

Single Use Plastics & Health

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**Icahn School
of Medicine at
Mount
Sinai**

Acknowledgments



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Sinai**

*Institute for
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New York State **Children's**
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Clinical and Translational Sciences Award (CTSA) Program
Translational Science Hub**
(UL1TR001433)





OUR MISSION

The Physician and Scientist Network Addressing Plastics and Health has gathered to take action on the health harms of plastics.

<https://psnap.org/>



The Minderoo-Monaco Commission on Plastics and Human Health

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ABSTRACT

Background: Plastics have conveyed great benefits to humanity and made possible some of the most significant advances of modern civilization in fields as diverse as medicine, electronics, aerospace, construction, food packaging, and sports. It is now clear, however, that plastics are also responsible for significant harms to human health, the economy, and the earth's environment. These harms occur at every stage of the plastic life cycle, from extraction of the coal, oil, and gas that are its main feedstocks through to ultimate disposal into the environment. The extent of these harms not been systematically assessed, their magnitude not fully quantified, and their economic costs not comprehensively counted.

ORIGINAL RESEARCH

ju[ubiquity press

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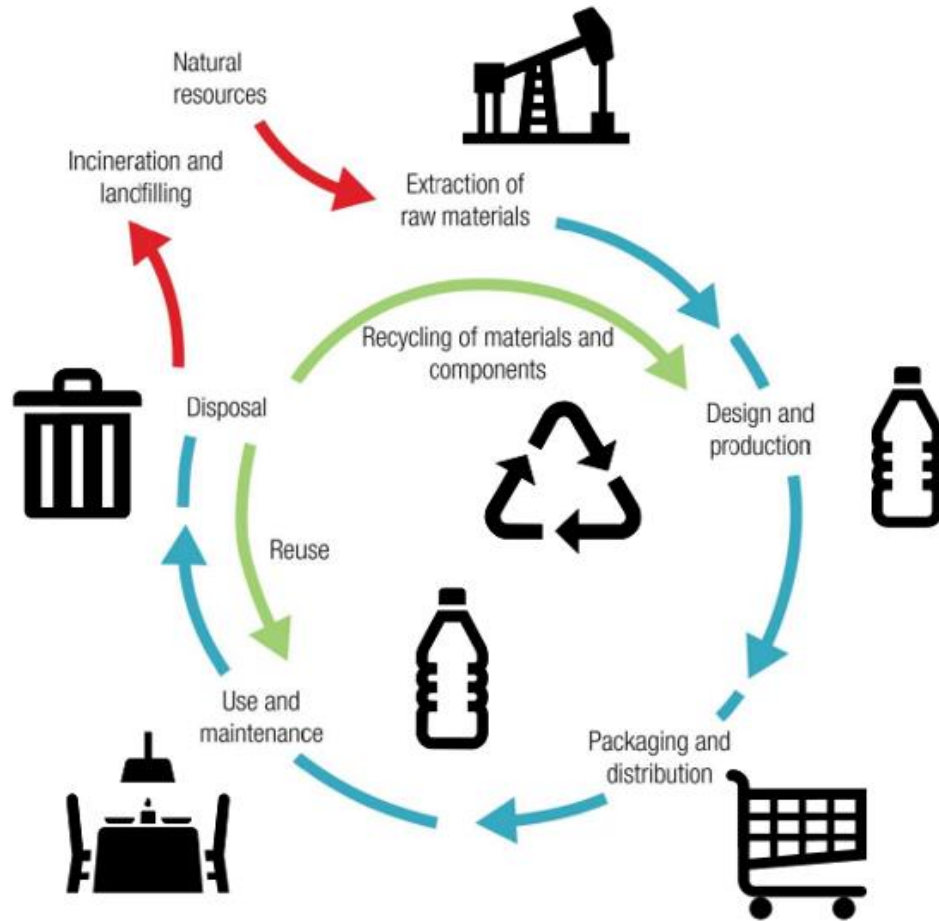
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health

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M, Seewoo BJ, Spring M,
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C, Takada H, Thompson RC, Vicini
A, Wang Z, Whitman E, Wirth D,
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"It is now clear that current patterns of plastic production, use, and disposal are not sustainable and are responsible for significant harms to human health, the environment, and the economy as well as for deep societal injustices."

-Minderoo-Monaco Commission

Plastic: A Toxic Lifecycle



- **Greenhouse gas production**
 - Extraction
 - Transport
 - Disposal
- **Air pollution**
- **16,000 chemicals**
 - Hormone disruptors
 - Neurotoxins
 - Carcinogens
 - Lack safety data for almost 50%
- **Micro- & nanoplastics**

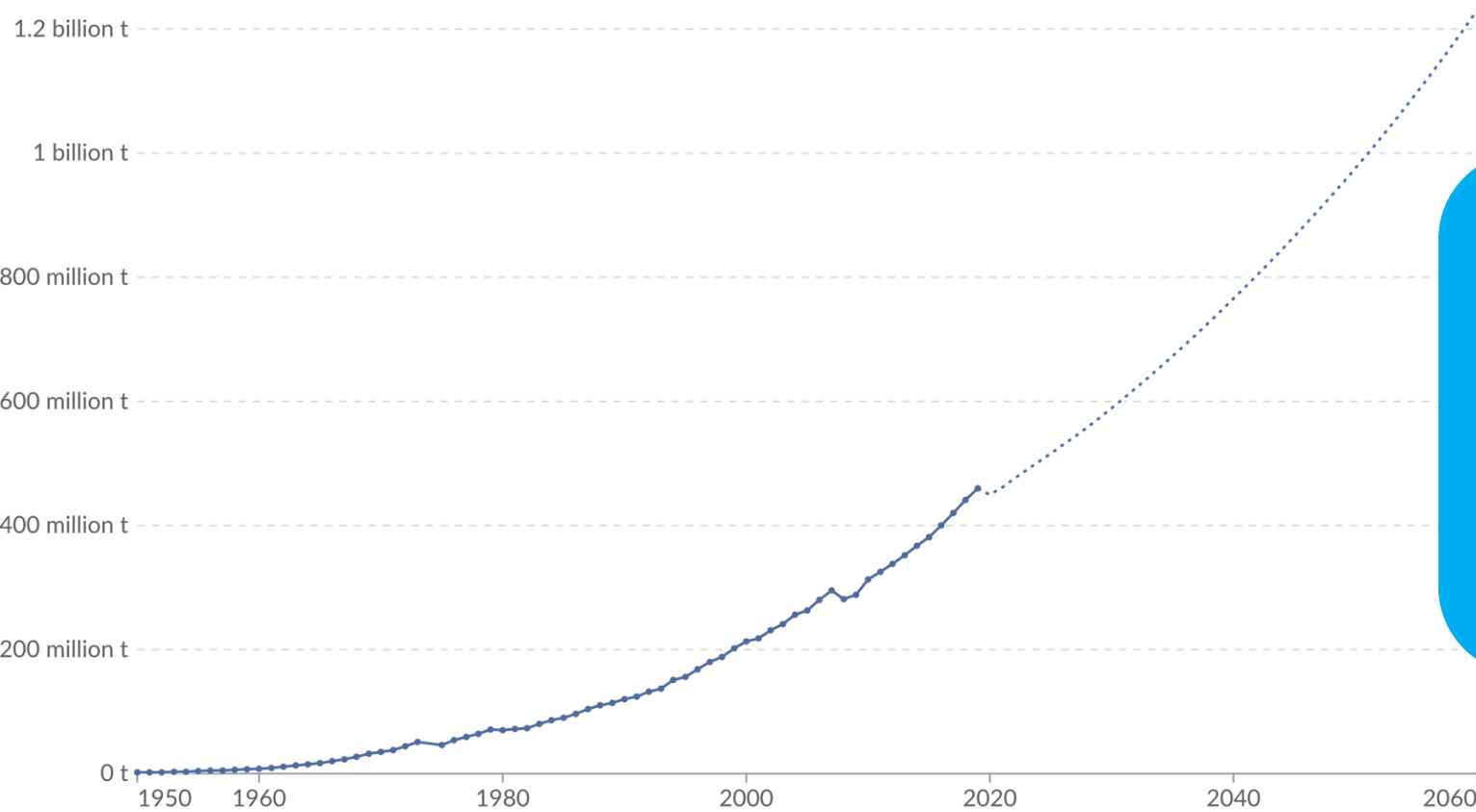
\$249B US healthcare costs per year

Plastic production to triple by 2060

Global plastic production with projections, 1950 to 2060

Our World
in Data

Annual production of polymer resin and fibers. Projections are based on the "business-as-usual" scenario which assumes that current policies remain unchanged in the foreseeable future.



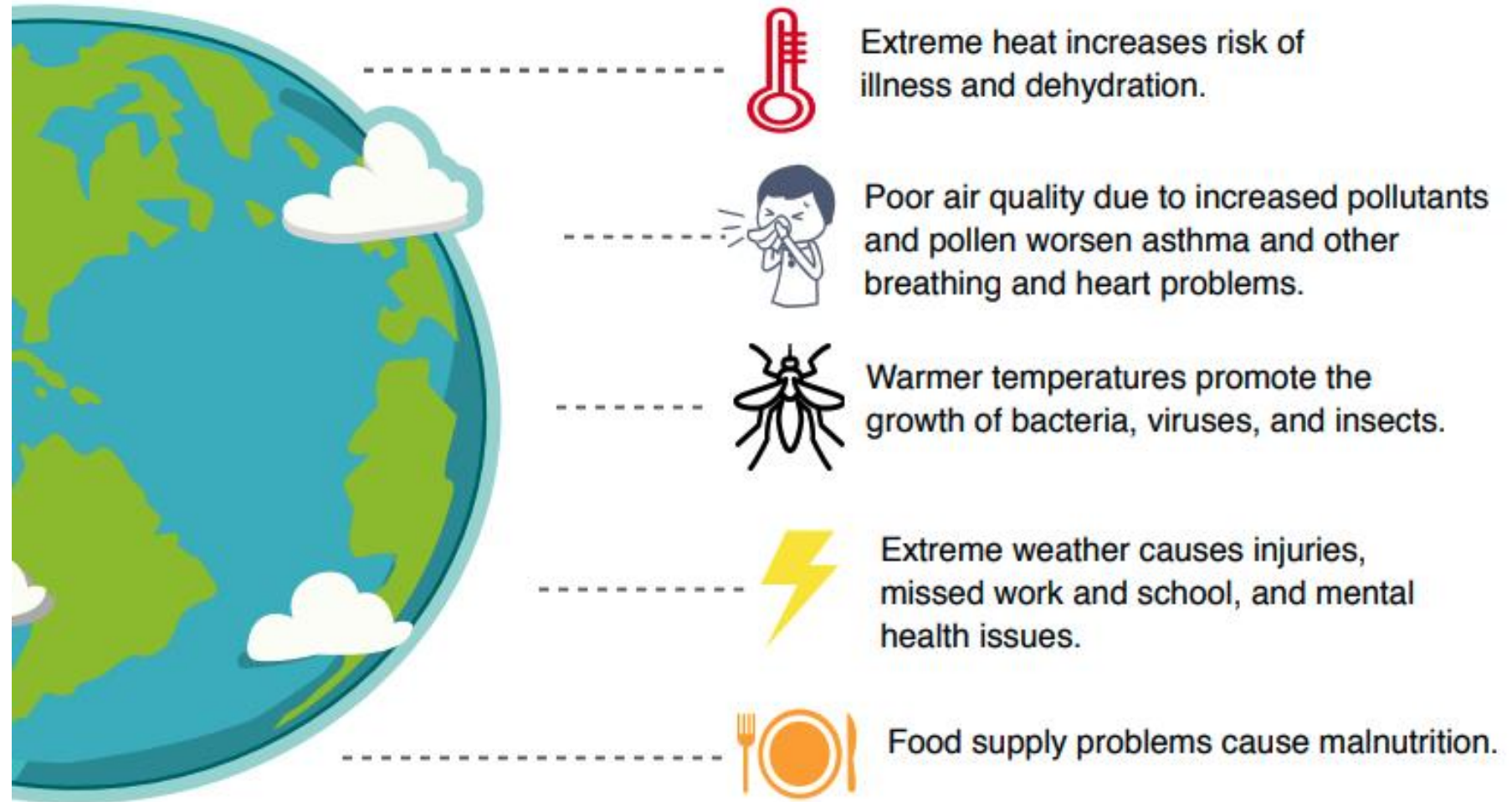
40% of all plastic is single use

Data source: Geyer et al. (2017); OECD (2022)

OurWorldinData.org/plastic-pollution | CC BY

Indirect health effects of plastic: climate change

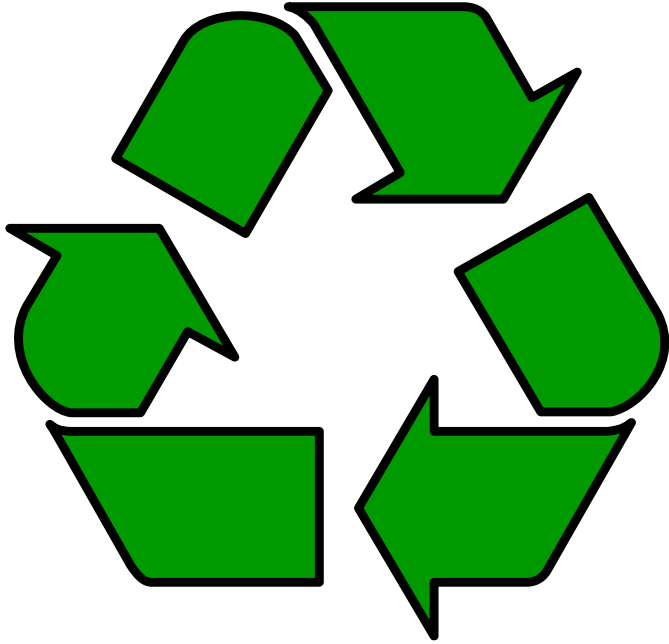
- 5.3% global GHGs
- 1.8B tons GHGs
 - 1.6B, production
 - 183M, end of life



<https://mountsinaiaexposomics.org/wp-content/uploads/2022/03/Infographic-Climate-Change.pdf>



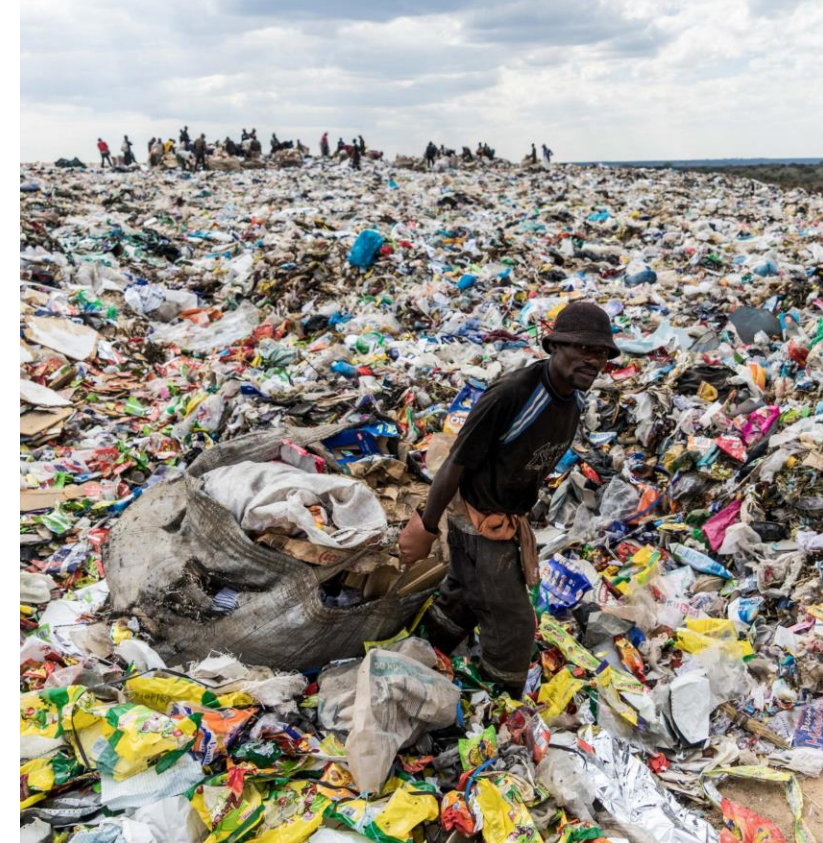
Plastic disposal harms health & the planet



5%

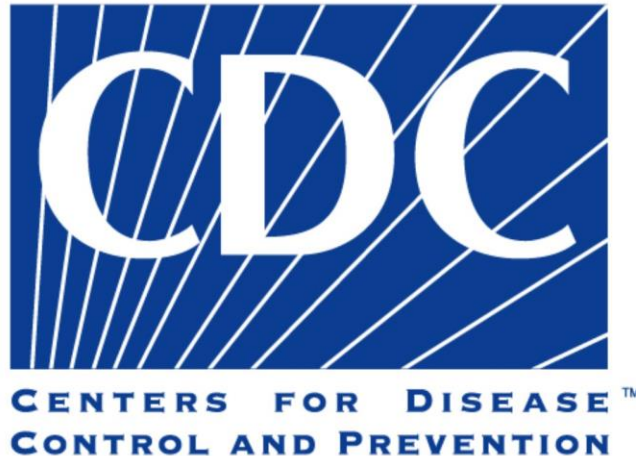


15%



80%

Our Plastic Chemical Body Burden



<https://www.cdc.gov/nchs/nhanes/>

- ❑ 200+ chemicals
- ❑ Food contact chemicals
 - e.g. phthalates, BPA, flame retardants, PFAS
- ❑ Exposures higher in people who eat more fast food & take out
- ❑ Many exposures higher in **children**
- ❑ Higher exposures in **Black and Hispanic** participants
- ❑ Chronic, low-dose + cumulative



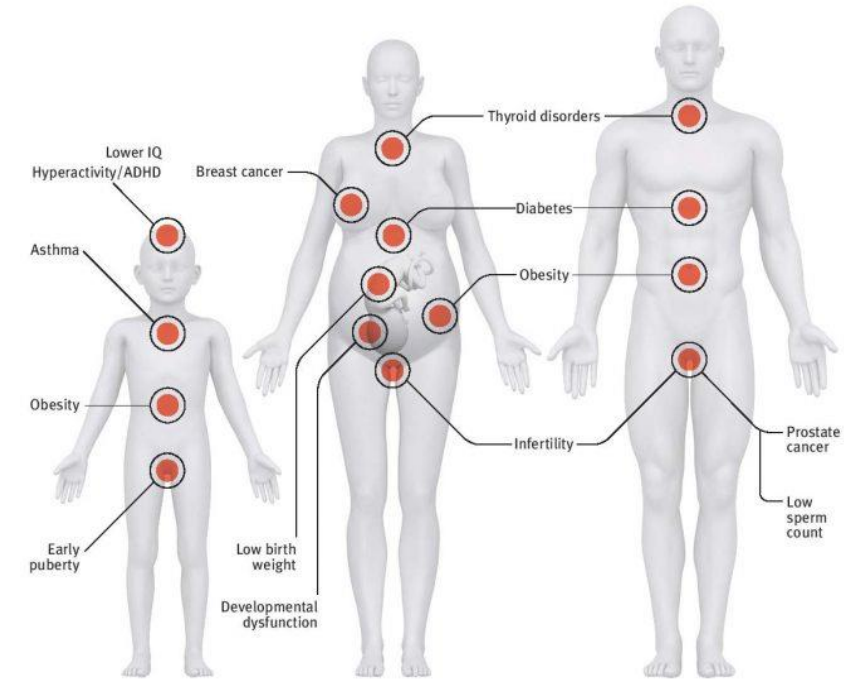
Plastic chemicals disrupt hormones

- Change the way hormones act in your body
- In many every day products
- Active at very low levels
- Linked to reproductive defects, cognitive and behavioral problems, cancer, obesity, and metabolic defects

Endocrine
Disrupting
Chemicals

Low Doses Matter

Everyday exposures to EDCs contribute to modern health epidemics.



How are people exposed?

Children's toys (phthalates)	Fragrances (phthalates)
Plastic drinking bottles (BPA, BPS, BPF)	Food (pesticides like chlorpyrifos)
Cleaning products (phthalates, triclosan)	Food packaging (BPA, PFAS, phthalates)
House dust (flame retardants, pesticides)	Thermal cash register receipts (BPA, BPS)
Home furniture/electronics (flame retardants, PFAS)	Drinking water (arsenic, lead, perchlorate)
Building materials (flame retardants, phthalates, PFAS)	Personal care products (parabens, phthalates, triclosan)

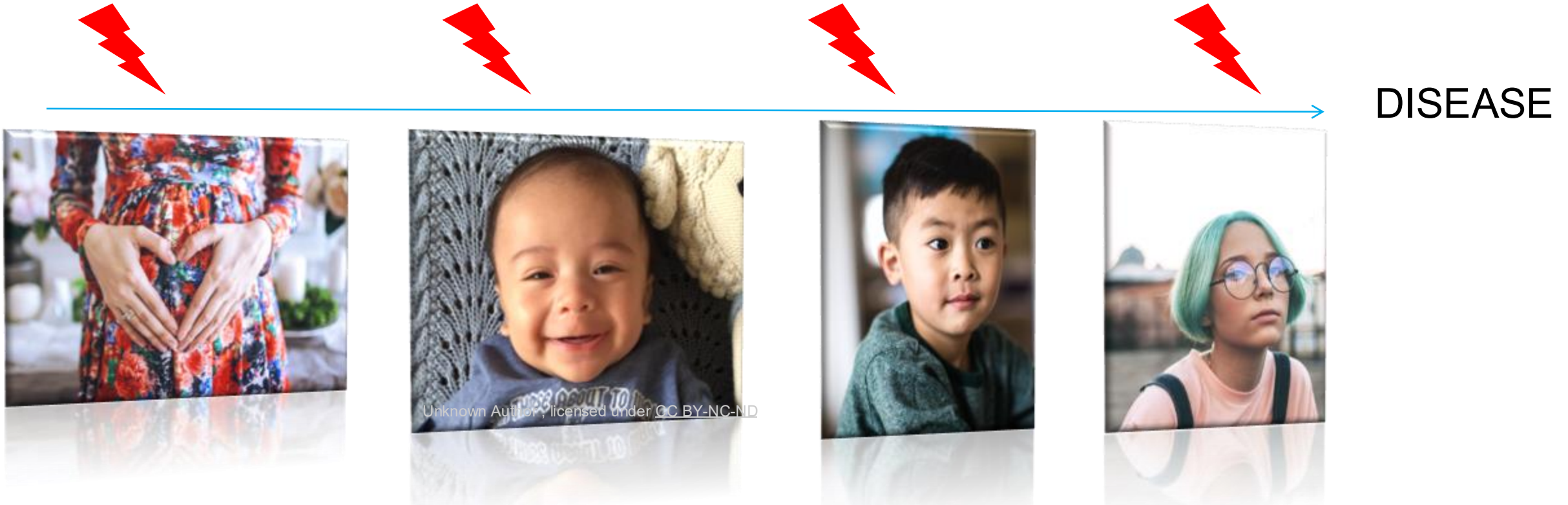


VISIT WWW.ENV-HEALTH.ORG AND WWW.ENDOCRINEDISRUPTION.ORG FOR MORE INFORMATION



Windows of Susceptibility

Not just *what*, but *when*



During these different time periods, developing systems are most sensitive to certain environmental toxins.



Black plastics contain toxic contaminants



Black Plastic Container



OUT. Throw them in the trash.

- 15% of all single use plastic
- Contain **carbon black**, possible carcinogen
- Made from recycled electronics and other sources
- Contain **flame retardant chemicals**, **heavy metals**, and other chemicals that leach into food
- Cannot be recycled; emit pollutants when burned or landfilled

Polystyrene



- 20% of plastic waste
- Polymer of styrene, a possible human carcinogen (NTP, IARC)
- EPS, Styrofoam
- Styrene and PS microplastics migrate into food
- Hot, fatty, and acidic foods most contaminated

"Farewell to Foam" Act

Van Hollen, Doggett Lead Charge to Curb Foam Container Pollution to Protect Our Environment, Improve Public Health

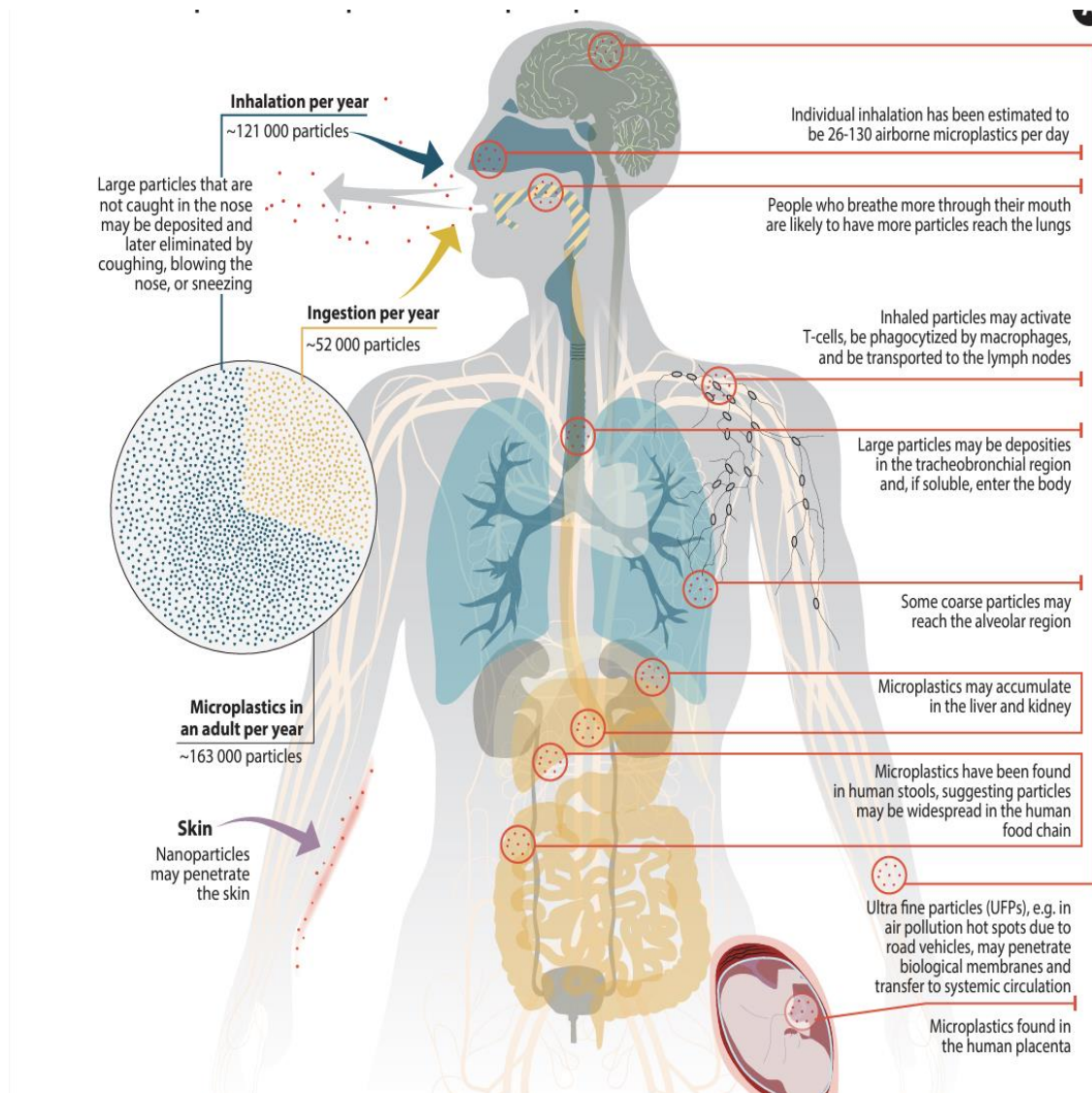


December 7, 2023 **Press Release**

Additional bans:

- 11 states, more pending
- CT HB
- 250 municipalities
- EU

Microplastics everywhere



- Indoor & outdoor air
- Tap and bottled water
- Seafood
- Inhale and ingest 5g/week
- Lung, blood, placenta, brain
- Health effects may include:
 - Inflammation
 - Heart disease
 - Dementia
 - GI problems
 - Obesity/metabolic disorders
 - Respiratory problems
 - Immune disruption
 - Endocrine disruption

Microplastics & cardiovascular health



The NEW ENGLAND
JOURNAL of MEDICINE

ORIGINAL ARTICLE

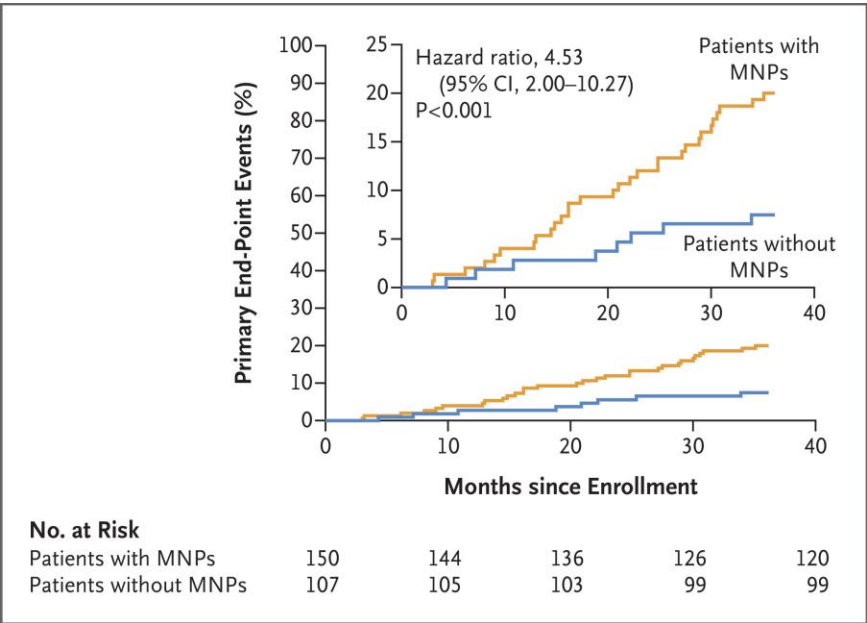
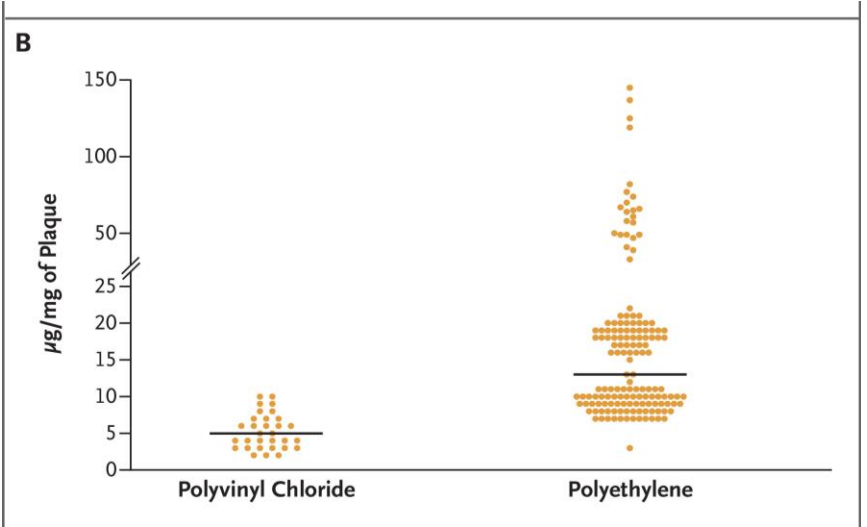


Microplastics and Nanoplastics in Atheromas and Cardiovascular Events

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Micro- and nanoplastics get into the brain

nature medicine



Brief Communication

<https://doi.org/10.1038/s41591-024-03453-1>

Bioaccumulation of microplastics in decedent human brains

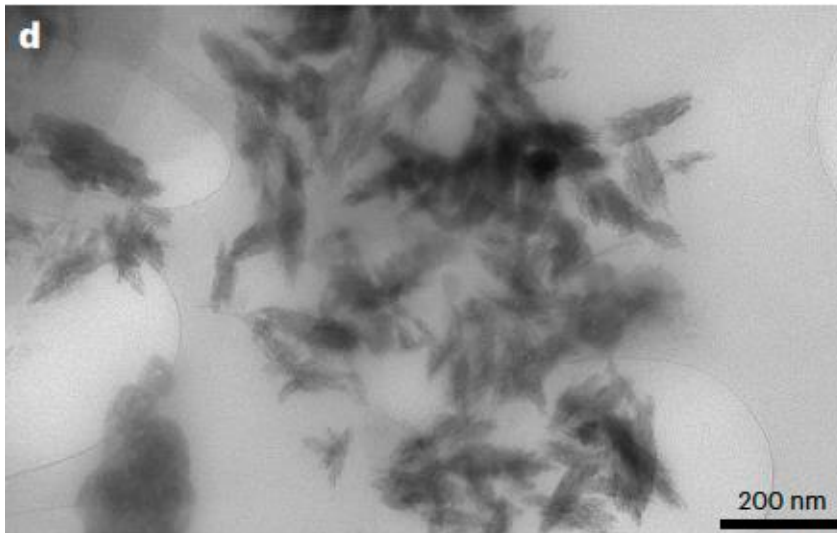
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Check for updates

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- Nanoscale "shardlike fragments" detected in postmortem brains
- Highest in dementia patients
- Mostly polyethylene (PE)
- PP, PVC, SBR also present
- Also detected in liver and kidney
- Presence increasing over time (2016 vs. 2024)

Additional Resources



<https://mountsinaiexposomics.org/learning-hub/plastics/>



<https://nyscheck.org/plastic/>



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Thank you! Questions?



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