

Researchers report decline in some phthalate levels following federal ban

By Bailey Schug

In a new study funded in part by NIEHS, researchers found that Americans are being exposed to lower levels of some phthalates banned from children's products. At the same time, exposure to other forms of these plasticizing chemicals has increased significantly.

In an analysis of data from the Centers for Disease Control and Prevention National Health and Nutrition Examination Survey (NHANES), researchers from University of California, San Francisco (UCSF) analyzed how phthalate exposure has changed over time. The [findings](http://www.ncbi.nlm.nih.gov/pubmed/24425099), (<http://www.ncbi.nlm.nih.gov/pubmed/24425099>) which were published in the January issue of the journal *Environmental Health Perspectives*, is the first of its kind to examine changes in phthalate exposure over time using a large representative sample of the U.S. population. The researchers examined NHANES data on urinary concentrations of eight different phthalate metabolites from 2001-2010.

Phthalates are a group of chemicals used to soften and increase the flexibility of plastic and vinyl, and are used in hundreds of consumer products. They are not chemically bound to products and are, therefore, released into the environment where they may enter the human body by ingestion, inhalation, or dermal absorption. The chemicals have been linked to reproductive anomalies in animal studies, and are associated with premature birth, as well as cognitive and behavioral problems, in human epidemiological studies.

Change in phthalate exposure over time

"We were excited to see that exposure to some of the phthalates that are of public health concern actually went down," said [Ami Zota, Sc.D.](http://sphhs.gwu.edu/content/ami-zota-joins-eoh-faculty), (<http://sphhs.gwu.edu/content/ami-zota-joins-eoh-faculty>) corresponding author on the study, in a UCSF [press release](https://www.ucsf.edu/news/2014/01/111066/exposures-some-phthalates-fall-after-federal-ban). (<https://www.ucsf.edu/news/2014/01/111066/exposures-some-phthalates-fall-after-federal-ban>)

"Unfortunately, our data also suggest that these are being replaced by other phthalates with potential adverse health effects."

Zota, who was a postdoctoral fellow at UCSF when the study was conducted, is now an assistant professor in the Department of Environmental and Occupational Health at George Washington University.

Like other studies, this one found that nearly all NHANES participants have been exposed to at least one of the eight phthalates that were measured, including ones partially banned under a law that took effect in 2009.

Government and private groups at work to reduce phthalate exposure

As expected, declines were observed in metabolites of those phthalates that have been the focus of regulatory efforts. However, these bans are not entirely responsible for the observed trends. The largest reductions were seen in diethyl phthalate (DEP), a chemical used in fragrances that is neither regulated in the U.S. nor the European Union.

The federal ban is not the only force at work in determining phthalate exposures. Both consumers and industry have also changed their behavior, in response to action by the state of California, and advocacy by such groups as the Campaign for Safe Cosmetics. Since 2004, more than 1,000 companies have agreed to remove certain chemicals from personal care products, and report more clearly what chemicals they are using.

However, the researchers said it is hard to know, for sure, how changes in industry preference and consumer behavior are affecting human exposures, given how little is known about the chemical composition of consumer products.

"Our study shows the power of monitoring exposures to chemicals, so we can identify where we have made progress and where more information is needed," said the study's senior author, [Tracey Woodruff, Ph.D.](#),



Zota has also co-authored NIEHS-funded studies on other endocrine disrupting compounds, including chemicals used as fire retardants during her time at UCSF (see [story](#)) and earlier (see [story](#)) with colleagues at the Silent Spring Institute. (Photo courtesy of Ami Zota)



Woodruff's research focuses on the effects of environmental exposures, during windows of susceptibility in gestation and early childhood, on the lifelong health of children. (Photo courtesy of UCSF)

(<http://obgyn.ucsf.edu/mfm/woodruff.aspx>)

who directs the Program on Reproductive Health and the Environment at UCSF. "It also indicates that actions by government and consumer groups can make a difference in exposures in all Americans."

Citation: Zota AR, Calafat AM, Woodruff TJ.

(<http://www.ncbi.nlm.nih.gov/pubmed/24425099>)

2014. Temporal trends in phthalate exposures: findings from the National Health and Nutrition Examination Survey, 2001-2010. *Environ Health Perspect*; doi:10.1289/ehp.1306681 [Online 15 January 2014].

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Phthalates in consumer products

According to the study's literature review, phthalate acid esters, also known as phthalates, are the predominant type of plasticizer used around the world. Low molecular weight phthalates, such as DEP, di-*n*-butyl phthalate (DnBP) and di-iso-butyl phthalate (DiBP), are used in personal care products, solvents, adhesives, and medications. High molecular weight phthalates, such as butylbenzyl phthalate (BBzP), di(2-ethylhexyl) phthalate (DEHP), di-iso-nonyl phthalate (DiNP), and di-iso-decyl phthalate (DiDP), are primarily used as plasticizers in polyvinyl chloride (PVC) applications found in building materials, cables and wires, toys, and food packaging.

Six of the phthalates have been banned from use in children's articles, such as toys. Three were permanently banned, and three were subjected, pending further study, to interim restriction in toys that can be placed in a child's mouth. Phthalates banned include BBzP, DnBP and DEHP. According to the research, exposure to these three chemicals decreased, but DEHP levels remained consistently higher in children than adults, with the levels of exposure narrowing with age differences over time.

Unexpectedly, levels of the phthalates that Congress banned, pending further review, increased in the study research period. Levels of di-*n*-octyl phthalate (DnOP) and DiDP increased by 15 to 25 percent, and DiNP levels grew by nearly 150 percent. DiNP has begun to replace DEHP as a plasticizer in the global market. Toxicology studies suggest that DiNP may disrupt androgen signaling and act cumulatively with other phthalates to affect male reproductive endpoints.

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