

Environmental Exposures and the Impact on Women's Health

Victoria Maizes, MD

Victoria Maizes, MD, Executive Director of the University of Arizona Center for Integrative Medicine, in Tucson, Arizona, has been a clinical practitioner, educator, author, and industry leader regarding the integrative approach to a wide variety of medical conditions. Dr. Maizes is also a Professor of Medicine and Public Health at the University of Arizona and was a research fellow with the University of California San Francisco (UCSF) Program on Reproductive Health and the Environment, and is the author of Be Fruitful: The Essential Guide to Maximizing Fertility and Giving Birth to a Healthy Child. In this column, she explores the increasing impact of environmental exposures on women's health and points for clinicians to consider.

Q: How did you first become interested in the link between environmental exposures and women's health?

Victoria Maizes: I have always been passionate about prevention and public health. My career has been focused on the question of how you help people lead healthier lives. This has absorbed my attention in my clinical practice, educational research, and teaching. Over time, I learned about the links between environmental exposures and health—and women's health in particular. I was stunned by the evidence, which revealed that babies are born with multiple environmental chemicals in their cord blood. In fact, in 2008, the Institute of Medicine (IOM) reported that babies are born pre-polluted. This made me realize that meaningful preventive initiatives must begin pre-conceptually, so I began studying, teaching, and writing about this subject.

I am committed to increasing the awareness about the impact of environmental exposures on women, as well as the actions that women can take to prevent exposure and disease and to improve their health. Hopefully, government and industry will also take significant steps to reduce exposures, but in the meantime, individuals can take action.

Q: As we think about the impact of environmental exposures on women's health, what are some of the major illnesses and diseases that the current literature associates with toxins and chemicals?

Dr. Maizes: This is not an easy area to research because we do not have, and never will have, randomized controlled trials

that intentionally expose women to particular doses of environmental chemicals and then study them. Instead, we have learned from accidental exposures, epidemiological evidence, animal studies, and retrospective assessment. For example, one of the drugs that we first learned was an endocrine disruptor is diethylstilbestrol (DES), which was prescribed broadly as a fertility drug. Years later, we discovered that women who took DES during pregnancy were at higher risk for abnormal cell development of the baby's reproductive tract, and higher rates of breast cancer, impaired fertility, and miscarriage. We are now learning about the granddaughters of these women; they may experience late onset of puberty, menstrual irregularities, and possibly more infertility. Researchers are following these exposed women to determine the impact.

We have also learned from the Dutch famine study that when women had insufficient nutrition in the early stages of their pregnancy, their children developed higher rates of diabetes and impaired glucose tolerance in adult life.¹ This finding led to Dr. Barker's fetal-origins hypothesis, which essentially posited that in utero exposures can have a lifetime impact on health or disease, and that impact may show up 40–50 years later.²

A twin study has revealed interesting information regarding their exposures to industrial chemicals.³ The twin exposed to the solvent trichloroethylene had a six times higher risk of developing Parkinson's disease compared with the non-exposed twin. When exposed to perchloroethylene (a chemical used in dry-cleaning), the exposed twin's risk was nine times greater. Of note, the onset of Parkinson's was 30–40 years after the exposure.

A Centers for Disease Control and Prevention (CDC) study showed that women with the highest levels of persistent environmental chemicals in their urine tended to have earlier onset of menopause.⁴ We know that earlier menopause has public-health consequences, including heart disease, infertility, and osteoporosis risk.

Q: It appears that environmental exposures affect women across the generations—from pre-conception, to adolescence, to peri-menopause and the later years. What is your take on this?

Dr. Maizes: That is true. Many people are wondering whether in utero exposure to environmental toxins increases

the risk of autism or attention deficit hyperactivity disorder. There is some evidence for this, and there is also evidence for an increased risk of heart disease, diabetes, and cancer.

Fetal life, infancy, and early childhood are critical periods for a variety of reasons. When exposed early in life, the impact is greater because the ability to detoxify is limited, and the immune system is not well developed. Also, young children's behaviors increase their risk for exposure. Household dust is a common source of exposure, and babies crawl on the floor, have their hands in the dust, and put their hands in their mouths. Thus, babies, toddlers, and young children's behaviors expose them to more chemicals than adults.

I wrote *Be Fruitful: The Essential Guide for Maximizing Fertility and Giving Birth to a Healthy Child*.⁵ A major focus of the book is on reducing as many exposures to environmental chemicals as possible before a woman conceives. The first three months of conception are critical to the development of essential systems, so ideally a woman would make behavior changes before becoming pregnant in order to reduce her body burden. Tracy Woodruff, PhD, the Director of the UCSF Program on Reproductive Health and the Environment, wrote an article in which she said virtually every pregnant woman in the United States is exposed to multiple chemicals, and certain chemicals are detected in 99–100% of pregnant women.⁶ So, taking steps toward change pre-conceptually is imperative.

Q: What are some of the main sources of toxins and chemicals that women need to be particularly concerned about, whether it is from plastics, cosmetics, or food, etc.?

Dr. Maizes: One of the things I like to say to my patients is that “the perfect is the enemy of the good.” In other words, the idea is not to make us afraid of life. Living life includes risk. Food and water are key sources of exposure. Eat organically when possible, especially meat, poultry, and dairy, because as we eat higher up on the food chain, we accumulate more environmental chemicals in our bodies. For vegetables and fruits, the Environmental Working Group (EWG) publishes a list of the Dirty Dozen (most contaminated produce) and the Clean 15 (least contaminated produce).⁷ When people eat from the Clean 15, it is estimated that they may avoid 93% of the environmental toxins compared to eating from the Dirty Dozen. Selecting safer fish with lower levels of mercury and polychlorinated biphenyls and other environmental toxins is also a good idea, as is avoiding canned food, because most canned food linings contain bisphenol A (BPA). Fortunately, there are companies that are now packaging in BPA-free cans.

In addition, clinicians can encourage their patients to avoid using plastics when microwaving and switch to glass or ceramic food-storage containers. Saying no to receipts helps avoid absorption of the BPA that is on thermal receipts. For drinking water, installing a water-filtration system is a good idea. Depending on the risks in a particular location, one can choose the most appropriate filter to remove impurities and toxins in the water supply. Carrying this home-filtered water in

stainless steel or glass containers can help and minimizes the use of plastics.

The average woman uses 12 or more personal-care products a day. These expose us to chemicals such as parabens, phthalates, and fragrance (which contain endocrine-disrupting chemicals) through absorption by our skin. The good news is that there is now an enormous industry that provides safer products in these categories. Skin Deep, which is part of the EWG, is a good resource on this issue, as are the apps Think Dirty and the Good Guide. There are also Facebook pages that focus on this issue. One is called No More Dirty Looks; another is Women's Voices for the Earth. Fortunately, there are easy ways to buy clean products. There are also green cleaning materials that do not have fragrances or dangerous chemicals. In addition, one can use a high-efficiency particulate air filter in the home and buy household furniture that does not have flame retardants. There are many steps that people can take to limit their exposure. People can change their habits. For example, I live in the desert, and people carry water with them all of the time. Compared with 10 years ago, many people are now using safer types of water bottles.

There is evidence that when a person makes these changes, the level of chemicals decreases in the body. A number of studies have shown, for example, that when you avoid plastics, feed children organic food, and avoid canned sodas, the urinary level of a number of chemicals, including BPA, dramatically decreases within days. A small study that included five San Francisco families showed that within three days of being fed mostly organic, freshly catered food, and minimal use of plastics or cans, their urinary BPA levels went down by two-thirds and their phthalates by about half.⁸

Another study looked at Mennonite women who typically do not use personal-care products, mainly eat their own garden produce, and avoid traveling in cars.⁹ The study compared a group of pregnant Mennonite women with a group of CDC National Health and Nutrition Examination Survey women and found dramatically lower levels of chemicals in the Mennonite women.

A well-done study looked at substituting organic food for children's usual food.¹⁰ For example, if the children eat pretzels, the researchers had them eat organic pretzels. It was not necessarily a healthy diet; it was a substitution of organic foods instead of their usual diet. The authors concluded that the urinary levels of organophosphate pesticides decreased to close to zero. The change was dramatic and rapid. This is the kind of information that clinicians can share with their patients to encourage them that such changes are worthwhile and do make a difference.

Q: Is there any evidence that our bodies are adapting to the enormous increase in environmental exposures over the last 60 years?

Dr. Maizes: I do not think there is evidence that we are adapting. A lot of the chemicals that we are exposed to now were produced post-World War II. Prior to that, people ate home-cooked food and did not eat processed food. We also did

not have an enormous array of pesticides or genetically modified organism food.

I was initially trained in family medicine, and in the early years of my practice, I did not see many children who had chronic disease. The number of children with chronic disease has grown significantly, including a rise in asthma. Many experts postulate that this has to do with environmental exposures. We have seen an incredible increase in rates of autism, and yet our genetics have not changed significantly in the last 30–40 years. So, many experts believe it is linked to some type of exposure. We have spent enormous sums of money looking for a genetic cause, and we have spent very little money determining the potential environmental exposures. I saw an estimate by the Director of the National Institute of Mental Health, Thomas Insel, who said the U.S. government spent almost \$1 billion dollars researching the genetics of autism and only about \$40 million on possible environmental factors.

Most breast-cancer researchers believe evidence links increased rates of breast cancer to environmental exposures. There is evidence that links BPA exposure with hypertension. We have an incredibly challenging problem in our nation with obesity, and we know that children who have higher levels of BPA in their urine also have higher rates of obesity than children with low levels.¹¹ So there is presumptive evidence that environmental exposures have consequences on our health.

When you go into the grocery store, there is no signage that tells you that the food you are choosing is genetically modified. Children in Flint, Michigan, were exposed to lead in the water when the water was not adequately purified. This is not an issue in Flint alone; it is happening in water supplies all over the country. As citizens, we may think we are protected by our government, but it is not necessarily adequate.

Studies have linked high rates of asthma in children to school buses that idle their engines on in front of the school.¹² Once the cause was understood, policies were created in which bus drivers were instructed to turn off their engines while waiting for the children, and asthma rates decreased.

We can get caught up thinking that it is too complicated to address environmental exposures. Then we hear of a study such as this and realize it is possible. It may be as simple as turning off an idling car in order to avoid exposure to the fumes, or when driving in traffic, turning on the recirculate button, to reduce exposure to air pollution. These are very practical and pragmatic things that we can do to reduce our exposures.

Exposure from electromagnetic fields is another area of concern. We should not carry cell phones on our bodies. There is evidence that men who carry their cell phone in their pants pockets or near their genitals have greater numbers of abnormal sperm and lower numbers of mobile sperm. It is harder to measure whether carrying a cell phone on the body is affecting ovarian function. The World Health Organization labeled cell phones as potential carcinogens, so it is prudent to avoid wearing them on our bodies. We especially need to limit children's exposure to cell phones.

Q: In terms of your advice to clinicians, is there anything else that you think is important regarding the integrative approach to women's health and the potential for environment exposures?

Dr. Maizes: Clinicians need to become educated, because this is certainly not something that is broadly taught, and it is not a problem that will be going away any time soon. The University of Arizona Center for Integrative Medicine has a free online six-hour course about environmental health.¹³ We offer continuing medical education and continuing education credits. We have studied the effects of this course and found that it increases medical knowledge and awareness, and people become more confident about taking an environmental history.¹⁴

Clinicians can consider when seeing patients with a presenting problem whether the condition makes sense. For example, if a patient is slim and seems to manage their stress well and yet has high blood pressure, or a woman is 42 years of age and going into premature menopause, it should cause clinicians to pause and think about what else might be contributing. Having a high index of suspicion about environmental exposures and how they may affect our patients' health is important.

I also ask my patients to be detectives. I give them a handout with information about environmental exposures, and I say, "I need you to start thinking about what are you exposed to that could potentially be contributing to your health?" Patients can review what they are exposed to at work and at home. Was there something significant that they were exposed to in childhood? I encourage patients to avoid the things that they can avoid, and I point them to various resources that will help them make smarter choices. Now, I do not believe the responsibility should lay solely with individuals in our society—I also believe the government bears responsibility.

Q: Is there hope regarding these issues? What are your thoughts about the future?

Dr. Maizes: One hopeful aspect is that there is evidence from studies that show that when we switch to eating organic foods, and reduce our personal-care products to safer, cleaner ones, we can reduce our toxic burden. Our bodies are able to detoxify. We have multiple systems from urination to defecation to hepatic metabolism to sweating and respiration that help in the detoxification process. We have many ways that the body rids itself of environmental chemicals if it is not overloaded.

There is also growing awareness and demand for information about this topic, and people's collective voices can make a big difference. When brominated vegetable oil was identified in some sodas, for example, a social-media campaign led by a teenager effectively succeeded in persuading the large companies to remove that chemical. We, as clinicians and as part of the greater community, have the power to change things by voting with our pocketbooks when we purchase from companies that create green products, as well as with

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social media campaigns. There is also the possibility of making the economic case around this issue.

One of the leaders in the field, Dr. Leo Trasande, wrote an article in *Health Affairs* arguing the economic case.¹⁵ He showed evidence that BPA exposure was associated with approximately 12,000 cases of childhood obesity and about 34,000 cases of heart disease in 2008 at a cost of almost \$3 billion. He argued that if BPA exposure was removed, this would prevent almost 6,000 cases of childhood obesity and 22,000 cases of heart disease and save approximately \$1.7 billion. This kind of argument may make a difference.

There is also emerging evidence that demonstrates that we may be able to enhance our detoxification systems. A Chinese randomized controlled trial showed that in a 12-week intervention among people living in a polluted area compared with those who received a placebo beverage, those who drank a broccoli sprout beverage daily increased their excretion of benzene and acrolein.¹⁶ There is also evidence that vitamin E and dietary flavonoids can protect our endothelial cells from persistent organic pollutants.^{17,18}

Policy changes at the state level can also help. California used to require that all furniture have flame retardants; they rescinded that law a couple of years ago. So I do believe there is hope and movement in a positive direction, from policy change, to industry pressures to capture the green market, to individual behavior changes, and to research that supports healthy lifestyle decisions that make a difference. ■

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