

CLINICAL UPDATE

Endocrine Disrupting Chemicals: What to Tell Your Patients

Deborah M. Kurrasch, PhD

Dr. Kurrasch (kurrasch@ucalgary.ca) is an associate professor in the Department of Medical Genetics at the Cumming School of Medicine at the University of Calgary. She is also a scientist in the Alberta Children's Hospital Research Institute.

There are more than 80,000 synthetic chemicals on the Toxic Substance Control Act registry, many of which exist in consumer products that we use every day—from furniture to toys to household cleaning products to cosmetics. In 2000, 400 million tonnes (880 billion lbs) of man-made chemicals were produced world-wide; the equivalent of 180,000 Olympic-sized pools! Due to outdated chemical-safety laws and loopholes, only 14% of these synthetic chemicals have been adequately tested for their effects on human health, leaving consumers to make purchasing decisions without proper information. Currently, there are many organizations, such as the National Resource Defense Council, actively pressuring the U.S. Environmental Protection Agency, U.S. Food and Drug Administration, and state governments to update these laws while, in the meantime, health care professionals play a necessary role in helping patients make informed decisions.

Within the long list of synthetic chemicals, Endocrine Disrupting Chemicals (EDCs) is a subgroup that receives (and deservedly so) considerable attention. By definition, any chemical that can interfere with our endocrine system and adversely impact any aspect of hormone action is considered an EDC. Also referred to as hormone-disruptors, these chemicals mimic or antagonize normal hormone signaling to produce adverse effects on development, reproduction, and immune signaling, among other physiologies. Although hundreds of man-made and natural substances can cause endocrine disruption, there are several classes

that are especially studied, including plasticizers (e.g., bisphenol A, phthalates), pesticides (e.g., DDT and atrazine), dioxin and dioxin-like compounds (e.g., TCDD), and polychlorinated/polybrominated biphenyls (e.g., PCBs). Combined, these EDCs have been found in a wide array of consumer products, such as plastic bottles, detergents, flame retardants, food, toys, cosmetics, pesticides, and metal food cans.

In 2015, the Endocrine Society released its second “Scientific Statement on Endocrine Disrupting Chemicals” (<https://www.endocrine.org/endocrine-press/scientific-statements>), designed to provide a comprehensive update of the current scientific literature.¹ The authors read thousands of published papers with the goal of evaluating the evidence that EDCs do adversely affect health. For results to be included in their final assessment, the authors set the following criteria:

1. evidence must span several levels of analysis, if possible from both human epidemiological data and mechanistic studies in animal models;
2. appropriate controls (both negative and positive) must be included;
3. sample size must be high enough to have adequate power for statistical conclusions; and
4. methodology must be appropriate.

They also include both government- and industry-funded research. The authors summarize the data into specific health categories where the impact of EDCs was most clear: obesity/diabetes, female

reproduction, male reproduction, hormone-sensitive cancers in females, prostate, thyroid, and neurodevelopment/neuroendocrine systems. Any physician interested in learning more about the scientific evidence linking EDCs to these diseases is strongly recommended to download (for free) this position statement from the link.

In the meantime, the authors state “conclusive evidence [exists] for whether, when, and how EDCs perturb endocrine systems, including in humans.” They go on to conclude that “it is more necessary than ever to minimize further exposures, to identify new EDCs as they emerge, and to understand underlying mechanisms in order to develop interventions.”

In support of these conclusions, a recent report in the *Lancet* estimates that the United States spends more than \$340 billion each year on health care related to EDC exposure and that almost 13 million IQ points are lost due to hormone-disrupting chemicals.² The authors warn that flame-retardant chemicals (PBDEs) are the worst culprits, causing \$268 billion in health care spending and the loss of 11 million IQ points. As a reference, despite the population of the European Union being nearly twice that of the United States, the authors estimate that health care costs for PBDEs to be only \$12.6 billion, demonstrating a sharp improvement in health when PBDEs are not widely used in consumer products. Finally, the authors opine that 4,400 cases of attention-deficit/hyperactivity disorder and about 1,500 cases of autism per year can be attributed to exposure to hormone-disrupting chemicals.

continued on page 2

CLINICAL UPDATE

continued from page 1

If the scientific data are so strong that EDCs are harmful to human health and lead to high medical costs, then why are hormone-disrupting chemicals still being used in consumer products? Predictably, the answers to this question are multi-faceted—an example is the plasticizer bisphenol A (BPA). Recent reviews of the scientific literature by regulatory agencies in the United States, Canada, Europe, and Japan conclude that BPA is safe for consumers at current exposure levels. One reason for this disparity is because cause-and-effect is hard to show in humans. When a patient is diagnosed with endometriosis, it is nearly impossible to link it to BPA exposure, which is often low-level and chronic over many years. Moreover, there is always some debate when translating studies from animal models back to humans, and inconsistencies between doses and age of exposure can be exploited to point to conflicting literature. And finally, plastic manufacturing is a \$375 billion per year industry that motivates invested parties to keep the debate alive. That being said, manufacturers are keen to produce products consumers want to buy, so they are actively trying to find safe alternatives to epoxy can liners that leach BPA, for example. Unfortunately, cheap, odorless alternatives that do not peel, chip, or flake have proven to be challenging to develop. Plus, in the meantime, consumers continue to buy these products in an act that diminishes the urgency to find safe replacements.

As a clinician, what do you need to share with your patients? First, and foremost, it is important for everyone to keep a balanced ap-

proach. Chemicals surround us, and there are only so many preventative steps that can be taken; it is not helpful to obsess. Second, the age of the patient is a large factor in determining the appropriate level of concern. Although everyone should be making educated decisions that limit exposure to EDCs, the level of urgency is much different for a postmenopausal woman than for others, such as a pregnant woman or a child. Recent research has demonstrated that developing brains and organ systems, both in utero and in early life, are particularly susceptible to EDCs and pregnant women should take some level of precaution to limit exposure where feasible (see “Scientific Statement on Endocrine Disrupting Chemicals” for more details). The following are tips on how to avoid EDCs:

- 1. BPA:** 93% of Americans have BPA in their urine. BPA is found in polycarbonate plastics, canned foods, thermal paper, and other consumer goods. Advice to limit exposure is to drink and eat from glass or stainless steel containers. If a plastic container is used to bring lunch to work, for example, do not heat it in the microwave nor put it in the dishwasher. Better to recycle the container when it starts to become worn. It is also a good idea to decline print receipts since thermal paper is often coated with BPA.
- 2. Phthalates:** 95% of Americans have phthalates in their urine. Phthalates are used to make soft and flexible plastics, such as plastic wrap, but can also be found in perfume, hair spray,

carpet, plastic toys, and almost anything fragranced (e.g., shampoo and laundry detergent). To limit exposure, avoid plastic food containers and plastic wrap with recycling labels #3 or #7. In 2009, many types of phthalates were banned from children’s toys, teething rings, and bottles, but older soft plastic toys likely contain phthalates. It is also wise to start reading labels and avoiding products that list “fragrance” or “parfum” since this can sometimes mean hidden phthalates.

- 3. Fire Retardants:** Due to flammability standards in the United States, chemical fire retardants are heavily used across a variety of household items, including furniture, electronics, appliances, and baby products. Children have been exposed to higher levels of fire retardants than adults; in large part due to these retardants leaching out of products and contaminating house dust that accumulates on the floor where infants or young children sit and play. Reducing in-home exposure to fire retardants is not easy and usually requires careful purchasing decisions of upholstered chairs and sofas, carpet, car seats, changing table pads, and crib mattresses. The best strategy is to buy items made without fire retardants and that usually requires contacting the manufacturer directly to ask if its furniture contains these chemicals.
 - 4. Perfluorinated Chemicals (PFCs):** 99% of Americans have perfluorinated chemicals in their
- continued on page 3

CLINICAL UPDATE

continued from page 2

urine. PFCs are used to make non-stick cookware and water-resistant coatings on furniture, carpet, and clothes. To reduce exposure, do not use non-stick pans for cooking and try to limit purchasing goods sprayed with water-resistant coatings.

- 5. Organophosphate Pesticides and Atrazine:** These pesticides are widely used on crops throughout the United States. If budgets allow, try to buy organic produce. Alternatively, shopper guides³ can identify produce that has the fewest pesticide residues (including asparagus, avocado,

cabbage, cantaloupe, carrots (peeled), cauliflower, eggplant, grapefruit, kiwi, onion, mango, mushrooms, papaya, pineapple, sweet corn, sweet peas, sweet potato, and watermelon).

References

1. Gore A C, Chappell V A, Fenton, S E, et al. The Endocrine Society's second scientific statement on endocrine-disrupting chemicals. <https://www.endocrine.org/endocrine-press/scientific-statements>. Published 2015. Accessed November 26, 2016.
2. Attina T M, Hauser R, Sathyanarayana S, et al. Exposure to endocrine-disrupting chemicals in the USA: a population-based disease burden and cost analysis. *Lancet*. [http://www.thelancet.com/journals/landia/article/PIIS2213-8587\(16\)30275-3/fulltext](http://www.thelancet.com/journals/landia/article/PIIS2213-8587(16)30275-3/fulltext). Published October 17, 2016. Accessed November 26, 2016.
3. Environmental Working Group. CLEAN FIFTEEN: EWG's 2016 shopper's guide to pesticides in produce™. https://www.ewg.org/foodnews/clean_fifteen_list.php. Accessed November 30, 2016.

SGIM