ECHO
Environmental influences on Child Health Outcomes
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Study Summary

Exposure to Common Flame-retardant Chemicals During Pregnancy May Be Associated with Behavioral Issues in Young Children, ECHO Study Finds

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Who sponsored this study?

The Environmental influences on Child Health Outcomes (ECHO) Program, Office of the Director, National Institutes of Health supported this research.

Why was this study needed?

Organophosphate esters (OPEs) are chemicals commonly used as flame retardants and plastic softeners in a variety of household and industrial products, including furniture, electronics, infant products, and fabrics. Previous research has linked exposure to OPEs during pregnancy with potential adverse effects on child brain development, but more evidence is needed. In this study, researchers investigated the association between prenatal exposure to OPEs and child behaviors.

What were the study results?

Among the nine OPEs measured, diphenyl phosphate (DPHP) was detected in almost all pregnant women (99.5%) and had the highest median concentration. Other frequently detected OPEs included dibutyl phosphate/di-isobutyl phosphate (DBUP/DIBP), bis (1,3-dichloro-2-propyl) phosphate (BDCPP), bis(2-chloroethyl) phosphate (BCETP), bis(2-butoxyethyl) phosphate (BBOEP), and bis(1-chloro-2-propyl) phosphate (BCPP).

Prenatal exposure to BBOEP (at moderate concentrations rather than high concentrations) was associated with more internalizing behaviors (e.g., anxiety, depression, emotional reactivity), externalizing behaviors (e.g., aggression, inattention), and total behavior issues in young children. Exposure to BCPP was associated with more externalizing behaviors and total behavior issues. In contrast, detectable dipropyl phosphate (DPRP) was associated with slightly fewer externalizing behaviors. Boys showed more behavior issues associated with prenatal BDCPP and BCPP exposure. Children from highly vulnerable neighborhoods—defined by community-level demographics, socioeconomic status, housing, access to transportation, and other factors—exhibited more behavior issues associated with prenatal BCPP exposure.

What was the study's impact?

Use of OPEs is increasing, with widespread exposure observed in pregnant women. While further research is needed, this study suggests that reducing exposure to certain chemicals during pregnancy may help mitigate emotional and behavioral problems in young children.

Who was involved?

The study included 2,948 mother–child pairs from 12 ECHO Cohort study sites across the United States. Non-Hispanic White (40.2%), non-Hispanic Black (28.6%), and Hispanic (21.3%) mothers were included in the study. Most participating mothers (85.2%) did not experience major pregnancy complications and most of their children (93.2%) were born after at least 37 weeks of pregnancy.

What happened during the study?

During the study, researchers collected urine samples from pregnant participants and analyzed them for nine chemical markers of OPE exposure. Later, researchers assessed the child's behaviors using the Child Behavior Checklist for Ages 1½–5. The researchers then used statistical methods to examine associations between each OPE exposure during pregnancy and behavioral issues in children. The study also evaluated how other factors, like the child's sex and their social vulnerability, may have influenced the effect of prenatal OPE exposure on their behavior.

Footnote: Results reported here are for a single study. Other or future studies may provide new information or different results. You should not make changes to your health without first consulting your healthcare professional.

What happens next?

Future studies could help researchers better understand the effects of prenatal OPE exposure on child brain development and determine whether reducing these exposures could be beneficial to children's health and development.

Where can I learn more?

Access the full journal article, titled "Prenatal Exposure to Organophosphate Ester Flame Retardants and Behavioral Outcomes in Early Childhood in the Environmental influences on Child Health Outcomes (ECHO) Cohort," in *Environment International*.