A Section 508–conformant HTML version of this article is available at https://doi.org/10.1289/EHP6169.

Hot Temperatures during Pregnancy: Evidence for an Impact on Fetal Growth

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https://doi.org/10.1289/EHP6169

Several environmental factors, including indoor[1] and outdoor[2] air pollution and exposure to certain chemicals such as organophosphate insecticides,[3] may have negative impacts on fetal growth and infant birth weight. Several studies have examined whether ambient temperature, too, may adversely affect fetal growth, but the results have been mixed. A large study recently published in *Environmental Health Perspectives* adds to the evidence, reporting associations between prenatal exposure to hot ambient temperatures and evidence of lower fetal growth among nearly 30 million births across the United States.[4]

Birth weight is an important marker of a newborn's health. Children born small for gestational age (SGA) have a birth weight below the 10th percentile for babies born at the same number of weeks.[5] SGA is associated with higher risk for stillbirth, neonatal morbidity, cognitive delays in childhood, and chronic disease in adulthood.[6,7]

For the current study, Shengzhi Sun, an epidemiologist at the Brown University School of Public Health in Rhode Island, and colleagues obtained publicly available data on 29,597,735 live singleton term births that occurred in 403 counties in the United States between 1989 and 2002. For each pregnancy, the investigators estimated the average outdoor temperature across the whole pregnancy and in each trimester. They based their definitions of warmer- and colder-than-average temperatures on county-specific estimates from the PRISM gridded climate data set.[8]

The researchers also estimated county-level average concentrations of fine particulate matter ($PM_{2.5}$) for each trimester and across the whole pregnancy. Higher levels of $PM_{2.5}$ previously have been linked to lower birth weight and higher risk of SGA.[2] The seasonal variation in air pollution depends on the species of pollutant and the atmosphere; in some parts of the country hotter periods may be accompanied by higher levels of $PM_{2.5}$.

Analysis showed that exposure to a pregnancy-average temperature above the 90th percentile was associated with an estimated 0.41% higher odds of SGA and with a slightly lower birth weight (an average of 15 g, or 0.5 oz), compared with exposure to average temperatures in the 40th to 50th percentile range. On the other hand, pregnancy-average temperatures below the 10th percentile were not associated with risk of SGA, although they, too, were associated with a slightly lower birth weight (an average 6 g, or 0.2 oz), compared with the reference range.

It is not clear how or why hot outdoor temperatures may impact fetal growth. One possibility is that warmer-than-average temperatures may increase a pregnant mother's levels of oxidative stress and inflammation, according to study author Gregory Wellenius, conditions that have been associated with impaired fetal growth.[9] Image: © iStockphoto/invizbk.

These risks are small, stresses senior study author Gregory Wellenius, an epidemiologist at Brown. "At the individual level, a very small decrease in birth weight probably will not be clinically important for most newborns. But on the population level, even a very small risk factor affecting a very large number of pregnancies can lead to a substantial public health impact," he says. That's because a small observed difference in average birth weights is assumed to reflect a downward shift in the entire distribution of birth weights, meaning the proportion of births with low and very low birth weights will increase.

Odds of SGA and lower birth weight were most strongly associated with temperatures during the second and third trimesters and in areas that typically have a cold or very cold climate. "The third trimester is when the fetus is undergoing the most rapid growth, so the fetus could be most susceptible to the effects of temperature during this stage of pregnancy," says Wellenius. He also explains that people in colder climates may be less adapted to hot weather or may lack air conditioning or other protective measures.

The study authors did not have information on where each pregnant woman lived within her home county, whether mothers moved during the course of their pregnancy, how much time they spent at home, or whether they had air conditioning. These factors will be important to assess in future studies if we are to more fully understand the relationship between outdoor temperature and pregnancy outcomes, says Sandie Ha, an epidemiologist at the University of California, Merced, who was not involved in the study.

The study also did not directly measure the women's actual exposures to ambient temperature. Wearable technologies could potentially be used to estimate how much time women spend in different environments and therefore create more precise estimates of each woman's exposure to temperature and air pollution throughout her pregnancy, Ha says. She adds, "We are just at the beginning of trying to understand the impacts of climate-related environmental exposures on pregnancy."

Lindsey Konkel is a New Jersey–based journalist who reports on science, health, and the environment.

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