

Socioeconomics may affect toddlers' exposure to flame retardants

May 23 2012

A Duke University-led study of North Carolina toddlers suggests that exposure to potentially toxic flame-retardant chemicals may be higher in nonwhite toddlers than in white toddlers.

The study also suggests that exposure to the chemicals is higher among toddlers whose fathers do not have a [college degree](#), a proxy measure of lower [socioeconomic background](#).

Hand-to-mouth activity may account for a significant amount of the children's exposure to the contaminants, according to the study, which appears Wednesday in the journal [Environmental Health Perspectives](#). Age and duration of breastfeeding also were associated with exposure.

The scientists, led by Heather Stapleton, assistant professor of environmental chemistry at Duke's Nicholas School of the Environment, tested 83 toddlers ages 12 to 36 months for levels of [polybrominated diphenyl ethers](#) (PBDEs). This class of exceptionally long-lasting chemicals was widely used over the last 30 years to reduce flammability in a variety of consumer products, including [polyurethane foam](#) padding, electronics and furniture.

Studies have shown that over time, PBDEs migrate into the environment and accumulate in [living organisms](#), where they can disrupt endocrine activity and impair thyroid regulation and [brain development](#). Early exposure to PBDEs has been linked to [low birth weight](#) and impaired cognitive, motor and behavioral development. One study in 2010 showed

that children with high levels of exposure to PBDEs scored lower on infant development and preschool [IQ tests](#).

Because children can be exposed to PBDEs three ways – by ingesting them with food or dust particles, breathing them in from the air, or ingesting them through mother's milk – Stapleton and her colleagues collected blood serum samples, hand-wipe samples and house dust samples for each child in the test group.

They detected PBDE contaminants in all of the blood and house dust samples and in 98 percent of the hand-wipe samples. Older children had higher average total body burdens of the [contaminants](#), the study found, with average levels increasing by an estimated 60 percent to 70 percent for each year of age. This may reflect the combined effect of PBDE accumulation in the body over time and the toddlers' increased hand-to-mouth activity.

Duration of breastfeeding also was associated with exposure. Blood samples contained significant levels of one PBDE component that has a long half-life in the body and is strongly correlated to the amount of time a mother spends breastfeeding. "This could be coming from PBDE exposures the mother had up to two-and-a-half years ago," Stapleton said.

Further research is needed to explain why white toddlers in the study averaged 32 parts per billion of PBDE chemicals in their blood serum, while nonwhite [toddlers](#) averaged 60 parts per billion, she noted.

"Race and socioeconomic status were closely associated in our test group, so it's hard to disentangle them," Stapleton said, "but it's important to note that we found no significant differences in PBDE concentrations in house dust samples by race or parental education. This suggests the exposure difference is not driven solely by higher levels of

PBDE in dust from lower socioeconomic homes."

One of the most promising findings of the study, Stapleton said, is that hand-wipe samples turned out to be good predictors of total exposures.

"Using hand-wipes, we were able to predict almost half of the toddlers' total exposure levels," she said. "This suggests in the future, we could use hand-wipes to characterize a child's exposure and predict levels of PBDEs in the blood, which would be much easier than having to draw blood."

Parents or caregivers may be able to reduce toddlers' potential exposures through more frequent hand-washing and by researching, as best they can, which flame retardants are used in their household products. "Right now, it's hard to determine what flame-retardant chemicals are in most products due to confidential business information that protects the companies' proprietary rights," Stapleton said. "Hopefully, this study's findings will inform policymakers that we need better public access to this information."

Historically, three mixtures of PBDEs have been sold under different trade names. Two mixtures, pentaBDE and octaBDE, were phased out in 2005 due to concerns about their persistence and toxicity. The third mixture, decaBDE, is slated for voluntary phase-out starting in 2013.

Being phased out doesn't mean they no longer pose risks, Stapleton noted. "The type of PBDE we tracked in our study was from the pentaBDE mixture, which has, officially at least, been off the market for more than seven years."

None of the children in the study group had prior diagnoses of thyroid problems, and the group was reasonably evenly distributed across gender, age, race, duration of [breastfeeding](#) and parents' education.

Provided by Duke University

Citation: Socioeconomics may affect toddlers' exposure to flame retardants (2012, May 23)
retrieved 27 April 2024 from

<https://medicalxpress.com/news/2012-05-socioeconomics-affect-toddlers-exposure-flame.html>

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