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Assessing the Impact of Ambient Temperature and Heat Stress Indices on Preterm Births in Greece: A Time-Stratified Case-Crossover Analysis

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### Introduction

Preterm birth complications are the **leading cause of death** among children under five, responsible **for 900,000 deaths in 2019**. In 2020, **13.4 million** babies were born preterm<sup>1</sup>.

#### **Exposure to Heat and Preterm Birth - Current Evidence**

**Conway et al<sup>2</sup>** 12 scientific literature reviews report an association between heat exposure and preterm birth risk.

**Cherish et al**<sup>3</sup>: 16% increase in preterm births during heat exposure, with a 5% higher odds for each 1°C increase in temperature.

- 1. <u>https://www.who.int/news-room/fact-sheets/detail/preterm-birth</u>
- 2. <u>10.7189/jogh.14.04128</u>
- 3. 10.1136/bmj.m3811



## Aim of the study

This study aimed to evaluate and assess the combined effects of various climatic factors on preterm birth in Greece by examining the association of 12 thermal stress indices with the occurrence of Preterm Birth.



#### Data sources:

#### Hellenic Statistical Authority (ELSTAT)

Birth Registry Data, 2,316,655 births (1999-2021)

#### European Centre for Medium-Range Weather Forecasts (ECMWF)

ERA 5 and ERA5 Land Hourly data

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# Methods [1]: Climate data acquisition and pre-processing



UTCI3

humidity, and wind speed)

2. https://www.nature.com/articles/s41597-021-01010-w

3. C. Brimicombe, et al, Thermofeel: A python thermal comfort indices library, SoftwareX 18 (2022) 101005. https://doi.org/10.1016/j.softx.2022.101005.

### Methods [2]: Statistical analysis

- ✓Time-stratified case-crossover analysis combined with distributed lag non-linear models (DLNM).
- ✓ Controls were defined as the same day of the week within the same month and year as the case day
- Exposure Assignment: Previous 0-6 days of heat stress indices assigned based on municipal data.
- ✓Conditional logistic regression, stratified by matched case-control groups.
- ✓DLNM with natural splines (ns) with 2 degrees of freedom to model the non-linear relationship
- ✓Associations presented as Odds Ratios(OR) at the 95th (or 99th) percentile vs 50th percentile of exposure



## Results [1]: Descriptive Statistics

#### **Preterm birth rates(%)**



### Results [2]: Seasonal patterns



Month



# Results [3] Effect of temperature on Preterm Birth



The graph shows the relationship between mean daily temperature and preterm birth. A U-shaped association indicates increased preterm birth risk at both low and high temperatures.



This graph illustrates the effect of minimum, mean, and maximum daily temperatures on preterm birth risk. Slightly higher Odds Increase is observed for minimum temperatures

# Results [4] Ranking Heat Indices based on the magnitude of the association



# Results [5] Geographical variance of the association



## **Concluding Remarks**

- All heat stress indices exhibited a U-shaped exposure-effect relationship, indicating increased risks of preterm birth at both high and low levels of heat stress.
- Similar associations were observed across different heat indices
- Minimum daily values of heat Indices corresponded to slightly higher increase in Odds, compared to maximum
- Indication of a lower magnitude of the effect in Islands that should be further investigated

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