Racial, Age, and Gender Disparities in Exposure to *ortho*-Phthalates in the U.S.

People of Color, Young Children, and Women and Girls are Disproportionately Exposed

National biomonitoring data reveal persistent disparities in exposure to hormone-disrupting chemicals known as phthalates, which are still widely used in food processing and packaging, beauty and personal care products, and household products.

Findings:

1. **People of color are exposed to higher levels of eight phthalates** compared to white Americans
2. **Women's exposure is nearly twice as high as men's for diethyl phthalate (DEP),** a common fragrance ingredient in beauty and personal care products
3. **African-American women face the highest exposure to DEP**, with levels more than double among all African-Americans compared to all whites.
4. **Young children (age 3 to 5) are the most highly exposed population for eight other phthalates**, with children of color likely facing higher exposure than white children
5. **Asian-Americans are more highly exposed to DEHP and DINP, and African-Americans more to DIDP,** the three phthalates often added to flexible vinyl and rubber in food contact materials, consumer products, and home furnishings
6. **Women and girls are exposed to higher levels of most phthalates** than men and boys
7. **The highest exposures to other phthalates occur among African-Americans** (BzBP, in older vinyl flooring), **Latinx** (DMP, a solvent in fragrance and other formulated products), **and Asian-Americans** (DBP, DiBP – in lacquer coatings)

Phthalates	Major Uses	**Production** (pounds)
DEHP, DINP, DIDP, DPHP	Softener (plasticizer) in flexible vinyl plastic and synthetic rubber in food contact materials, consumer products, building materials	DEHP = 6.5 billion, globally (37% of market) DINP = 2.8 billion, globally (16% of market) DIDP, DPHP = high production volume in the U.S.
DEP, DMP	Fragrance ingredient in beauty and personal care products	High production volume, meaning more than one million pounds per year of each phthalate is manufactured and/or imported into the United States every year
BzBP	Plasticizer in old vinyl flooring, etc.; spray paint, sealants, caulk	
DBP	Historically used in nail polish; also as a plasticizer	
DiBP	In lacquer coatings on packaging, playing cards, finger nails, cigarette filters, fiber for apparel, furnishings, and other products	

People of Color are Disproportionately Exposed to *ortho*-Phthalates in the United States

Phthalate		Metabolites of Phthalates Measured in Urine	Concentration in Urine, ug/g of creatinine, at 95th Percentile, in 2015-16					
			Highest Exposure		Blacks	Hispanics	Asians	Whites
			Young Children	Females				
DMP	Dimethyl phthalate	Mono-methyl phthalate (MMP)	**X**	x	**11.1**	**12.7**	**11.5**	**10.0**
DEP	Diethyl phthalate	Mono-ethyl phthalate (MEP)	x	**X**	**741**	**504**	**315**	**310**
BzBP	Benzylbutyl phthalate	Mono-benzyl phthalate (MBP)	**X**		**50.7**	**41.3**	**20.0**	**35.5**
metabolite of both BzBP and DBP:		Mono-n-butyl phthalate (MnBP)	**X**	x	**46.8**	**40.0**	**51.8**	**32.9**
DBP	Dibutyl phthalate	Mono-3-hydroxybutyl phthalate (MHBPP)	**X**	x	**4.67**	**4.24**	**4.81**	**3.58**
DiBP	Di-isobutyl phthalate	Mono-isobutyl phthalate (MiBP)	**X**	x	**39.6**	**42.5**	**45.4**	**27.6**
		Mono-2-methyl-2-hyroxypropyl phthalate (MHiBP)	**X**	x	**11.8**	**14.2**	**14.9**	**9.93**
DEHP	Di-2-ethylhexyl phthalate	Mono-2-ethylhexyl phthalate (MEHP)	**X**	x	**7.08**	**5.88**	**11.5**	**5.58**
		Mono-(2-ethyl-5-hydroxyhexyl) phthalate (MEHHP)	**X**	x	**30.0**	**30.0**	**43.2**	**21.8**
		Mono-(2-ethyl-5-oxohexyl) phthalate (MEOHP)	**X**	x	**19.8**	**18.6**	**27.7**	**14.6**
		Mono-(2-ethyl-5-carboxypentyl) phthalate (MECPP)	**X**	x	**45.2**	**48.3**	**67.8**	**33.6**
DiNP	Di-isononyl phthalate	Mono-isononyl phthalate (MINP)	**X**	x	**5.33**	**7.11**	**5.85**	**4.92**
		Mono-oxoisononyl phthalate (MONP)	**X**	x	**16.8**	**21.1**	**27.2**	**18.8**
		Mono-(carboxyoctyl) phthalate (MCOP)	**X**		**77.0**	**80.1**	**92.5**	**75.2**
DiDP	Di-isodecyl phthalate	Mono-(carboxynonyl) phthalate (MCNP)	**X**	x	**9.68**	**6.69**	**7.70**	**8.89**
Di-n-octyl phthalate (DOP) and several high molecular weight phthalates:		Mono-(3-carboxypropyl) phthalate (MCPP)	**X**		**7.63**	**9.18**	**6.44**	**7.44**
DOP	Di-*n*-octyl phthalate	Mono-n-octyl phthalate (MOPP)			**< LOD**	**< LOD**	**-**	**< LOD**
DCHP	Dicyclohexyl phthalate	Mono-cyclohexyl phthalate (MCHP)	**X**		**0.88**	**1.20**	**-**	**< LOD**

EXPOSURE KEY: **X** = Highest exposure group; x = elevated by age or gender; RED = highest level; YELLOW = intermediate; WHITE = lowest

DATA SOURCES

Production:

Alexander H. Tullo, **Plasticizer Makers Want a Piece of the Phthalates Pie**, Cover Stories: A Reckoning for Phthalates, *Chemical & Engineering News*, 93(25):16-18, June 22, 2015. https://cen.acs.org/articles/93/i25/Plasticizer-Makers-Want-Piece-Phthalates.html

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Use:

Allen Godwin, ExxonMobil Chemical Company, Uses of Phthalates and Other Plasticizers, July 26, 2010. https://www.cpsc.gov/s3fs-public/godwin.pdf

Exposure:

U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, **Fourth National Report on Human Exposure to Environmental Chemicals,** Updated Tables, January 2019, Volume 1, https://www.cdc.gov/exposurereport/pdf/FourthReport_UpdatedTables_Volume1_Jan2019-508.pdf

DATA NOTES

The exposure date are from the most recent survey from 2015-2016, except that the metabolites MOPP and MCHP were not measured after the 2009-2010 and MMP was not measured after 2011-2012. LOD means the limit of detection. The racial descriptors in the table header are the same terms used by the CDC: Blacks, Hispanics, Asians, Whites

Background. The National Biomonitoring Program has been measuring the exposure of the American population to toxic chemicals, including *ortho*-phthalates, since 2010. Every two years, the U.S. Center for Disease Control and Prevention (CDC) samples and measures blood and urine from a representative group of Americans for chemicals as part of the National Health and Nutrition Examination Survey (NHANES).

For *ortho*-phthalates, CDC measures the metabolites, or biological breakdown products, of phthalates in urine. Several phthalates produce multiple or even shared metabolites. Most but not all metabolites are measured. The metabolite results are reported in raw form and also a corrected for creatinine, a waste product produced by the kidney and always present in urine. By correcting for creatinine, the exposure levels reported are more comparable to one another, since it adjusts for dilution affected by the time of day that the urine sample was collected and how much water was recently consumed.

The results reported are for the 95th percentile. That means that five percent of the American population were exposed at those levels or higher. This mostly highly exposed group is the most relevant for assessing the risks from phthalates.