

Natural exposure to wildfire smoke increased pregnancy loss in rhesus macaques

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Rhesus macaque mothers with infants at the California National Primate Research Center. The 2018 breeding season coincided with the peak of wildfire smoke from the Camp Fire, with a reduced rate of live births the following Spring. Credit: California National Primate Research Center

Rhesus macaques naturally exposed to wildfire smoke early in pregnancy

had an increased rate of miscarriage, according to new research from the California National Primate Research Center at the University of California, Davis. The work is published online in the journal *Reproductive Toxicology*.

In November 2018, smoke from the Camp Fire in Paradise, California, about 100 miles away blanketed the Davis area. Air quality exceeded national limits and reached unhealthy levels.

The disaster coincided with the peak of breeding season for the center's colony of rhesus macaques. Hundreds of animals at the center live in outdoor corrals in large family groups. Breeding typically takes place in the fall, with offspring born in spring after an average gestation of 166 days.

Bryn Willson, an OB/GYN resident at UC Davis Health, began the research project in collaboration with Professor Kent Pinkerton, UC Davis Center for Health and Environment, and Bill Lasley, professor emeritus at the Center for Health and Environment and School of Veterinary Medicine, and colleagues.

The researchers randomly selected 66 female animals of reproductive age from the colony to follow for pregnancy outcomes. They were compared to pregnancies from nine previous years.

Of the 66, 45 became pregnant while levels of smoke pollution were high, based on measurements of small particles (PM_{2.5}). Twenty animals conceived after air quality had returned to normal levels in December. One animal did not become pregnant.

There were 37 live births among the 45 animals exposed to wildfire smoke during early pregnancy, a rate of 82%. The average rate of live births in the previous nine years, with normal air quality, varied from

86% to 93%. The 20 animals not exposed to smoke during pregnancy all had successful live births.

"There was an increase in miscarriage among the primates exposed to wildfire smoke during the 2018-2019 breeding season compared to primates from the nine preceding breeding seasons," Willson said. Most pregnancies did result in a successful birth, she noted.

Although there are some important differences, rhesus macaques are considered a useful animal model for human pregnancy. Previous studies have associated poor air quality with reduced birth weight in human babies but not with increased risk of miscarriage.

Pregnant women a sensitive group for air quality

Pregnant women should consider themselves as being a "sensitive group" for poor air quality, she said, similar to people with asthma or other lung conditions. Willson recommended minimizing time spent outdoors when the air is unhealthy for sensitive groups, and wearing a mask that can filter fine particles.

The study did not establish a cause for the increased rate of miscarriage, but air sampling showed that Camp Fire smoke contained both oxidized organic material—probably from burning vegetation—and phthalates, likely from burning plastic in houses or other human-made structures. Phthalates are known to be endocrine disruptors, Willson said.

High levels of small particles (PM_{2.5}) are known to increase morbidity overall. Previous work from the California National Primate Research Center, led by Professor Lisa Miller, UC Davis School of Veterinary Medicine, has shown that natural exposure of infant macaques to wildfire smoke has long-term effects on their lungs comparable to chronic obstructive pulmonary disease, or COPD, in humans.

More information: Bryn E. Willson et al, Effects of the 2018 Camp Fire on Birth Outcomes in Non-human Primates: Case-Control Study, *Reproductive Toxicology* (2021). [DOI: 10.1016/j.reprotox.2021.08.005](https://doi.org/10.1016/j.reprotox.2021.08.005)

Provided by UC Davis

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