



PLASTICS

Danger where we least expect it?

They hold your water, line your canned goods, even help save sick babies. But are the potential health risks of certain plastics so great they outweigh the benefits?

In the United States, local and state governments are banning the sale of baby bottles that contain the chemical bisphenol A (BPA), creating a confusing patchwork of regulations. But the U.S. Food and Drug Administration (FDA) and most comparable agencies around the world maintain that the chemical is safe. They cite a lack of human research data that BPA poses health problems, while discounting considerable animal evidence that the chemical is hazardous.

These polar positions have left consumers in the lurch. Should we avoid the plastic water bottles, food cans, and myriad other products in our daily lives that contain BPA? Are we being harmed by a chemical that the U.S. Centers for Disease Control and Prevention (CDC) says is present in detectable levels in 93 percent of Americans ages 6 and older? What should we do when the experts themselves can't agree?

Though the evidence isn't all in, the threat seems both real and

ubiquitous. "At minimum, we want to reduce our exposure, whether it's from the water cooler bottle or the lining in a can of food," says Russ Hauser, MPH '90, ScD '94, professor of environmental and occupational epidemiology at the Harvard School of Public Health and the newly appointed Frederick Lee Hisaw Professor of Reproductive Physiology. "It's not like there's a single-point source. With bisphenol A, we have literally hundreds of different sources of exposure. If you avoid the water cooler, you probably get it from other sources—food from a can, soda from a can, dental composites."

"The nightmare scenario is that we one day find out that a lot more of our current disorders, including infertility and cancer, may be due to bisphenol A and only show up after cumulative exposure. But by then, we all have accumulated so much exposure that it's too late to reverse the effects," adds HSPH Associate Profes-

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THIS IS PUBLIC HEALTH.

When human research lags behind animal studies suggesting substances could cause ill effects, experts must present their best evidence to officials and legislators debating safety and health issues.



Food cans typically contain BPA.

sor of Epidemiology Karin Michels, MPH '94, ScD '95. "You could say that about other substances just as much, but right now, bisphenol A is a top concern."

A HIDDEN PUBLIC HEALTH THREAT?

Used for more than 50 years to manufacture polycarbonate plastic and resin for protective linings inside

food cans, BPA has come into sharper focus over the last 10 years. Hundreds of animal studies point to potential health dangers from exposure in the uterus before birth. These include abnormal development of the brain, breast, and prostate. Many animal studies link the chemical to reproductive disorders, including infertility, feminizing of male organs in

fetuses, and early puberty in females. A synthetic hormone, BPA mimics estrogen.

The plastics chemical family of phthalates also is at the top of researchers' list of concerns. Like BPA, phthalates are endocrine disruptors, chemicals that can enter the body through food and personal care products and interfere with hormones the body itself produces. Phthalates inhibit androgens and affect males more than females. Manufacturers add the substances to a wide range of products, from toys to cosmetics to medical tubing.

Researchers say pregnant women, fetuses, and newborn children are most vulnerable to these pervasive chemicals. Hauser's research on babies in neonatal intensive care units has found that their exposures to phthalates and BPA are ten times higher than exposure levels in the general population. "Plastic medical products such as polyvinyl chloride tubing, which are lifesaving and important, are inserted into infants," explains Hauser, who also is professor of gynecology, obstetrics, and reproductive biology at Harvard Medical School, Massachusetts General Hospital. The chemicals leach from the medical devices and enter infants' bodies—with potential effects that may not show up for years.

A CRAZY QUILT OF REGULATIONS

Various government jurisdictions have approached the threat with different levels of urgency. Suffolk County, New York, claimed title in April 2009 as the first government entity in the United States to ban the sale of

7 WAYS TO REDUCE YOUR EXPOSURE TO BPA

- 1.** Don't microwave foods or beverages in any plastic containers. Heating plastics can cause chemicals to leach. These chemicals include not only BPA and phthalates but also dyes, antioxidants, and catalysts that may produce unknown effects.
- 2.** Use glass, porcelain, or stainless steel containers for hot food or beverages.
- 3.** Use BPA-free baby bottles, now readily available.
- 4.** Reduce consumption of canned foods, in favor of fresh foods.
- 5.** If you drink bottled water, buy it in glass bottles.
- 6.** Hand-wash plastic containers; do not wash in the dishwasher.
- 7.** Avoid drinking from bottles with the recycling code 7.

baby products containing BPA. (The city of San Francisco had enacted a ban on BPA baby products in 2006, but later rescinded it.) The states of Connecticut and Minnesota and the city of Chicago enacted similar bans this year. Other cities and states are considering bans, and restrictive legislation is pending in the U.S. Congress.

Canada declared BPA a “dangerous substance” in 2008 and banned it from use in baby bottles, the first country to do so. After news circulated in Denmark about a 2009 study in *Environmental Health Perspectives* led by Michels, the city of Copenhagen banned water coolers with polycarbonate bottles from its city buildings. Michels—who also is associate professor of gynecology, obstetrics,

and reproductive biology at Harvard Medical School, Brigham and Women’s Hospital—and her colleagues had followed 77 Harvard College students over a two-week period. The students drank cold beverages from stainless steel bottles one week and from polycarbonate bottles the other week. Urine samples showed a 69 percent increase in BPA levels during the polycarbonate week.

But FDA rulings on BPA have been contradictory. In 2008, the agency determined that BPA is safe. Soon after, the agency’s own scientific board subcommittee issued a report calling the ruling “inadequate” and not reflective of all available research. At press time, the agency was reevaluating its evidence and is expected to issue another ruling soon that could

range from upholding its previous position to taking a stance similar to Canada’s.

Chemical and plastics industries maintain that BPA is safe and does not require regulation. “Our views are consistent with the many regulatory agencies around the world that have reviewed the science on bisphenol A,” says Steven G. Hentges, chief BPA scientist with the American Chemistry Council.

But for Suffolk County, New York, with its 1.5 million population and 911 square miles, “there was enough evidence to warrant some type of intervention before that final study is done that shows this to be harmful,” says Humayun Chaudhry, SM ’01, the county’s commissioner of health when the ban was enacted, and now the president and chief executive officer of the Federation of State Medical Boards in Dallas, Texas. “This was an opportunity to be proactive and preventive. Our concern was exposure of young children to high levels of this chemical.”

Many manufacturers on their own have started producing alternative baby products, he adds, saying, “The industry responded even before the law went into effect. Ultimately, though, a local health jurisdiction should not be the prime agency to do something. Action should be taken at the federal level.”

WHAT CAN BE DONE?

In June, the Endocrine Society issued a position statement calling for comprehensive federal regulation of exposure to endocrine disruptors under the “precautionary principle.” Representing




Heating plastics can cause chemicals to leach.

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BPA AND PHTHALATES BY THE NUMBERS

The Society of the Plastics Industry introduced today’s recycling code system in 1988, when many communities in the United States were starting recycling programs. The codes—which usually appear on the bottom of bottles and other products—are mainly used to identify which plastics are amenable to recycling. While BPA and phthalates are considered potentially harmful, other chemicals used in plastics manufacture have not been studied as thoroughly and may have unknown effects.

| CODE |  1 PET |  2 HDPE |  3 V |
|------------------|---|---|---|
| PLASTIC | Polyethylene terephthalate | High-density polyethylene | Polyvinyl chloride (plasticized and unplasticized) |
| CHARACTERISTICS | Clear, smooth, and flexible; lightweight, designed for one-time use | Relatively stiff | Flexible, clear (plasticized) Hard, rigid, can be clear (unplasticized) |
| EXAMPLES OF USES | Individual bottles for water, juices, salad dressing; jars for peanut butter, pickles; mouthwash bottles; salad dressing and vegetable oil containers | Milk bottles, detergent bottles, grocery bags, freezer bags | Blood bags and tubing, PVC pipes and siding, detergent bottles, shampoo bottles, cooking oil bottles, fruit juice bottles, clear food packaging, medical equipment, cosmetics, toys |
| HEALTH ISSUES | Not known to contain BPA or phthalates. Not recommended as reusable bottles due to potential bacteria buildup. Also contains antimony, a possible carcinogen. | Not known to contain BPA or phthalates | Plasticized PVC may contain phthalates, which have been linked in animal studies to reproductive health problems. |

HOW DO YOU KNOW IF IT HAS BPA?

Polycarbonate plastic products are coded with the number 7, the word “Other,” or the initials “PC” (which is specific for polycarbonate). But not all polycarbonates are labeled, because the recycling code system is a voluntary industry system, not federal law. Clear and hard plastics in a variety of colors are likely to be polycarbonate if they have the number 7 on them.



Low-density polyethylene

Polypropylene

Polystyrene and expanded polystyrene

Polycarbonate and others not in 1-6 (includes acrylic, nylon, polyurethane)

Soft, flexible, translucent, solvent-resistant

Hard, flexible, translucent or transparent, good chemical resistance

Clear, glassy, rigid, brittle, opaque, not resistant to fats and solvents (polystyrene)
Lightweight foam, heat-insulating (expanded)

Clear, hard, shatter-proof (polycarbonate)

Garbage bags, squeeze bottles, frozen foods packaging, dry cleaning bags

Containers for yogurt, margarine, medicine bottles, toys, drink bottles, ketchup bottles

To-go food containers, aspirin bottles, foam packing, insulated coffee cups, yogurt and dairy containers, vending cups, meat trays (one brand is Styrofoam)

3- and 5-gallon water cooler bottles, plastic to-go coffee mugs, some dental fillings, clear hard plastic reusable water bottles, medical equipment

Not known to contain BPA or phthalates

Not known to contain BPA or phthalates

Not known to contain BPA or phthalates.

Polycarbonate plastic contains BPA, a chemical that has been linked in animal studies to developmental, reproductive, and metabolic health problems.

REFILL THOSE CODE 1 BOTTLES?

Do you refill and reuse those code 1 water bottles? Many people do, but experts recommend that you toss them after first use into the recycling bin. Bacteria can build up inside and the plastic can disintegrate, explains HSPH's Russ Hauser: "The primary concern is with bacterial contamination. The other concern is if you're washing it, you can release the chemicals in the plastic. Any kind of abrasion leads to leaching. Microscratches, heating, and acids help break down plastics. Plastic used for code 1 bottles also contains a metal called antimony, a possible carcinogen."

Items coded 7 and PC are known to contain BPA. Items coded 7 and Other may or may not contain BPA.

Plastics: Danger Where We Least Expect It?

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14,000 members from more than 100 countries, the organization also issued its first-ever “science statement,” a review of endocrine disruptors with HSPH’s Hauser as a co-author. “The animal studies are consistent and clear, but we really don’t have the human data,” Hauser says, a gap that the FDA had to take into account when it issued its opinion.

ties, and cities have taken make sense while the human research catches up,” she says. “Ideally, you would like to have a life-course study where you evaluate the impact of a chemical starting with intrauterine exposure and ranging through adulthood 50 years later. But a lot of us alive right now would not see the end of it.”

Hauser notes that some of the

of six chemicals to investigate more thoroughly in newly announced efforts to revamp the Toxic Substances Control Act of 1976. In a speech in San Francisco on September 29, EPA Administrator Lisa Jackson said, “The public is understandably anxious and confused. They’re looking to the government for assurance that these chemicals have been assessed using

“The nightmare scenario is that we one day find out that a lot more of our current disorders, including infertility and cancer, may be due to bisphenol A.” —Karin Michels

So far, human research includes one study that linked BPA exposure to recurrent miscarriage among Japanese women. Another study, published after the FDA’s ruling that BPA was safe, associated the chemical with heart disease, diabetes, and liver disorders among the population surveyed by the CDC. An *Environmental Health Perspectives* report published online October 6, drawing on data from 249 mothers and their children in Cincinnati, Ohio, associated prenatal BPA exposure with more aggressive and hyperactive behavior in girls at age 2.

HSPH’s Michels believes that this kind of suggestive evidence is sufficient reason for action. “Because there is a lot of concern about baby bottles, the steps that states, coun-

needed shorter-term human studies, involving newborns and young children, are now starting up or are in their early stages. These investigations could yield results within two to four years. “If these studies find associations with adverse effects, I don’t think we’re going to need to wait until it’s replicated five times, given what we know from animals.”

In the meantime, in a quick and cheap stopgap measure, manufacturers could list contents such as phthalates and BPA on all their products, says Hauser. “That would give consumers a chance to make their own decisions about what to use.”

SIGNS OF CHANGE

While the FDA mulls over its position on BPA, the U.S. Environmental Protection Agency (EPA) has set its sights on the substance as one

the best available science. Current law doesn’t allow us to give those assurances.” U.S. Senator Frank Lautenberg of New Jersey has vowed to introduce new legislation to strengthen the act.

Industry sees the writing on the wall. The American Chemistry Council issued a statement in August of this year “acknowledging the need for modernization of laws,” something of a reversal of previous positions on regulation. Some industry observers likened the move to the period just before federal clean air and clean water laws went into effect—when a patchwork of local and state regulations would soon give way to consistent federal guidelines.

Larry Hand is associate editor of the Review.