

## Title

Prolonged heat exposure and pregnancy outcomes in the tropics

## Authors

Samuel H. Gunther, Shiao-Yng Chan, Zhongwei Huang, Jason K. W. Lee

## Objectives

Pregnant women and their fetuses are particularly vulnerable to health impacts of extreme heat exposure due to their reduced capacity for thermoregulatory responses. Previous studies have reported associations between heat exposure during pregnancy and higher risk of adverse birth outcomes. We aim to determine the association between prolonged heat exposure and risk of gestational diabetes (GDM) and preterm birth (< 37 weeks' gestation) in Singapore, which is notably different from previous study settings due to its tropical climate and high penetration of air-conditioning usage in domestic, workplace and transportation settings.

## Methods

Ethical approval was obtained to access de-identified birth records between 2013 and 2020 from the National University Hospital, which were analysed alongside daily climate records from Changi Airport weather station. Multivariable logistic regression estimated the association between the occurrence of heatwaves (defined as average temperature > 90<sup>th</sup>-percentile of historical temperatures for at least 3 consecutive days) with GDM and preterm birth, with further analyses stratified by maternal race and parity.

## Results

Of the 32,110 singleton live births, 3,010 were to mothers exposed to heatwaves during pregnancy. There was a significant association between heatwave occurrence during the second trimester of pregnancy and higher risk of GDM (RR: 1.23; 95% CI: 1.02, 1.47;  $p = 0.022$ ), especially in Indian women (1.62 [1.08, 2.39]; 0.017). However, heatwave occurrence during the third trimester was associated with a reduced risk of preterm birth (0.57 [0.39, 0.79]; 0.001). Similar effects were seen in all race and parity groups.

## Conclusions

While a heatwave association with GDM has been previously reported, our findings on preterm birth are in direct contrast to previous studies. We speculate that heatwave exposure in Singapore prompts increased air-conditioning use, which could be protective of preterm birth. Our ongoing survey on heat-related behavioural change during pregnancy will provide clarification on potential mechanisms.