

Exposure to nitrogen dioxide lowers in vitro fertilization success

April 12 2010

(PhysOrg.com) -- Exposure to an increased level of air pollutants, especially nitrogen dioxide, has been associated with lower likelihoods of successful pregnancy among women undergoing in vitro fertilization, according to a team of fertility researchers.

The team examined the outcomes of the first pregnancy attempt of 7,403 women undergoing IVF at Penn State Milton S. Hershey Medical Center, Hershey, Pa.; Shady Grove Fertility, Rockville, Md.; and Columbia University College of Physicians and Surgeons, New York, N.Y. They conducted their observations over a seven-year period from 2000 to 2007.

"Numerous studies have consistently shown a relationship between air pollution and human health, ranging from mortality, cardiovascular disease and other chronic conditions," said Duanping Liao, Ph.D., professor of epidemiology and vice chair department of public health sciences, Penn State College of Medicine. "In the process of searching for the mechanisms responsible for the above associations, we, and others, have reported significant links between air pollution and inflammation and increased blood clotting. These intermediate factors are also associated with reproductive health."

The IVF population was chosen, as it is a well-controlled and timed process to investigate the association of air pollution and human reproductive effects.

Burning of fossil fuels and diesel [engine combustion](#) produces [nitrogen dioxide](#) and fine particles. Researchers looked at those pollutants along with ozone, the gas involved in [smog formation](#). While the effects of declining air quality on IVF success are variable and pollutant-dependent, elevated exposures to nitrogen dioxide and fine particles were consistently associated with lower success rates of pregnancy.

Researchers looked at the effects of pollution particles both individually -- single pollutant model, and with other particles -- multi-pollutant model. For the single pollutant model, exposure to ozone appeared to have a positive association with a successful birth if the exposure was before the embryo culture or embryo transfer. Researchers theorize that higher ozone levels indicate lower nitrogen dioxide levels, which would show better pregnancy outcomes. In addition, for the multi-pollutant model, the "positive" effects of ozone were diminished with the addition of nitrogen dioxide. In contrast, after adjusting for ozone, higher nitrogen dioxide exposures consistently associated with the lower success rate, regardless of which indicator was used -- positive pregnancy test, clinically confirmed intrauterine pregnancy or live birth.

These findings may be useful in studying the adverse effects of air pollution on human reproduction in general.

"Since IVF is a well controlled and highly timed process, we have a much better handle on the assessment of the time of exposures to elevated [air pollutants](#) in relationship to fertilization, pregnancy, and delivery," Liao said. "Therefore, the IVF population coupled with detailed assessment of air pollution exposures may provide us an ideal situation to investigate the potential health effects of air quality on human reproduction."

Air pollutant concentration data for the study period came from the U.S. Environmental Protection Agency. The researchers calculated daily

pollution concentrations for each patient during the entire in vitro cycle and pregnancy. They calculated varying periods of air quality exposure for average daily concentrations at the patient's home during four stages of IVF and at the IVF clinic during fertilization and embryo transfer.

The researchers published their results in "*Human Reproduction*." The Pennsylvania Department of Health in part funded this research using tobacco settlement funds.

Provided by Pennsylvania State University

Citation: Exposure to nitrogen dioxide lowers in vitro fertilization success (2010, April 12)
retrieved 18 April 2024 from

<https://medicalxpress.com/news/2010-04-exposure-nitrogen-dioxide-lowers-vitro.html>

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