ECHO
Environmental influences on Child Health Outcomes
A program supported by the NIH

Study Summary

Study Finds Link Between Phthalate Exposure During Pregnancy and Development of Multiple Health Outcomes in Children

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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?

Chronic health conditions, such as asthma and obesity, can develop together during childhood but are usually studied separately. ECHO researchers used new machine learning tools to explore patterns of health outcomes in children and then looked at how common exposures are associated with multiple health conditions.

The goal of this study was to use data from ECHO Cohort research sites across six U.S. cities to characterize "clusters," or patterns of obesity-related, lung health, and brain development outcomes in children and to investigate how these patterns relate to mothers' exposures to chemicals called phthalates during pregnancy. Phthalates are chemicals widely used in plastics, and maternal exposure to certain phthalates have been linked to preterm birth.

What were the study results?

The researchers identified three groups of children with a pattern of health outcomes that occurred together:

1. A group of relatively healthy children;
2. A group of children with lower IQ, elevated obesity, and slightly elevated asthma-related outcomes such as asthma, wheezing, and allergies; and
3. Another group of children with high asthma-related outcomes along with elevated obesity and some increase in anxiety- and depression-related outcomes.

Compared to children in the healthy group, other groups had more male children, mothers with higher BMI and lower education attainment, and lower household incomes. The researchers found that children—particularly boys—were more likely to be in the third group if their mothers were exposed to phthalates during pregnancy.

What was the study's impact?

These findings suggest that exposure to phthalates during pregnancy might be associated with an increased risk of developing not only asthma and related lung outcomes, but also obesity and mental

health issues such as anxiety and depression. This study also suggests that low-income households are at higher risk for worse childhood health outcomes.

The three patterns of health outcomes seen in this study also reveal more about how pediatric diseases might arise together, which could help inform future research on what biological processes contribute to those health outcome patterns as well as better treatments and interventions to enhance child health.

Who was involved?

Researchers looked at health outcomes in 1,092 children across six U.S. cities. Researchers were able to collect measurements of phthalate exposure during pregnancy from 856 of these children's mothers.

What happened during the study?

The researchers measured 15 health outcomes in children between the ages of 4 and 9 years—including body mass index (BMI), IQ, anxiety, depression, irritability, learning disabilities, speech problems, asthma, wheeze, and nasal allergies. The researchers evaluated how children developed multiple outcomes and investigated how the probability of being in a particular group was affected by exposure to 15 plastic-associated phthalate chemicals during pregnancy. The researchers measured phthalate exposure during pregnancy using urine samples collected from 2007–2014 from mothers during late pregnancy.

Note: 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?

This study's multi-outcome approach can be used in future studies to identify public health risks that may affect central biological processes that result in multiple negative health outcomes. ECHO Cohort researchers are working to extend this method to include several additional U.S. research sites, which will allow them to evaluate whether similar patterns are observed in a larger dataset. Larger studies will also help researchers characterize how demographic differences like income and sex may influence the development of multiple health outcomes during childhood.

Where can I learn more?

Find the full research article, titled "Subpopulations of children with multiple chronic health outcomes in relation to chemical exposures in the ECHO-PATHWAYS consortium," in the journal *Environment International*.

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