

EDUCATION

Environmental exposures: how to counsel preconception and prenatal patients in the clinical setting

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A large and growing body of scientific literature provides evidence that environmental exposure during the prenatal period can impact fetal development adversely and potentially have long-lasting effects throughout the lifespan. Several well-recognized scientific bodies that include the American Academy of Pediatrics, the Endocrine Society, and the President's Cancer Panel recognize that some prenatal environmental exposure can be associated with adverse birth outcomes and abnormalities in early childhood development with the potential for long-lasting impacts.¹⁻³

Reproductive health providers have an important role to play in "risk communication" that is associated with environmental health. They can be knowledgeable about these issues and empower their patients to make positive decisions to reduce exposure and to prevent adverse health impacts to both mother and fetus. In an article that described the role of reproductive health providers in the

A growing body of scientific evidence suggests that preconception and prenatal exposures can impact fetal development adversely and lead to potential long-lasting health effects. Reproductive health professionals have little training on these exposures and how to counsel patients effectively. We present short summaries of some of the most common environmental exposures and give providers practical tools with which to counsel patients in the clinical setting. These tools may enable practitioners to help prevent harmful environmental exposures and to reduce the risk of future adverse health impacts for the prenatal and preconception patient population.

Key words: counseling, environmental exposure, preconception, prenatal

prevention of exposure, Sutton et al⁴ summarized the potential environmental threats to the unborn fetus and state that clinicians are in a unique position to provide anticipatory guidance to all patients with information about how to avoid toxic exposures at home, in the community and at work. Although many environmental hazards that can impact the developing fetus are well-recognized in the scientific literature, it is unclear how reproductive health providers can counsel patients effectively regarding these issues. In the current article, we provide practical tools to counsel women regarding some of the most common environmental risks that include lead, mercury, pesticides, and endocrine-disrupting chemicals (EDCs). We have chosen lead, mercury, and pesticides as topics because biomonitoring shows that most of the population is exposed to these chemicals and because published peer-reviewed literature exists to guide screening, counseling, and treatment. We also included EDCs that are emerging contaminants of concern to illustrate how providers can approach guidance in the setting of evolving scientific information. The topics we have chosen are not exhaustive but do represent common exposures in the general population. We present a short summary of background data and discuss approaches to counseling in the prenatal setting. Tables 1-4 contain key points

and can be used during the clinical encounter to communicate environmental health-based messaging, exposure-reduction techniques, and references to treatment when applicable and to offer resources for further information. Most women in the prenatal/preconception period experience low-level chronic exposure over time for which providers can counsel about risk and exposure reduction to prevent further disease. Clinicians who are concerned that their patients may be exposed to excessive amounts of environmental or occupational toxicants should call their local poison control center or refer patients to a medical toxicologist. We do not discuss smoking and environmental tobacco-smoke exposure because reproductive health providers already are aware that these exposures lead to adverse health impacts for both the pregnant woman and the developing fetus and because resources to aid in counseling currently exist.

Mercury

Mercury is released into the atmosphere by coal-fired power plants, waste incineration, and other industrial processes and enters waterways by run-off or settling of air-borne particulate matter. It is metabolized by microorganisms into methylmercury that then accumulates in fish, concentrating in the tissue. Because large fish eat smaller fish, mercury bio-magnifies up the food chain. In the

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TABLE 1
Mercury messaging

Messaging	Key points
Health-based	<p>Exposure to mercury can come from eating fish, contact with quicksilver, use of skin-lightening creams, or inhalation of mercury vapors at work.</p> <p>Mercury is a potent neurotoxin; exposure during pregnancy can lead to adverse neurodevelopmental outcomes that include lower IQ and poor language and motor development.</p> <p>Fish is an excellent source of protein and omega-3 fatty acids, which have been shown to improve visual acuity and scores on the Denver Developmental Screen.</p>
Exposure reduction	<p>Pregnant, preconception, and breastfeeding patients should follow US Environmental Protection Agency and state-specific fish consumption guidelines.</p> <p>To maximize the benefits of fish consumption, eat fish twice per week.</p> <p>Choose a variety of fish; avoid shark, swordfish, king mackerel, and tile fish.</p> <p>Eat fish that are lower in mercury.</p> <p>If you eat recreationally caught fish, access local fish advisories and follow the recommendations for consumption.</p> <p>Do not use skin-lightening creams or home remedies that might contain mercury.</p>
Resources	<p>Reproductive health providers can access web resources that offer lists of “healthy fish” and species to avoid; patients can use these when grocery shopping or eating out: http://www.doh.wa.gov/ehp/oeas/fish/fishchart.htm¹⁶ and http://www.nrdc.org/health/effects/mercury/guide.asp.¹⁷</p> <p>Reproductive health providers who suspect mercury toxicity in their patients from very high fish consumption, exposure to metallic mercury, home remedies, or use of skin-lightening creams should contact a toxicologist at their local poison control center (http://www.aapcc.org/dnn/AAPCC/FindLocalPoisonCenters.aspx)¹⁸ or an occupational and environmental medicine physician/pediatric environmental health specialist (www.aoc.org)¹⁹ for advice on testing and chelation.</p>

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United States, mercury has contaminated 43% of US lakes and wetlands; all 50 states have fish advisories that recommend limits on the ingestion of locally caught fish by pregnant and nursing women and children.⁵

Other forms of mercury such as metallic mercury (“quicksilver”) from broken thermometers and sphygmomanometers and mercuric salts that are found in ethnic home remedies and skin-lightening creams that are sold outside of the United States may also be a source of exposure. Mercury is used in occupational settings, and workers may be exposed by inhalation or dermal contact in the handling of dental amalgams, in glass calibration, in the manufacture of fluores-

cent lamps in the paper pulp industry, and in chloralkali plants.⁵

Mercury is a potent neurotoxin. The tragedy of Minamata Bay, Japan, in the 1950s (in which villagers who subsisted on fish from the contaminated bay had children who experienced an increase of cerebral palsy, mental retardation, blindness, and other neurologic conditions and congenital anomalies) helped to illuminate the toxicity of methylmercury. More recently, several landmark studies that have examined lower dose exposure that were conducted among pregnant women from high fish consumption populations have shown evidence of poorer neurologic development that is associated with higher levels of

mercury exposure during pregnancy. Lower scores on the Denver Developmental test, the Bayley Psychomotor Development index, and the Neonatal Assessment Behavioral Scale were all associated with higher cord blood mercury, higher maternal hair mercury concentrations, and the consumption of fish at least 3 times per week during pregnancy.⁶⁻⁹ Mercury exposure has also been associated with shorter duration of pregnancy.¹⁰ In the past decade, several studies that combined data on fish consumption frequency questionnaires and mercury levels in hair, blood, and cord blood have estimated that 5-8% of pregnant women may have mercury levels above the recommended limits.¹¹

Increasing awareness of the potential adverse effects of methylmercury to the developing fetus has caused many pregnant women to decrease their consumption of fish or eliminate it entirely from their diets. It should be recognized that fish is an excellent low-fat source of protein and omega-3 fatty acids. There is some evidence to show that fish consumption or omega-3 supplementation during pregnancy may increase the duration of gestation and birthweight in some populations.¹² Improved visual acuity, performance on developmental testing, and higher IQ scores have all been associated with the consumption of omega 3s and fish in pregnancy.¹³⁻¹⁵

The fish consumption message is complex, but important, because women should be encouraged to eat fish to gain the benefits of the omega-3s, yet they need to “choose wisely” to avoid the potential risk of adverse pregnancy effects. The US Environmental Protection Agency provides fish consumption guidelines for pregnant and nursing women, women of child-bearing age, and young children that include recommendations to eat fish twice per week (total of 12 oz), avoid fish that are highest in mercury (which includes king mackerel, shark, swordfish, and tile fish) and to follow local fish advisories for recreationally caught fish (Table 1).

Reproductive health providers should screen their patients who are pregnant or nursing or who are in the preconception phase with questions such as, “How of-

ten do you eat fish?”, “What types of fish do you eat?”, and “Do you eat recreationally caught fish?” Regarding other sources of exposure to mercury, providers should ask, “Do you use skin-lightening creams or other personal care products that contain mercury? Do you have a mercury thermometer at home? Do you work with mercury?”

Lead

Successful public health efforts to eliminate lead from paint and gasoline have resulted in a significant decrease in blood lead concentrations in the US population over the past 3 decades. Despite these efforts, 1% of childbearing women in the United States have a blood lead level (BLL) of $\geq 5 \mu\text{g/dL}$.¹⁶ There is good evidence that maternal lead exposure at concentrations of $\leq 10 \mu\text{g/dL}$ can cause fetal lead exposure and impair fetal growth and child neurodevelopment, independent of postnatal exposure.¹⁷ Maternal blood levels of $\geq 10 \mu\text{g/dL}$ are linked to gestational hypertension, increased risk for preterm delivery, and low birthweight.¹⁶ Extremely high concentrations ($\geq 30 \mu\text{g/dL}$) are associated with birth defects, spontaneous abortion, and placenta previa.¹⁶ Pregnant women are also at increased risk because of increased bone mobilization of lead stores during pregnancy.¹⁶ At this time, there is no threshold BLL below which adverse effects do not occur.

The Centers for Disease Control and Prevention recommends identifying pregnant women who are at high risk for BLLs above background levels to reduce exposure and prevent adverse health outcomes.¹⁷ Certain subpopulations may be at an increased risk for exposure, which would include workers in certain occupations (eg, working in a battery factor) and foreign-born recent immigrants. Women should be screened on the basis of the following risk factors: recent immigration to the United States, presence of pica, occupational exposure, nutritional status, culturally specific practices (that include the use of traditional remedies), the use of imported cosmetics, and/or the use of lead-glazed pottery. Women who are hypocalcemic are at higher risk for lead poisoning because

TABLE 2
Lead messaging

Messaging	Key points
Health-based	<p>Lead is neurotoxic to the developing fetus.</p> <p>Risk factors for lead exposure include recent immigration to the United States, pica practices, occupational exposure, culturally specific practices that include the use of traditional remedies, imported cosmetics, the use of lead-glazed pottery, and renovating or remodeling a home that was built before 1970.</p> <p>Women at high risk for lead exposure should be screened with a venous blood lead level test.</p> <p>A maternal blood lead level as low as $10 \mu\text{g/dL}$ and under is associated with an increased risk of impaired fetal growth and neurodevelopment; higher blood lead level concentrations are associated with birth defects, spontaneous abortion, and gestational hypertension.</p> <p>A pregnant woman with a blood lead level of $\geq 5 \mu\text{g/dL}$ should be counseled to reduce exposure and have follow-up testing</p> <p>A pregnant woman with a blood lead level of $\geq 10 \mu\text{g/dL}$ should be counseled to reduce exposure, to have follow-up testing, and be referred to a local health department for home investigation of lead sources.</p>
Exposure reduction	<p>Never eat or mouth nonfood items (such as clay, soil, pottery, or paint chips) because they may be contaminated with lead.</p> <p>Avoid jobs or hobbies that may involve lead exposure and take precautions to avoid take-home lead dust if a household member works with lead (eg, construction or home renovation/repair in pre-1978 homes and lead battery manufacturing or recycling).</p> <p>Stay away from repair, repainting, renovation, and remodeling work being done in homes built before 1978 to avoid possible exposure to lead-contaminated dust from old lead-based paint; avoid exposure to deteriorated lead-based paint in older homes; have water tested if you suspect lead contamination from wells or solder in pipes.</p> <p>Eat a balanced diet with adequate intakes of iron and calcium.</p> <p>Avoid alternative cosmetics, food additives, and medicines that were imported from overseas.</p> <p>Shoes should be removed at the door to prevent tracking in lead and other pollutants.</p>
Resources	<p>Reproductive health providers can use the evidence-based guidelines published in 2010 by the Centers for Disease Control and Prevention (www.cdc.gov/nceh/lead/publications/Leadandpregnancy2010.pdf)¹⁷ for further information on health impacts of prenatal lead exposure, biomarker measurement, and prevention/management.</p> <p>Reproductive health providers with pregnant patients with blood lead levels of $\geq 20 \mu\text{g/dL}$ should contact a toxicologist at their local poison control center (http://www.aapcc.org/dnn/AAPCC/FindLocalPoisonCenters.aspx)¹⁸ or an occupational and environmental medicine physician/pediatric environmental health specialist (www.aoc.org)¹⁹ for advice on testing and chelation.</p>

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cause lead takes the place of calcium-binding sites in bone, and bone is mobilized during pregnancy, which increases the risk of circulating lead in the blood stream.¹⁷ Pregnant women who live in

older homes (built before 1978) that are undergoing renovation or remodeling are also at increased risk.

The Centers for Disease Control and Prevention recommends the use of a ma-

TABLE 3
Pesticides messaging

Message	Key points
Health-based	<p>Pesticide exposure can come from eating produce and from using pesticides in your home or on your pets.</p> <p>Exposure to pesticides in pregnancy has been shown to increase the risk of intrauterine growth retardation, congenital anomalies, leukemia, and poor performance on neurodevelopmental testing</p>
Exposure reduction	<p>Avoid the application of pesticides indoors and outdoors, and stay out of areas that have been treated recently.</p> <p>Do not use chemical tick and flea collars or dips.</p> <p>If you choose to eliminate pests, consider the following options:</p> <ul style="list-style-type: none"> Use only licensed pesticide applicators. Use baits and traps instead of sprays, dusts, and bombs. <p>Integrated pest management techniques include the following options:</p> <ul style="list-style-type: none"> Seal cracks and holes in the outside of the building. Practice good sanitation; remove food, crumbs, and standing water; make sure garbage cans have tight-fitting lids. Hire a company that specializes in integrated pest management. <p>Consider buying organic produce when possible; focus on the “Dirty Dozen,” which is a list of the 12 most contaminated products that is published by the Environmental Working Group that is available at http://www.ewg.org/foodnews/.</p> <p>Wash all fruits and vegetables before eating.</p> <p>Remove shoes at the door.</p>
Resources	<p>Reproductive health providers who suspect pesticide toxicity in their patients should contact a toxicologist at their local poison control center (http://www.aapcc.org/dnn/AAPCC/FindLocalPoisonCenters.aspx)¹⁸ or an occupational and environmental medicine physician/pediatric environmental health specialist (www.aoec.org)¹⁹ for advice on testing and treatment.</p> <p>Other useful resources:</p> <ul style="list-style-type: none"> Safer Pest Control Project that is available at http://www.spcpweb.org/resources/#factsheets.²⁵ National Pesticide Information Center at http://npic.orst.edu/health/safeuse.html.²⁶

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ternal BLL of $\geq 5 \mu\text{g/dL}$ to indicate the need for the prevention of ongoing lead exposure. All pregnant women with a BLL of $\geq 5 \mu\text{g/dL}$ should have increased patient education and environmental, nutritional, and behavioral counseling; follow-up BLL testing should occur within 1 month. In addition, prenatal patients with a BLL of $\geq 10 \mu\text{g/dL}$ should receive similar counseling and follow-up testing and should be referred to the local health department to

conduct a home investigation to identify sources of exposure. Patients with a BLL of $\geq 45 \mu\text{g/dL}$ should be referred to a medical toxicologist for evaluation and potential chelation therapy.¹⁷

Assessment for lead exposure should take place at the earliest contact with the pregnant patient. The following questions should be incorporated into counseling pregnant and preconception practice: Do you or others in your household

have an occupation that involves lead exposure? Sometimes pregnant women have the urge to eat things that are not food. Do you have these urges? Do you live in a house built before 1978 with on-going renovations that generate a lot of dust (eg, sanding and scraping)? Do you use any traditional folk remedies or cosmetics that are not sold in a regular drug store or are homemade? Do you use non-commercially prepared pottery or leaded crystal? Do you or others in your household have any hobbies or activities that are likely to cause lead exposure?

Pesticides

The group of chemicals called pesticides includes substances that are used to kill bugs (insecticides), weeds (herbicides), mice and rats (rodenticides), and mold (fungicides). The use of these chemicals has allowed for the mass production of food and the control of mosquito-borne diseases such as West Nile virus and malaria. More than 1 billion pounds of pesticides are used in the United States annually.¹⁸ This class of substances includes chemicals such as organophosphates, some of which degrade within hours of application, and organochlorines, some of which are persistent in the environment for many years. Exposure to pesticides during pregnancy by the ingestion of foods and the inhalation and dermal absorption of pesticides that are used in the home and garden may cause adverse health outcomes. Advising prenatal and preconception patients to decrease their exposure to pesticides can help decrease the risk of these health effects.

The strongest studies that show adverse outcomes to offspring of mothers who are exposed to pesticides during pregnancy were derived from cohorts of pregnant women who live and work in agricultural settings. Results from the Center for Health Assessment of Mothers and Children of Salinas cohort in the Salinas Valley of California show that concentrations of pesticide metabolites in pregnant women, many with urine levels comparable with the general population, are associated with lower IQ and performance on other neurodevelopmental tests among offspring.¹⁹ Children who were evaluated at 7 years old

showed a decrement of 7.0 Full Scale Intelligence Quotient points among those whose mothers' urinary metabolite levels fell within the top quintile. A metaanalysis of studies that examined the association between home-based pesticide use and childhood leukemia concluded that the use of indoor and outdoor pesticides during the preconception period and during pregnancy was associated significantly with childhood leukemia: preconceptional household use (odds ratio [OR], 1.53; 95% confidence interval [CI], 0.98–2.39), preconception outdoor use (OR, 1.9; 95% CI, 1.03–2.77), pregnancy indoor use (OR, 1.54; 95% CI, 1.13–2.11).²⁰ Studies of the association between the use of pesticides in the home during pregnancy and childhood leukemia indicate an increased risk of leukemia of 50–100% above baseline.²⁰ Studies of pregnant women who were exposed to pesticides in both agricultural and inner-city environments have shown an increased risk of intrauterine growth restriction (relative risk, 1.8; 95% CI, 1.3–2.7)²¹ and low birthweight (–183.6 g; 95% CI, –327.2 to –45.4, compared with the lowest exposure group) that are associated with elevated pesticide levels in drinking water and maternal blood levels, respectively.^{22,23} Ecologic studies of residents in high-usage areas of certain agricultural pesticides show higher rates of congenital anomalies overall and among infants conceived in the spring, which is the time that herbicides are typically applied.²²

The evidence of adverse birth outcomes from exposure to pesticides through contaminated foods is less robust. However, evidence shows that urinary levels of pesticides are linked directly to the consumption of contaminated produce. A landmark study that measured urinary levels of pesticides in 23 school children before, during, and after an organic diet for 5 days found that levels became undetectable soon after the children began an organic diet, then increased after resumption of a conventional diet.²⁴

Pregnant and preconception women should be screened for their use of and exposure to pesticides. Questions such as, “Do you use pesticides such as Raid, ‘weed and feed’, or OFF inside your home, outside your home, or on pets?” might be included in the initial prenatal

TABLE 4

Endocrine-disrupting chemicals messaging

Message	Key points
Health-based	<p>Overall, the health impact of phthalates, bisphenol A, and polybrominated diethyl ethers on the developing fetus are not well understood; current research studies will continue to elucidate potential health impacts.</p> <p>Animal studies suggest that prenatal exposure to bisphenol A are associated with obesity, reproductive abnormalities, and neurodevelopmental abnormalities in offspring.</p> <p>Human prenatal phthalate exposure is associated with changes in male reproductive anatomy and behavioral changes primarily in young girls.</p> <p>Human prenatal polybrominated diethyl ethers exposure is associated with changes in prenatal thyroid hormone concentrations, neurodevelopmental abnormalities, and male reproductive tract abnormalities in infancy.</p>
Exposure reduction	<p>We encourage providers to counsel families to prevent endocrine-disrupting chemicals exposure to reduce the potential risk of harm.</p> <p>Overall, women can reduce exposure to phthalates and bisphenol A by (1) reducing the consumption of processed foods, (2) increasing fresh and/or frozen foods, and (3) reducing consumption of canned foods.</p> <p>Avoid the use of plastics with the recycling codes (often found on the outside bottom of containers) #3 and #7 because they can contain phthalates and/or bisphenol A.</p> <p>For polybrominated diethyl ethers, foam items that were bought before 2005 should be inspected; anything that is ripped or breaking down should be replaced.</p> <p>Be careful when removing old carpet because the padding may contain polybrominated diethyl ethers.</p> <p>Use a vacuum machine that is fitted with a HEPA filter to get rid of dust that may contain endocrine-disrupting chemicals.</p> <p>When purchasing new products, ask the manufacturers what type of fire retardants were used.</p>
Resources	<p>The National Institutes of Environmental Health Sciences information on bisphenol A for providers and parents: http://www.niehs.nih.gov/news/sya/sya-bpa/.³⁷</p> <p>The Centers for Disease Control and Prevention Public Health statement on the phthalate di(2-ethylhexyl)phthalate: http://www.atsdr.cdc.gov/toxprofiles/tp9-c1-b.pdf.³⁸</p> <p>US Environmental Protection Agency's website on polybrominated diethyl ethers: http://www.epa.gov/oppt/pbde/.³⁹</p>

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visit history form or might be incorporated into the electronic health record (Raid and OFF; SC Johnson Co, Racine, WI). Testing patients for pesticide exposure with blood or urine levels for substances or metabolites is performed typically in the setting of acute poisoning and is not recommended for routine practice. Chronic, low-level pesticide exposure will likely result in levels below the level of detection under current laboratory practices, and action

levels or levels of concern have not been established for many substances. Moreover, relating low-level exposure to direct health outcomes is fraught with uncertainty and can generate unnecessary anxiety. A risk management approach that includes screening for pesticide use followed by advice to reduce exposure will assure that prenatal and preconception patients are minimizing their exposure to potentially harmful substances.

EDCs

EDCs are defined as chemicals that either mimic or antagonize the effects of endogenous hormones in the endocrine system and consequently can cause adverse health effects that can be passed on to future generations.²⁵ We are not able to discuss all EDCs here but have chosen a few key examples that illustrate sources of exposure, potential health impacts, and effective communication to patients. Within the medical community, diethylstilbestrol is the most well-known endocrine disruptor. It is a synthetic estrogen that was used to prevent miscarriages from 1940-1970; long-term health impacts after exposure included a 40-fold increase in breast cancer risk in the generation who took the drug, the increased incidence of vaginal adenocarcinoma and reduced fertility in male and female offspring in the second generation, and an increased incidence of hypospadias and cryptorchidism in the third generation.²⁶ Diethylstilbestrol is now banned from use, but women are exposed to many less potent EDCs through their daily activities.

Bisphenol A, phthalates, and polybrominated diethyl ethers (PBDEs) are common EDCs that are used in a wide variety of products. Bisphenol A is a synthetic estrogen that was created in the same laboratory as diethylstilbestrol but was less potent and therefore not used in the pharmaceutical setting.²⁷ Bisphenol A is used in a wide variety of products that include hard polycarbonate plastics, canned food linings, and cash register receipts.²⁸ Phthalates are used as a plasticizer in personal care products, flexible plastics, and polyvinyl chloride tubing.²⁹ The single largest source of exposure to phthalates and bisphenol A in the general population is diet likely by contamination through industrial food processing. PBDEs are used in flame retardants on clothes and furniture and are similar in composition to polychlorinated biphenyls that are now banned in the United States. Some PBDEs were banned from production in the United States, but individuals are still exposed through the use of older products such as foam mattresses. Dust in the home can be a

large source of exposure to phthalates, bisphenol A, and PBDEs.³⁰ Phthalates and bisphenol A have short half-lives of a few hours to days; PBDEs are persistent and can bioaccumulate in fat and other human tissues for several months.^{31,32}

The National Health and Nutrition Examination Survey documents widespread exposure to these chemicals in the general population and specifically in women of child-bearing age.^{32,33} In animal studies, prenatal exposure to phthalates, bisphenol A, and PBDEs cause a variety of adverse health impacts in offspring that include male and female reproductive tract abnormalities and neurodevelopmental abnormalities.³⁰ In humans, PBDE exposure during pregnancy has been associated positively with changes in maternal thyroid hormone concentrations, which is essential for normal fetal cognitive development.³⁰ Human epidemiologic cohort studies report associations between prenatal high molecular weight phthalate exposure and male reproductive tract phenotypic abnormalities and prenatal low molecular weight phthalate exposure and behavioral changes in young girls.^{34,35} Knowledge of health impacts of EDCs is evolving constantly as more research studies are published, but several scientific bodies, which includes the Endocrine Society, state that exposure during the prenatal period have the potential to lead to adverse health outcomes.¹

We are in a rapid scientific discovery phase that elucidates the role of early life exposure to chemicals that have endocrine-disrupting properties on fetal development. We encourage providers to counsel families to prevent exposure to reduce the potential risk of harm. Although sources of EDCs are known, little evidence exists regarding how best to reduce effectively exposure to these chemicals. Targeting diet may be an effective means of reducing exposure to multiple toxicants. One study has documented that a complete dietary replacement that uses fresh, organic foods that are not prepared with plastics can reduce urinary phthalate and bisphenol A concentrations.³⁶ A diet that is high in vegetables and fruits and low in processed foods is likely to reduce exposure to these chemicals. In addition, avoiding the use of cer-

tain plastics (Table 4) when possible likely will reduce daily exposure to phthalates and bisphenol A. Dust within the home can be a large source of exposure for phthalates, bisphenol A, and PBDEs; therefore, keeping surfaces clean can help reduce exposure.³⁰ Because low molecular weight phthalates are in personal care products, decreasing the use of these products likely will reduce exposure to these chemicals.

Providers can ask the following questions in their practice to screen for phthalate and bisphenol A exposure: "What percentage of your diet is made up of fresh foods? Processed foods? Canned foods? Do you use plastic utensils or plastic food preparation tools? How many cosmetic products do you use on a daily basis?" Providers can ask the following questions to screen for PBDE exposure: "Are you exposed to any furniture that was made before 2005 that has ripped or is breaking down with foam showing? Have you replaced or are you planning to replace carpets in your home?" Providers can address these questions by using information in Table 4, which includes health messages and ways how to reduce exposure to EDCs through daily actions. At this time, the evidence base is too premature to be able to advise about definitive health impacts or the time course of such health impacts.

Comment

The health impacts of environmental exposure have become an important topic that affects all areas of medicine. This is particularly important during the preconception and prenatal period when developmental programming can occur. Although it is true that toxicants such as lead and mercury are studied more widely with known associated adverse pregnancy outcomes, pesticides and EDCs also deserve attention. The preconception and first prenatal visits provide the opportune time to begin an open discussion regarding these toxicants. Few environmental history-taking guidelines/templates have been put forth for the preconception and prenatal patient. We support the development, implementation, and evaluation of these as

TABLE 5
Key resources for reproductive health providers

Resource	Contact	Use in practice
American Academy of Pediatrics, Pediatric Environmental Health (AAP Green Book)	Online bookstore http://www.aap.org/ or 866-843-2271	Serves as a textbook on environmental health for clinicians; gives information on developmental susceptibility, toxicants, and environments where one can be exposed.
Magee Women's obstetrics/gynecology CD on prenatal environmental exposure	www.facebook.com/MageeWomensHospital?sk=app_2513891999	Gives information on: how to take a prenatal/preconception environmental history, what toxicants are of particular concern during the prenatal period, and how to counsel patients to reduce exposure.
Pediatric Environmental Health Specialty Units (PEHSU)	http://aoec.org/PEHSU/index.html	Can be a referral base for reproductive health providers; regional PEHSUs are made of teams of clinicians and other environmental health experts that educate clinicians and perform consults for individual families/patients; the website includes evidence-based factsheets on a variety of environmental health topics.
Organization of Teratology Information Specialist	http://www.otispregnancy.org/otis-fact-sheets-s13037	Provides factsheets for patients on a variety of common exposures that include lead, methylmercury, mold, paint, and pesticides.
University of California at San Francisco Toxic Matters brochure	http://prhe.ucsf.edu/prhe/toxicmatters.html	This patient brochure (in English and Spanish) tells how to prevent exposure at home, work, and in the community.

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instruments to be integrated in the electronic medical record. Further resources for providers are listed in Table 5.

Reproductive health providers are in a unique position to counsel child-bearing families about environmental stressors and health. The preconception visit provides an opportunity to assess environmental health knowledge. Attitudes and behaviors of women who are planning a pregnancy can be explored, and suggestions on how to limit toxicant exposure can be discussed. It is important to strike a balance between fear of exposure and empowerment through education. The healthcare provider can keep the message positive by focusing on what is in the patient's control to reduce exposure to the greatest extent possible. Simple techniques that include eating a well-balanced diet that is free of processed food, keeping window sills clean, avoiding the use of pesticides, and removing shoes when entering one's home are precaution-

ary practices that can reduce exposure and help prevent potential health risks. The state of being pregnant often inspires women to take better care of themselves and to engage in health-promoting activities. Providers and patients can work together to both engage, learn, and act to prevent harmful environmental exposure during the preconception and prenatal period to promote better health for both the mother and infant. ■

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