

TITLE

Prenatal Polybrominated Diphenyl Ether Exposures and Neurodevelopment in U.S. Children through 5 Years of Age: The HOME Study

AUTHOR(S)

Aimin Chen, Kimberly Yolton, Stephen A. Rauch, Glenys M. Webster, Richard Hornung, Andreas Sjödin, Kim N. Dietrich, and Bruce P. Lanphear

ABSTRACT

Background:

Polybrominated diphenyl ethers (PBDEs) are persistent chemicals that have been used widely as flame retardants in furniture, carpet padding, car seats, and other consumer products over the past three decades. Humans have been exposed to PDBEs since the group of chemicals were introduced to the market in the 1970s and PBDEs are now widely found in the U.S. population. Routes of human exposure are ingestion (dust and contaminated foods), absorption from dermal contact, and inhalation. Potential PBDE toxicity concerns include thyroid disrupting effects and developmental neurotoxicity implications – specifically hyperactivity, decreased habituation, and deficits in learning and memory.

Objective:

To examine whether *in utero* exposure to PBDEs is associated with child cognitive function and behavior in a US study sample.

Methods:

Maternal serum concentrations of BDE-47 and other PBDE counterparts were measured in 309 pregnant women at 16 weeks of gestation during 2003-2006 in Cincinnati, Ohio. The children were then followed and assessed. Cognitive and motor abilities were measured using the Bayley Scales of Infant Development at ages 1, 2, and 3 years; intelligence was measured using the Wechsler Preschool and Primary Scale of Intelligence-III at 5 years old; and children's behavior were assessed using the Behavioral Assessment for Children-2 annually at ages 2-5. Care was taken to adjust analysis of the results for potential confounders (such as maternal depression, maternal IQ, and sociodemographic factors).

Results:

A ten-fold increase in prenatal (the mother's) BDE-47 level was associated with a significant 4.5 point decrease in Full Scale IQ, and a 3.3 point increase in the hyperactivity score of the children at 5 years of age. Prenatal BDE-47 was not significantly associated with Bayley Mental or Psycho-motor Development Indices at 1-3 years.

Conclusion:

Prenatal exposure to PBDEs was associated with lower IQ scores and higher hyperactivity scores in children. These results confirm previous study findings that suggest PBDEs may be developmental neurotoxicants. The research highlights the need to reduce young children's and pregnant women's inadvertent exposure to PDBEs in the home and office environment, and it diet, to avoid potential developmental neurotoxicity.

POLICY IMPLICATIONS

In 2006, the EPA established a significant new use rule (SNUR) for two types of PDBE chemicals, and this regulation ensured that no new manufacture or import of these chemicals would occur without first being subject to EPA evaluation. A 2012 proposal to amend the 2006 SNUR expanded the types of regulated PDBEs, as well as articles to which PDBEs had been added. Ongoing uses would be exempt from the SNUR. The EPA also proposed a Toxic Substances Control Act (TSCA) section 4 test rule for different types of PDBEs, which would require development of information necessary to determine the effects of these PDBEs on human health or the environment. Some states have stricter PBDE regulations than others, such as prohibiting manufacturing, processing, or distributing a product or part of a product containing more than one-tenth of 1% containing pentaBDE or octaBDE.

This study notes that additional research is needed to illustrate the mechanistic pathways linking PBDE exposure and neurodevelopmental deficits and to investigate BDE-209 and OH-PBDEs for human developmental toxicity. Research on the neurodevelopmental toxicity of the flame retardants being used to replace PBDEs is also needed. Funding efforts by the EPA or other entities to conduct these studies will be important, as will the continued strengthening of regulations to keep potentially damaging PDBEs out of the environment. Policy efforts to keep investigating the effects of PDBEs and how to decrease exposure to them will be beneficial for human health, specifically on the health of children during the entire gestation period and the subsequent effects. This study also highlights the need for reform of US chemicals policy under the Toxic Substances Control Act, or TSCA, which should be strengthened to ensure that chemicals like PDBEs or their replacements are safe for children before they are allowed in children's environments and bodies.

References

<http://www.epa.gov/oppt/existingchemicals/pubs/qanda.html>

<https://www.federalregister.gov/articles/2013/06/14/2013-14232/endocrine-disruptor-screening-program-final-second-list-of-chemicals-and-substances-for-tier-1#h-6>

<http://www.ncsl.org/research/environment-and-natural-resources/flame-retardants-in-consumer-products.aspx>

REFERENCE

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KEY WORD(S)

[Polybrominated diphenyl ethers \(PBDEs\)](#), [Toxic Substances Control Act \(TSCA\)](#)