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Comparing temperature exposure with time to birth using Bayesian joint models at population-scale; computationally tractable methods for exploring temporal associations incorporating full-parameter uncertainty

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Climate change is affecting our world, and the impact of rising temperatures on health is not well understood. Prior work found exposure to heat was associated with reduced gestational age, increased prematurity and smaller birth weights. The goal of the Maternal and Pregnancy Health and Elevated Heat (MAGENTA) project is to determine if these patterns exist in a UK population. Utilising healthcare and environmental exposure data held in the Secure Anonymised Information Linkage (SAIL) Databank we developed a cohort of mothers who were pregnant between 2010 and 2023, and the associated daily maximum temperatures experienced during each pregnancy. Modelled Land Surface Temperature accounts for the effects of the built environment. The primary outcome was time to birth. We used a joint longitudinal and time-to-event model, constructed in a Bayesian framework to capture full parameter uncertainty and fit using the Integrated Nested Laplace Approximation (INLA). The longitudinal process modelled temperature experienced during the pregnancy with linear and quadratic terms for time. Time to birth was modelled using a Cox regression model with a spline baseline hazard, and smoothed at second order. Joint modelling is a flexible, powerful set of tools for understanding associations in healthcare research, and approximation methods such as INLA enable analysis in large-scale electronic health record datasets. Work is ongoing to produce fully adjusted models, which will be used in simulation studies in conjunction with climate change projections to explore the impact of future scenarios to inform mitigation and adaptation strategies.

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