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Natural Environment Research Council

2024_74_SPH_MB: Pregnancy losses under a changing climate in England

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Miscarriages and stillbirths are both forms of pregnancy loss: whilst miscarriages take place up to the 20th gestational week, stillbirths can happen before and after delivery from the 20th week. Pregnancy loss is associated with several adverse physiological and psychological health effects on the mother, including maternal depression, anxiety, and Post Traumatic Stress Disorder (PTSD). In some cultural contexts, the loss of a pregnancy before term is considered to be a taboo topic, associated with high levels of stigma. Stillbirths are also associated with maternal mortality.

Pregnancy loss is strongly associated with genetic defects and substance misuse, whereas the effects of the mothers' environment on health outcomes in utero is less understood. Some studies have suggested that pollutants such as PM2.5 exposure can increase the risk of pregnancy loss and negative pregnancy outcomes, whilst others concluded that moderate to high ambient temperature exposure can increase the risk of miscarriage. The studies so far have considered coarse spatial units (e.g. cities) and short time series as study period.

We hereby propose a population-based study to investigate the effects of ambient temperatures and heatwaves on pregnancy losses at a small spatial scale in England. First, we will build a temperature model combining monitors and remote sensing to obtain estimates (with the associated uncertainty) at high spatio-temporal resolution. We will consider different definitions of heatwaves (for instance using the same threshold across the country or area specific ones). We will then use weekly births from administrative registries data (hospital episode statistics and birth records) between 1980 to 2020 and develop a Bayesian spatio-temporal model to assess differences in the effect of temperature (and heatwaves) in different spatial locations across the country. We will also be able to evaluate if the effect has changed in time, suggesting potential adaptation. The study will also assess effect modification by social and environmental variables such as deprivation, green space, built environment and air pollution. We will need to use complex statistical models (for instance non-linear distributed lags) to account for the gestational period and to investigate a critical gestational age in which exposure to extreme ambient temperatures is more likely to have an impact on the risk of pregnancy losses. While the project will focus on England, there is the potential to extend the developed methods to cohorts in LMIC (for instance in India, where one of the co-supervisors has active collaborations on the impact of climate on maternal health).