ENDOCRINE SOCIETY
Hormone Science to Health

Chemicals Used in Plastic Materials Harm Human Health and the Economy

The Endocrine Society has led the way in documenting disease burden and associated costs due to hazardous chemicals used in plastic materials. Its Second Scientific Statement published in 2015 by Andrea Gore and colleagues[1] identify the following chemicals used in plastic that contribute to disease and disability:

- Flame retardants (used as stabilizers in plastics)
- Phthalates (used as a softener in polyvinyl chloride plastics)
- Bisphenols (used as a building in polycarbonate plastics)
- Perfluoroalkylsubstances (used in high-density polyethylene plastic containers)

Expert panels organized by the Endocrine Society and led by Leonardo Trasande and colleagues in 2015 conservatively estimated the costs of diseases in the European Union.[2,3] Teresa Attina and colleagues expanded these to the US in 2016,[4] and Julia Malits and colleagues expanded these to Canada in 2022.[5] Trasande and colleagues have also estimated cardiovascular mortality due to phthalates,[6] and Vladislav Obsekov and colleagues estimated PFAS costs, both in the US.[7]

These are conservative estimates because:

1. They are limited to a subset of chemicals in plastic materials that contribute to disease and disability.
2. They are limited to a subset of diseases due to the few chemicals we studied.
3. The cost estimates represent a subset of the entire costs due to the disease studied.

Exposure	Life stage of exposure	Outcome	US		Canada		EU	
			Disease Burden	Economic Cost (USD)	Disease Burden	Economic Cost (USD)	Disease Burden	Economic Cost (USD)
Brominated flame retardants	Prenatal	IQ point loss & intellectual disability (ID)	11 million IQ points lost; 43,000 ID cases	$266 billion	374,395 IQ points lost; 1610 ID cases	$11.4 billion	873,000 IQ points lost; 3290 ID cases	$12.6 billion
	Prenatal	Cryptorchidism	4300 cases	$35.7 million	567 cases	$7.3 million	4615 cases	$172.6 million
Phthalates	Adult	Obesity	5900 cases	$1.7 billion	2093 cases	$684.8 million	53,900 cases	$20.8 billion
	Adult	Type 2 Diabetes	1300 cases	$91.4 million	225 cases	$25.8 million	20,500 cases	$807.2 million
	Adult Females	Endometriosis	86,000 cases	$47.0 billion	10,151 cases	$5.7 billion	145,000 cases	$1.7 billion
	Adult Males	Male infertility	240,100 cases	$2.5 billion	1395 cases	$17.0 million	618,000 cases	$6.3 billion
	Adults	Cardiovascular mortality	90,800 cases	$39.9 billion				
Bisphenol A	Prenatal	Childhood Obesity	33,000 cases	$2.4 billion	1023 cases	$59 million	42,400 cases	$2.0 billion
PFAS	Prenatal	Low birth weight	10,053 cases	$1.4 billion				
	Prenatal	Childhood Obesity	127,362 cases	$2.7 billion				
	Children	Pneumonia	447-6759 cases	$1.5-22.5 million				
	Pregnant People	Gestational Diabetes	6061 cases	$414-852 million				

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	Adult	Obesity	4,294,379 Cases	$17 billion				
	Adult	Kidney cancer	142 cases	$184 million				
	Adults	Couple Infertility	593-26,160 cases	$37.6 million - $1.7 billion				
	Adult Females	Hypothyroidism	14,572 cases	$1.3-5.2 billion				
	Adult Females	Type II Diabetes	1728 cases	$140 million				
	Adult Females	Endometriosis	696-18,062 cases	$397 million - $10.2 billion				
	Adult Females	Polycystic ovarian syndrome	7209-7505 cases	$10.5-10.9 million				
	Adult females	Breast cancer	421-3095 cases	$555 million-$4.1 billion				

References

1. Gore AC, Chappell VA, Fenton SE, et al. EDC-2: The Endocrine Society's Second Scientific Statement on Endocrine-Disrupting Chemicals. *Endocr Rev.* 2015:er20151010.
2. Trasande L, Zoeller RT, Hass U, et al. Estimating burden and disease costs of exposure to endocrine-disrupting chemicals in the European union. *J Clin Endocrinol Metab.* 2015;100(4):1245-1255.
3. Trasande L, Zoeller RT, Hass U, et al. Burden of disease and costs of exposure to endocrine disrupting chemicals in the European Union: an updated analysis. *Andrology.* 2016.
4. Attina TM, Hauser R, Sathyanarayana S, et al. Exposure to endocrine-disrupting chemicals in the USA: a population-based disease burden and cost analysis. *The lancet Diabetes & endocrinology.* 2016;4(12):996-1003.
5. Malits J, Naidu M, Trasande L. Exposure to Endocrine Disrupting Chemicals in Canada: Population-Based Estimates of Disease Burden and Economic Costs. 2022;10(3):146.
6. Trasande L, Liu B, Bao W. Phthalates and attributable mortality: A population-based longitudinal cohort study and cost analysis. *Environ Pollut.* 2022;292(Pt A):118021.
7. Obsekov V, Kahn LG, Trasande L. Leveraging Systematic Reviews to Explore Disease Burden and Costs of Per- and Polyfluoroalkyl Substance Exposures in the United States. *Exposure and Health.* 2022.