

Phthalates in Pregnant Women and Children

Project Scope

Phthalates, ubiquitous industrial chemicals used in a variety of applications, are among the most abundant synthetic chemicals in the environment. This class of chemicals has recently come under increased scrutiny because of growing evidence of reproductive toxicity. Although appreciable human exposure to several phthalates has been established, few studies have examined phthalate levels in relation to reproductive outcomes in humans, and none have examined exposure during human pregnancy.

The objective of this study is to:

- Examine patterns of environmental phthalate exposures in the environment in relation to human reproductive health
- Examine phthalate levels in relation to personal product use and other factors, including geographic location

Investigators are following children born to subjects recruited in the Study for Future Families (SFF), a pregnancy cohort study conducted in four U.S. cities. In addition to assaying urine samples from the babies and mothers for metabolite levels of nine phthalates, pediatric physicians are conducting standardized genital and anthropometric examinations on the babies, and the mothers are providing detailed information on their use of personal care products. By December 2005, study researchers expect to have complete data on 500 mother-child pairs. Mothers' self-reported use of phthalate-containing products (soaps, cosmetics, teething rings, nipples, and other plastics) at the time of urine collection will be examined in relation to measured phthalate metabolite levels. Levels of phthalate metabolites in the mothers' prenatal urine and from infant urine samples are being examined in relation to the children's growth and development. Data from maternal questionnaires are being analyzed to identify factors (including geographic location) that are associated with phthalate metabolite levels.

Grant Title and Principal Investigator

Phthalates in Pregnant Women and Children
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Key Findings

- This grant has funded preliminary analyses in a major investigation of the relationship between phthalate levels in urine, indices of household exposure, and reproductive outcomes in a large cohort of pregnant women
- Of the nine phthalates assayed in maternal urine samples, all were found above the limit of detection in at least 50 percent of prenatal samples, and five metabolites were found in almost all (over 90%) of the samples.
- Urine concentrations of phthalate metabolites exhibited geographic variability, with higher exposures possibly correlated with phthalate use in pesticide formulations.
- Metabolite levels in women's samples of three butyl phthalates, but not other phthalates, were significantly and inversely associated with their partners' semen quality.
- This study is the first to obtain urinary phthalate metabolites in samples from mothers (pre- and postnatally) and infants and evaluate concentrations in relation to structural and functional development of the breast and/or genitalia in males and females.

Relevance to ORD's Multi-Year Research Plan

This research contributes directly to Long Term Goal 2 (LTG), identified in ORD's Multi-Year Plan, by improving our understanding of phthalate exposure in relation to reproductive outcomes in humans, especially during pregnancy. Additionally, this study is the first to obtain urinary phthalate metabolites in samples from mothers (pre- and postnatally) and infants, and has provided suggestive evidence of higher phthalate exposures in Missouri, possibly due to the use of phthalates as inert ingredients in pesticide formulations.

Project Results and Implications

In a preliminary analysis completed to date, researchers have analyzed prenatal urine samples from 214 women in Columbia, MO, Minneapolis, MN, and Los Angeles, CA. Of the nine phthalates assayed, all were found above the limit of detection (LOD) in at least 50 percent of prenatal samples, and five metabolites were found in urine samples from almost all (over 90%) of the women. Investigators noted a wide range for most metabolites, with average levels being generally consistent with prior reports. Surprisingly, considerable geographic variability was observed, with higher levels for eight of nine metabolites in women living in Missouri compared with those in Minnesota. Because the SFF study previously found poor semen quality in men living in Missouri compared with men living in Minnesota, the investigators hypothesized that elevated phthalate levels in Missouri women reflected household exposure that was shared by their partners and that adversely affected semen quality. Using general linear models, they found that metabolite levels in women's urine samples of three butyl phthalates, but not others, were significantly and negatively associated with their partners' semen quality.

This study is the first measure phthalates and their metabolites in urine samples from a sizable cohort of mothers (pre- and postnatally) and their infants. The finding of higher levels of eight of nine phthalates in urine from pregnant women in Missouri compared with urban Minneapolis is unexpected, but would be consistent with higher exposures resulting from the use of phthalates as inert compounds in pesticides commonly used in Missouri. The preliminary finding that mothers' urine levels of three butyl phthalates are inversely related to fathers' semen quality is novel and surprising, suggesting that maternal urine samples may reflect exposures common to the entire household. As the study progresses, phthalates in the men's urine will be measured and correlated with the mothers' and babies' levels to test this hypothesis.

Investigators

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For More Information

NCER Project Abstract and Reports:

http://cfpub2.epa.gov/ncer_abstracts/index.cfm/fuseaction/display.abstractDetail/abstract/1950/report/0