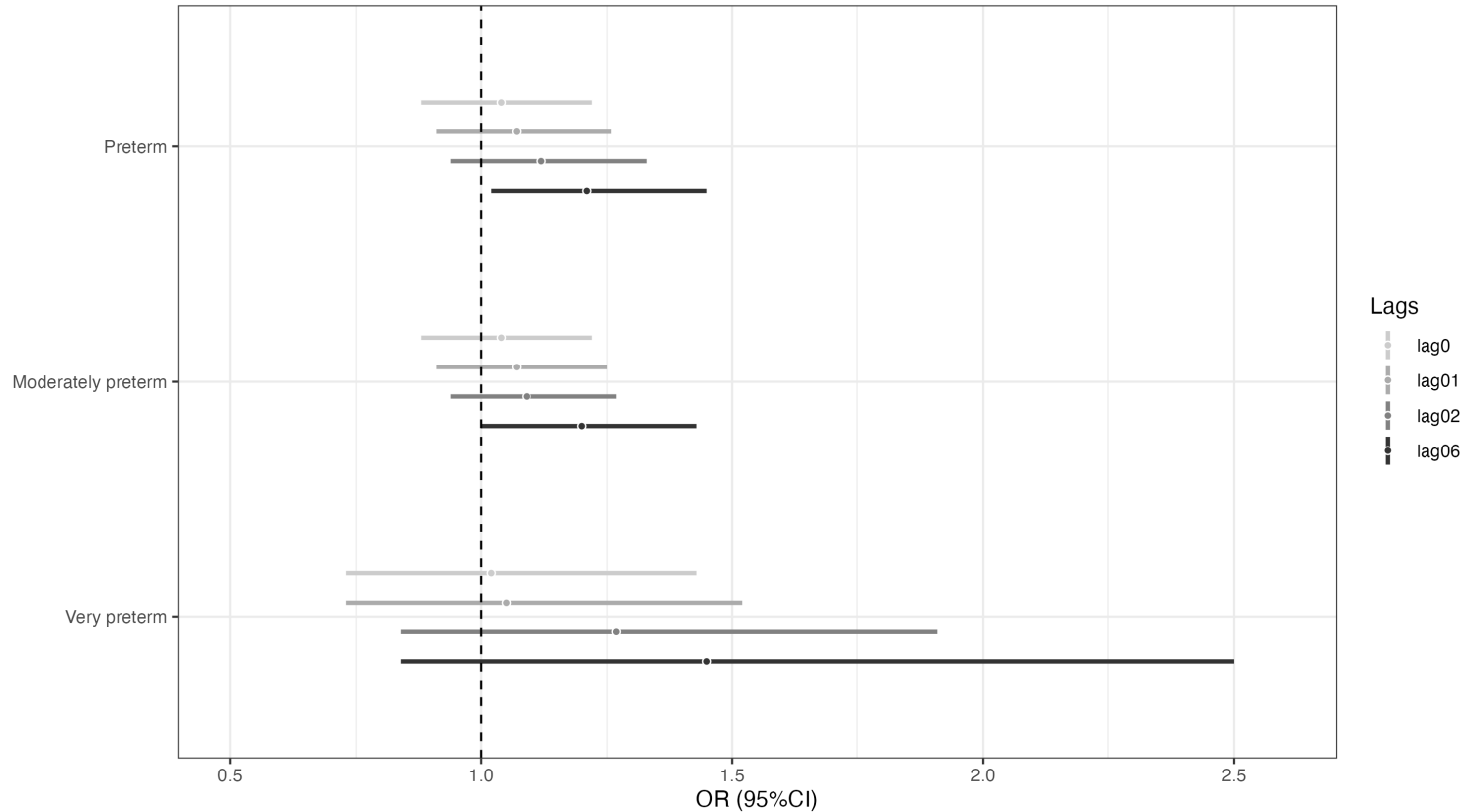
# Effect modification

Category	Category	OR
Sex	Girl	1.19 (0.83; 1.70)
	Boy	1.28 (1.00; 1.64)
N° pregnancies	1st	1.12 (0.85; 1.48)
	2nd or more	1.28 (0.86; 1.89)
Maternal age	<35 years	1.27 (1.06; 1.53)
	>=35 years	0.85 (0.51; 1.43)
Birthweight	<2500 gr	1.17 (0.92; 1.50)
	>= 2500 gr	1.23 (0.97; 1.56)
HIV status	Negative	1.22 (1.02; 1.46)
	Positive	1.49 (0.43; 5.12)
Labour problems	Normal	1.18 (1.00; 1.41)
	Prolongued	1.19 (0.43; 3.31)
Hypertensive disorders	No	1.20 (0.98; 1.47)
	Yes	1.22 (0.76; 1.96)

# Sensitivity analyses: hottest months



# Sensitivity analyses: different lag patterns





# Discussion and results



## **Strengths:**

- Inclusion of large number of preterm from 135,010 singleton births
- Limited changes in care in our study hospitals
- Dissaggregated moderately and very preterm births

## **Limitations:**

- Hospital-based study → high proportion of childbirth complications and limiting generalizability of our findings to wider populations
- Case-crossover: Invariance of the individual-level baseline → risk is expected to increase in the last weeks of gestation.
- Exposure assessment at the hospital address, limiting to evaluate long-term exposures.

# Discussion

- Our results provide support for an **increased** risk of **preterm birth** with **heat** exposure during the **last week of pregnancy** in sub-Saharan Africa.
- Although the findings are inconclusive for **very preterm births**, they remain significant, as these births often lead to **worse long-term health** consequences.
- It is essential to increase **empirical studies** in this **region**, where **climate change** and rising **temperatures** are of particular concern.
- **Implementation research** is needed to develop appropriate **interventions** to protect **pregnant women** from the adverse effects of **extreme heat**.





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