How Plastic Can Harm Your Health

Plastic is everywhere, yet it often contains chemicals linked to reproductive harm, cancer risk,
By Kevin Loria
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CR's recent tests of nearly 100 foods found two types of chemicals used in plastic, bisphenols and phthalates, in a wide variety of packaged foods.

These findings are concerning because there's clear evidence linking exposure to these particular chemicals to a number of health effects, including disruptions of the endocrine or hormone system. Such disruption has been linked to neurodevelopmental problems, metabolic disorders, and reproductive issues. According to one new study, diseases that have been linked to exposure to plastic-related chemicals cost the U.S. approximately $250 billion in healthcare costs in 2018.

CR's findings are particularly worrisome because the issues with chemicals in plastic are not limited to phthalates and bisphenol-A (BPA). Those are just "poster children for a broken system," says Maricel Maffini, PhD, a chemical safety expert.

Researchers have cataloged thousands of chemicals found in plastic. Many have been linked to health hazards, according to Tracy Woodruff, PhD, a professor of reproductive sciences at the University of California, San Francisco, School of Medicine. Many are used widely but have yet to be adequately studied or tested for safety, Maffini says. What's more, tiny bits of plastic, known as microplastics, break off plastic all the time and are now found in food, water, and air. And these tiny bits of plastic not only can leach chemicals but also may present risks all their own.

The widespread use of plastics means they are so ubiquitous that national biomonitoring surveys by the Centers for Disease Control and Prevention find some plastic chemicals—including BPA and phthalates—in pretty much everyone in the U.S., according to Maffini.

Many Effects on Health

Chemicals found in plastic "include carcinogens, neurotoxic chemicals, and endocrine-disrupting chemicals," says Philip Landrigan, MD, a pediatrician and epidemiologist and director of the Boston College Program for Global Public Health and the Common Good. Some of these chemicals can directly damage organs, leading to disease over time. Others interrupt important biological processes, often involving hormones.

This happens because some of the chemicals in plastic can affect the same biological receptors that hormones do in our bodies. Some of the health issues that could be triggered by chemicals in plastic include low birth weights and preterm births, impaired fertility, maternal breast cancer risk, and problems with brain development in young children.

These types of chemicals—known as endocrine disrupters—have also changed old ideas about how the dose makes the poison. While that's true for certain types of toxins, compounds that disrupt the endocrine system, such as bisphenols and phthalates, can have long-lasting effects on health even at low doses.

Exposure to endocrine disrupters can increase the risk of obesity, metabolic disorders like diabetes, neurodevelopmental problems, and reproductive issues. Pregnant people and their children are most susceptible to these effects, Landrigan says. That's because babies and young children are extremely vulnerable to small changes in hormone levels as they are developing. For example, if thyroid hormone levels are disrupted in a pregnant person, that can affect crucial stages of brain development.

Early life exposure to brominated flame retardants, which are found in plastics and incorporated into electronics, textiles, furniture, and building materials, has been linked to "brain damage which shows up as reduced IQ in children and shortened attention system and ADHD," Landrigan says.

Other compounds used to make certain plastics, like vinyl chloride—notably spilled when a train derailed in East Palestine, Ohio, in February 2023—can increase the risk of certain cancers, according to Woodruff.

In the areas near plastic production facilities, researchers have documented increased risk for leukemia and lymphoma, lung cancer, asthma, stroke, premature birth, and stillbirth. When it comes to general use, these chemicals are not typically considered acutely toxic the way something like a high dose of lead is. But the everyday exposure we all have to these chemicals still concerns many researchers, who say that this exposure is responsible for a significant amount of disease.

As plastic production has increased, so has the incidence of chronic disease, according to Woodruff. And while several interrelated factors are likely at play, many expert groups including the American Academy of Pediatrics

and the International Federation of Gynecology and Obstetrics say that at least some of that increase is likely due to chemical exposure.

The Evidence Gets Clearer

It's hard to quantify the exact impact of every chemical that people are exposed to through day-to-day life. But there's a growing body of research about plastic chemicals that has followed populations over time to look at patterns of disease and examined how these chemicals directly affect animals and in some cases, people. All this has helped clarify how certain chemicals cause disease, and provided evidence for concerns researchers have raised for many years.

After decades of study, the health effects of exposure to some chemicals in plastic—such as bisphenols and phthalates—are better understood. But based on what we know about those chemicals, and the number of similar chemicals and other additives used in plastic, experts suspect that the list of potentially worrisome plastic chemicals is long.

Researchers say that we know less about the health effects microplastics, but there are reasons to be concerned. "They may function as Trojan horses that carry toxic chemicals into the human body," Landrigan says.

Plus, according to Woodruff, researchers have found that microplastic exposure is linked to issues with male fertility, biomarkers of colon and gut cancer, and to potential respiratory problems. The mechanism for these effects is not yet clear. But in addition to the risk of these particles carrying toxic chemicals, it's also possible that as they end up in various tissues, these particles serve as an irritant, causing inflammation that leads to further health effects.

Plastic Everywhere

There are at least two mechanisms through which researchers say exposure to plastic can affect human health: exposure to chemicals in plastic, and then the ingestion or absorption of micro- and nanoplastics. And human exposure to plastics—and to the chemicals that make up and are added to plastic materials—occurs at every stage of the product life cycle, from production to use to disposal.

"The health hazards of plastic begin with the hazards that surround pulling oil and gas out of the ground," Landrigan says. Plastic is largely derived from coal, oil, and gas, and people who live near where these materials are extracted or processed are exposed to high rates of hazardous chemicals and air pollution. But all of us are exposed to plastics while they are used.

Thousands of chemicals are added to plastics for a variety of reasons, including to make them more flexible, more stable, or resistant to fire. “For the most part those chemicals are not tightly bound to the plastic, they’re sort of stuck into the plastic skeleton,” Landrigan says. “When people use them, when they heat them in the microwave or put the rubber duckie in the bath and it gets warm, these chemicals can get out and into people.”

Certain factors make plastics more likely to leach chemicals: heat can release them from the plastic structure, and fats and oils can draw compounds like phthalates out. Because of these factors, people can be exposed when they wash a plastic dish in the dishwasher or store fatty foods in plastic containers. Many products we come into contact with every day, like clothing and carpet made from synthetic materials, really are largely plastic and can release both chemicals and microplastics.

In addition to chemical release, wear and tear causes tiny micro- and nanoplastics to break off, contaminating food and building up in household dust that’s then breathed in. “Dust is really a sink for chemicals coming from all different products,” and can be filled with microplastics and chemicals found in plastic, Woodruff says.

One recent study found that a 1-liter plastic bottle of water could contain approximately 240,000 nanoplastic fragments, small enough to enter the bloodstream and cross protective barriers in the body.

Finally, when plastics are disposed of, there are yet more opportunities for exposure. Little plastic is actually recycled—less than 9 percent of plastic waste in 2018 was recycled, according to data from the Environmental Protection Agency, and a 2022 Greenpeace report pegged the amount of plastic waste recycled in 2021 as about 5 percent. Plastic that’s littered or sent to landfills can release chemicals and break down into microplastics, and plastic that’s incinerated creates harmful air pollution. Microplastics from plastic trash end up in water that might be used to feed livestock or grow crops, laden with those tiny plastic fragments.

Though awareness of these issues is growing, the problem is still getting worse, not better. Plastic production continues to increase, meaning there is more and plastic that we’re all exposed to all the time. From 1950 to 2019, plastic production grew from 2 million metric tons annually to 460 million metric tons.

And the quantity of plastic produced is expected to nearly triple by 2060, according to the Organisation for Economic Co-operation and Development, with an increasing proportion of that being made of single-use and short-lived plastic products. Today, those make up between 35 and 40 percent of plastic production. As plastic production continues to increase, there are more opportunities for people to be exposed to hazardous compounds.

Regulatory Failure

Researchers say that two of the best known of these chemicals—bisphenols and phthalates, which CR's recent research showed are commonly found in foods—help demonstrate how our regulatory system has failed to protect consumers.

U.S. regulators have spent money and time studying BPA, but without taking adequate steps to protect people from exposure, Woodruff says. (Learn more about what you can do to limit your exposure to plastic.)

The Food and Drug Administration thresholds for acceptable levels of BPA in food don't take into account the latest research on the levels of exposure that can cause harm, according to Tunde Akinleye, the CR scientist who oversaw CR's recent tests. Regulators often rely on traditional toxicological assessments that look for a certain dose that's acutely poisonous, instead of looking at the lower levels of exposure that cause harm over time.

In Europe, food safety officials are in the process of setting new, much stricter limits on BPA in food, which should provide better protection for consumers, Woodruff says. But while this will have an impact on the use of one chemical, it doesn't address thousands of other potentially problematic ones—including similar but less regulated bisphenols, which are sometimes used instead of BPA.

To better protect people around the world, regulators need to set stricter limits on the use of hazardous chemicals in plastic, argues an analysis on the health effects of plastics published in the journal Annals of Global Health, by Landrigan and other researchers.

The authors of that report recommended global limits on plastic production focused on severely restricting the production of problematic plastic items (such as manufactured plastic microbeads, plastics containing toxic chemicals, and plastics that are made of so many different chemicals that they are impossible to recycle) as well as single-use items, which have a disproportionate impact on the amount of plastic that's produced and disposed of. Such modifications would continue to allow for the production of useful and important plastics, like those used in medicine, aerospace, construction, and electronics, while helping limit waste and chemical exposure from flimsy, potentially toxic single use products.

In the U.S., Woodruff says regulators should do more to evaluate the safety of the chemicals that are used in plastic so we have a better understanding of our exposure. Without that, we cannot get a clear and comprehensive picture of how these chemicals might be causing harm, she says.