Environmental Hazards Education for Childbirth Educators

Michele Ondeck, RN, MEd, LCCE, FACCE

Judith Focareta, RN, MEd, LCCE

ABSTRACT

The purpose of this article is to educate childbirth educators about environmental hazards and provide resources. Hazardous chemicals have been found in cord blood, placenta, meconium, and breast-milk samples. These chemicals include commonly known hazards such as lead, mercury, and environmental tobacco smoke, as well as some pesticides, solvents, products containing chlorine, and other chemicals referred to as “persistent organic pollutants.” The fetus is particularly vulnerable to environmental chemicals that can disrupt the developmental process at critical times during gestation. Childbirth educators are encouraged to inform themselves in order to inform childbearing families to take preventive action and explore alternative behaviors to reduce exposure to environmental hazards.

The Journal of Perinatal Education, 18(4), 31–40, doi: 10.1624/105812409X474690

Keywords: environmental health education, environmental hazards, prevention, childbirth educator, childbirth education

Currently, most childbearing women have access to a large amount of information about a healthy pregnancy and birth. The childbirth educator’s role is to help families make sense of that information. In childbirth classes, the educator provides information and resources to help women make optimal choices for themselves and their baby. Information about environmental hazards that could potentially pose a threat to families can be incorporated into a course curriculum or into alternative resources. Childbearing families can learn that this information is important to health, and that excellent and easily accessible resources are available. Just as the childbirth educator uses evidence-based sources to introduce information related to obstetric

practices, she can do the same to guide families about environmental hazards.

ORIGINS OF ENVIRONMENTALLY INDUCED DISEASE

The most vulnerable time for adverse effects of environmental hazards is during fetal and early postnatal development. Strong evidence indicates a connection between child health and development and prenatal exposure to air, water, food, and product contaminants (American Academy of Pediatrics [AAP] Committee on Environmental Health, 2003). Development of the immune system in utero begins in the first few weeks after implantation. Factors related to the development of the immune system

either increase the susceptibility or resistance to diseases such as asthma, allergy, and immune deficiency. The thymus, which appears at the end of the first trimester, promotes maturation of lymphocytes in the first few years of life. By the end of the second trimester, the fetus has the ability to “mount antigen-specific responses” to viruses and parasites (Hertz-Picciotto et al., 2008, p. 147). Prenatal exposures to environmental hazards have been shown to cause dysregulation of these processes (Hertz-Picciotto et al., 2008; Mastorakos, Karoutsou, Mizamtsidi, & Creatsas, 2007).

During fetal life, thyroid hormones contribute to the process of differentiation of tissues; when the availability of these hormones is decreased, irreversible developmental disorders of the fetus can occur (Mastorakos et al., 2007). The developmental programming hypothesis, which proposes that early development determines subsequent organ functions and disease risks, has gathered much support from both experimental and epidemiological studies. During gestation, developmental programming can be affected by environmental factors that modify normal cellular and tissue function, which could increase the risk of reproductive pathologies later in life (Woodruff & Walker, 2008).

The story of the xenoestrogen DES, a pharmaceutical used from the 1940s to the 1970s to prevent miscarriage, is an example of developmental programming. Any process that alters gene activity without changing the DNA sequence and leads to changes that influence daughter cells is referred to as “epigenetic” (Grandjean & Weihe, 2008, p. 71). An environmental hazard that changes developmental programming could affect future reproduction and health for generations.

Longitudinal studies such as the planned National Children’s Study will provide important exposure data to better understand the effects of environmental hazards. However, limitations will continue to exist because these studies cannot provide details of dose, duration, and route of exposure. Environmental health scientists suggest the need to place greater weight on data from animal studies to provide insight into the mechanism of gene-environment interactions (Foster, 2008; National Academies, 2008). Currently, enough evidence exists to support health promotion and prevention efforts.

ENVIRONMENTAL HAZARDS

Some chemicals are harmful only at high doses, and others are harmful at low doses. Most unpredictable

of all are the effects of a combination of exposures. Every 2 years, the Centers for Disease Control and Prevention publishes *The National Report on Human Exposure to Environmental Chemicals* based on a sample of participants from the National Health and Nutrition Examination Survey, which provides data on the health and nutritional status of the U.S. population (Calafat, Wong, Kuklenyik, Reidy, & Needham, 2007). Blood and urine samples are assayed for the presence of hundreds of chemicals that do not belong in the human body and have the potential to cause harm. Because reports are released every 2 years, trends can be analyzed.

In addition, studies have examined the exposure of infants to a variety of hazardous chemicals, as measured in umbilical cord serum, placentas, breastmilk, and meconium (Gomara et al., 2007; Suzuki, M. Nakano, & S. Nakano, 2005; Zhao, Xu, Li, Han, & Ling, 2007). In its report, *Body Burden: The Pollution in Newborns*, the Environmental Working Group (2005), a national research and advocacy organization, randomly examined the umbilical cords of 10 newborns and found 287 different chemicals, including pesticides that have been banned for more than 30 years. The transfer of chemicals from maternal to cord blood via the placenta is restrictive in most cases but permeable. Some chemicals that are hazardous substances (e.g., mercury and dioxin) accumulate in adipose tissue. They are referred to as “lipophilic.” The mammary gland synthesizes milk fat for breastmilk from the fatty acids mobilized from the mother’s adipose tissues.

Lead, methyl mercury, and tobacco smoke are a few of the most common exposures that environmentalists have addressed for decades and that have well documented associations with poor birth outcomes (see Table 1). Other chemicals of concern include some pesticides, solvents, products containing chlorine, and other chemicals referred to as “persistent organic pollutants.” The story of lead represents an epic of public health policy. When lead was banned in gasoline, the average level of lead in all Americans dropped significantly. Lead is a poison with a long history of suspected developmental effects, but policymakers demanded indisputable evidence that lead affects the intelligence and the behavior of children before it was removed from gasoline and paint (AAP Committee on Environmental Health, 2003; Greater Boston Physicians for Social Responsibility, 2001a). Although lead levels are decreasing, there is no evidence of a safe lead level;

therefore, children should be tested at least once, beginning at 12 months old (AAP Committee on Environmental Health, 2003).

Because the percentage of the population that smokes tobacco has decreased, and because more regulations have passed to decrease smoking in public places, less cotinine (a metabolite of tobacco) has been found in the blood and urine of pregnant women and their babies. Environmental tobacco smoke comprises both the waste product of the burned cigarette or cigar and the smoke that is exhaled by the smoker. Of the 4,000 chemicals found in environmental tobacco smoke, over 250 have been found to be toxic or cause cancer (Healthy Child Healthy World, n.d.). Smoking cessation programs, long recommended by childbirth educators, continue to be necessary due to the percentage of women of reproductive age who smoke.

Mercury exposure occurs primarily from dietary sources such as fish and seafood. It is a by-product of burning coal to produce electricity. When mercury settles in streams and other bodies of water, it contaminates the fish. The amount of mercury magnifies as it passes up the food chain: for example, the small fish eats the microbes in the sediment of the lake and, then, is eaten by the larger fish, which stores the mercury in its fat. The mercury in just one thermometer could be enough to contaminate a small lake and make the fish unsafe to eat. The elimination of mercury in medical products and devices is occurring, but the chemical remains in some flu vaccines (Shaner, 2002). When women regularly eat fish high in methyl mercury, many months may pass before the levels drop significantly.

Administrated by the U.S. Environmental Protection Agency (2009), the Toxic Substances Control Act of 1976 grandfathered 63,000 chemicals “safe as used” despite the lack of any scrutiny of the chemicals’ safety. When a chemical company applies for approval of a new substance, the Environmental Protection Agency must rule within 90 days. The federal government does not mandate new safety studies; rather, the government reviews the voluntary information provided by the companies. Some manmade chemicals, such as persistent organic pollutants (POPs), are carbon-containing chemicals that have a number of properties in common. Like mercury, POPs are lipophilic. Persistent organic pollutants travel around the globe through air currents and water. They can take as long as a century to degrade. The United Nations Environmental Program identified 12 of these

chemicals, referred to as the “dirty dozen,” and has called for their elimination due to their threats to humans and wildlife (Abelsohn, Gibson, Sanborn, & Weir, 2002). Included in the “dirty dozen” list are nine pesticides, dioxins, polychlorinated biphenyls, and chlorination disinfection by-products.

Dioxin is an example of a POP that is a known human carcinogen. Removing dioxin from the environment is not simple because dioxin is the common name of many chemicals that are unintentionally formed by a number of industrial processes. The most notable source of dioxin is the production and incineration of polyvinylchloride and other chlorine-containing products such as white bleached paper (Abelsohn et al., 2002). Meats and full-fat dairy products are the largest sources of dioxin in the food supply.

Persistent organic pollutants are associated with neurodevelopment and hematological, immunologic, and reproductive effects (Abelsohn et al., 2002). Findings from a landmark longitudinal study of babies whose mothers ate fish contaminated with polychlorinated biphenyls from Lake Michigan showed lower birth weights, smaller head circumferences, and shorter attention spans than babies whose mothers did not eat the contaminated fish (Abelsohn et al., 2002). Another example of a POP is Bisphenol A (BPA), which was found in 92% of children who were younger than 6 years old and were tested for the National Health and Nutrition Examination Survey (Calafat et al., 2007). Bisphenol A and other potentially toxic chemicals such as brominated flame retardants have been shown in animal studies and cell cultures to mimic estrogen when they are present in as low of a dose as 1 part per billion. Chemicals like BPA that mimic estrogen are referred to as “endocrine (hormone) disruptors.” In addition to affecting the female reproductive system, endocrine disruptors have been found in animal research to have a range of effects on the male reproductive system, including “infertility, undescended testes, malformation of the penis, and other reproductive tract malformations” (National Academies, 2008, para. 4). In the National Toxicology Program’s report about BPA, Frederick vom Saal of the University of Missouri states, “It’s the smallest doses that may cause the greatest harm, by stimulating estrogen receptors to produce more estrogen. High doses may actually shut down estrogen production” (Ottawa Citizen, 2007, para. 27).

TABLE 1
Environmental Hazards

Chemical	Source of Exposure	Health Effects	Prevention Strategy
Lead	Ingestion of particles in dust from paint or soil, or from water or foreign bodies. Other less common sources are cosmetics, folk remedies, pottery glaze, vinyl mini blinds made before 1997, candle wicks, and contaminated vitamin supplements. Lead in water is tasteless.	Low levels of exposure can cause cognitive impairment, creating inattentive, hyperactive, and disorganized behavior. Higher levels are associated with dysfunction, aggression, and delinquency. Delayed growth and puberty can result.	Hire certified lead risk assessor for older home (built prior to 1978) or purchase a test product (www.leadinspector.com). Run water faucet for 2 minutes in the morning or through a filter, and use cold water in cooking. Screen exposed children's lead blood level. If a childbearing woman is exposed to high levels of lead or eats large amounts of fish that contain mercury, she may consider having her own level tested. If not pregnant, the woman may consider postponing pregnancy (3 to 6 months).
Mercury	Primary source for pregnant women is consumption of fish with high levels of methyl mercury (ocean fish: swordfish, king mackerel, tilefish, and shark). Elemental mercury used in folk remedies, such as Santeria practices by some groups of Hispanic Americans.	Children whose mother's diet includes large amounts of fish containing methyl mercury can have deficits in language, attention, and memory.	Pregnant women can follow fish consumption guidelines provided by U.S. Food and Drug Administration, U.S. Environmental Protection Agency, and local advisories. In addition to avoiding some fish, pregnant women and children should limit other fish, such as tuna, to 6 oz per week. Request Thimerosal-free vaccines.
Environmental Tobacco Smoke	Exposure is through inhalation from particulate matter in indoor air.	Fetal exposure has been linked to decreased birth weight, increased risk of sudden infant death syndrome, and predisposition to persistent pulmonary hypertension. Childhood exposure includes decreased lung function, increased asthma, and cancer. Adult exposure is linked to increased lung cancer and coronary heart disease.	Local and state resources.
Persistent Organic Pollutants	Persistent organic pollutants, such as dioxin, are compounds formed during paper bleaching and waste incineration. Exposure occurs through ingestion, inhalation, and dermal, but for most people it is through contaminated food. Polychlorinated biphenyls (PCBs) used by the electrical industry as insulators were banned in the 1970s but are present in human tissues and breastmilk.	Exposure to fetus by mother's body burden during pregnancy to a mix of multiple chemicals. It accounts for most findings in newborns and children. Studies have shown lower psychomotor scores through 2 years old, decreases in short-term memory through 4 years old, and lowered IQs through 11 years old.	Persistent organic pollutants are stored in fat tissues; therefore, achieving a normal weight before pregnancy is ideal.

Primary sources:

- American Academy of Pediatrics Committee on Environmental Health. (2003). *Pediatric environmental health* (2nd ed.). Elk Grove Village, IL: American Academy of Pediatrics.
- Greater Boston Physicians for Social Responsibility. (2002). *Out of harm's way: Preventing toxic threats to child development – Creating a healthy environment for your child's development*. Retrieved January 29, 2009, from <http://www.psr.org/site/DocServer/CHeasyeng6pg.10.18.pdf?docID=5202>

WHAT CHILDBEARING FAMILIES NEED TO KNOW

Ideally, environmental health education begins before conception. Leaders in promoting preconception education are the March of Dimes and the Institute of Medicine. Since 1992, the Institute of Medicine has urged that the preconception clinical visit include questions about a woman's occupation as well as her microenvironment (home, community, school, and leisure-time activities), which increase the possibility of environmental exposures (McDiarmid, Gardiner, & Jack, 2008; McDiarmid & Gehle, 2006). This assessment would include diet and drugs. The March of Dimes (2009) has developed preconception clinical education modules for nurses, conducts workshops, and provides resources.

Women and men in the workforce come in contact with many chemicals in workplaces that have not been evaluated for reproductive toxicity and in workplaces with chemicals known to affect reproduction. Agricultural workers exposed to pesticides can experience adverse reproductive health outcomes, such as male infertility (Wigle et al., 2008). Women working in beauty salons and dry cleaners have been studied for an increased risk of miscarriage. For example, long-term exposure to perchloroethylene, a chemical used in dry cleaning, may damage the developing fetus (National Library of Medicine, 2008). Nurses are among the health-care providers who might be exposed to chemical and hazardous agents in the workplace. According to K. Hall (personal communication, June 28, 2008), the Nurses' Health and Chemical Exposures Survey examined 11 chemicals and hazardous agents. Among the more than 1,500 nurses who responded, 96% reported on-the-job exposures. Sterilants, anesthetic gases, and anti-cancer drugs have the potential of increasing nurses' reproductive risk (McDiarmid & Gehle, 2006). In addition to the workplace, the food a childbearing woman eats and the air she breathes, as well as hazardous waste sites, expose her to toxins. Moreover, women who are disadvantaged are more likely to be at risk for exposure (McDiarmid & Gehle, 2006).

The U.S. Food and Drug Administration (FDA) protects pregnant American women from the drug Thalidomide. Thanks to the instincts of the presiding FDA administrator when Thalidomide was introduced in the United States, approval for the drug was delayed. In the late 1950s, Thalidomide was used by pregnant women in Europe and caused limb deformities in newborns. The horrific, historic incidents in Europe led the U.S. Congress to give the

FDA the powers it has today to review and test new drugs. Drug testing does not include herbal preparations because they are not considered drugs. Metals can contaminate herbal preparations.

The rigorous FDA standards for drugs do not apply to food or cosmetics. The FDA has little legal authority over cosmetics, as evident in the Federal Food, Drug, and Cosmetic Act (FDA, 2009a). Similarly, the FDA (2009c) has limited resources to protect food. Nevertheless, the agency uses its limited resources to target the areas of greatest risk by sampling food supplies. The agency's key strategy is risk prevention by promoting corporate responsibility to prevent food-borne illness. Another important prevention strategy is public education. The FDA's (2009b) Center for Food Safety and Applied Nutrition is an excellent resource for professionals and consumers.

When discussing pregnancy and childbearing in relation to food and safety, it is remiss not to mention breastmilk. Certainly, there is concern about contamination of breastmilk with hazardous chemicals. Yet, in reality, babies who are fed formula get sick more often than babies who are fed breastmilk. The APA recommends breastmilk as the best food for babies (APA Committee on Environmental Health, 2003). One notable organization advocating for preventing toxic threats to child development is the Greater Boston Physicians for Social Responsibility (2001a, 2001b, 2002). Their fact sheet, "Why Breastfeeding is Still Best for Baby" (Greater Boston Physicians for Social Responsibility, 2001b), is an excellent resource and is part of a series of fact sheets titled *Out of Harm's Way: Preventing Toxic Threats to Child Development*.

Achieving a healthy pregnancy is a complex process. Childbirth educators and health-care professionals can help childbearing women feel more confident by emphasizing factors that are somewhat in their control, such as choosing healthy foods, exercising, and having a support system of friends and family, which all reduce stress on the body and make it more resilient to harmful exposures. The Collaborative on Health and the Environment (2007) developed a toolkit for women that includes an explanation of the science connecting health and the environment with many prevention strategies for women to reduce their exposure to harmful environmental contaminants.

WHAT CHILDBEARING WOMEN CAN DO

Good nutrition and achieving a normal weight before pregnancy have always been part of the advice

for a healthy pregnancy. A nutrition study of the intake of vitamin A around conception and adverse birth outcomes determined that higher levels of vitamin A in the diet might modulate the harmful effects of prenatal exposures to environmental hazards (Jedrychowski et al., 2007). The Institute of Medicine recommends reducing the amount of animal fat ingested by choosing lean meats, poultry, and low-fat dairy products, so that saturated fat comprises only 10% of the total daily calories (Yaktine, Harrison, & Lawrence, 2006). Achieving a low percentage intake of saturated fat is important because of the many chemicals that are stored in animal fat, such as dioxin. The amount of dioxin that passes from the mother through the placenta to the baby is approximately 20% of the mother's body burden (Yaktine et al., 2006).

As part of their preconception and prenatal assessments, childbearing women need to be asked what types and the amount of fish they eat (McDiarmid et al., 2008). Consumption of fish is recommended as a high source of Omega-3 fatty acids that correlate with the reduction of coronary heart disease and stroke; however, not all organizations agree on the most appropriate guidelines to avoid contaminated fish (Budtz-Jorgensen, Grandjean, & Weihe, 2007). All agree that pregnant women, women who might become pregnant, and breastfeeding women should avoid shark, swordfish, mackerel, and tile fish. The Institute of Medicine offers the most conservative recommendation, advising caution on the portion size of fish with even less mercury, such as canned tuna, to "2 meals of 3 ounces each per week" (McDiarmid et al., 2008, p. S358). Fish advisories for pregnant women can be found through both local sources and the FDA. In addition, the maternal diet may be supplemented with essential fatty acids from nonseafood sources (McDiarmid et al., 2008).

Eating fruits and vegetables not contaminated with pesticides is the best choice, but organic produce (without pesticides, artificial fertilizers, human waste contamination, food additives, and ionizing radiation) is not always available and affordable. Local farmers are less likely to use pesticides, and their produce is more likely to be affordable. Some fruits and vegetables are more likely to be contaminated with pesticides (FDA, 2009b). According to the Environmental Working Group's *Shopper's Guide to Pesticides* (n.d.), peaches, apples, and sweet bell peppers are examples of produce most likely to be contaminated with pesticides, so it is

best to choose organic when possible. Onions, cabbage, and bananas are least likely to contain pesticides.

One of the most common ways pesticides and other environmental hazards get into our homes is on our shoes. Consider a household policy of leaving the shoes at the door. Along with storing pesticides outside the home, there are safe alternatives to use as indoor pesticides instead of "bug sprays," "ant traps," or other chemicals to deal with unwanted pests. For example, lavender can be a preventive method for moths and a treatment method for ants. The most important prevention method is storing food in sealed containers and properly disposing of garbage.

Time spent indoors should be in well-ventilated rooms. The health benefits of fresh air are often forgotten with the use of air fresheners, which are considered volatile organic compounds. Choosing less toxic cleaners and solvents is another way to keep the home safer. The words "non-toxic" or "all natural" may not mean the product is safer. Ingredients of homemade household cleaning products—including vinegar, baking soda, lemon juice, and hydrogen peroxide—are safer than purchased products and often less expensive.

Because cosmetics and personal care products are not required to be tested for health effects, it makes sense to limit products to those that do not contain chemicals linked to health problems, birth defects, and cancer. Comprehensive information about the toxicity of cosmetics and personal care products, including baby care products, can be found at the *Skin Deep: Cosmetic Safety Database* consumer site (www.cosmeticsdatabase.com), which is sponsored by the Environmental Working Group (2009). The site pairs up more than 25,000 products with 50 definitive and regulatory databases. The products are rated on a scale from 0 to 10. Products rated above 7 are referred to as "hazardous" and contain chemicals known to be endocrine disruptors.

The controversy about the chemical BPA has included concern by a number of advocacy organizations over its use in plastic baby bottles. Manufacturers are voluntarily removing BPA from bottles. Generally, polycarbonate plastics such as BPA (identified by the numbers 3 and 7 on the bottom of the bottle) can be avoided by using safer plastics, glass, and stainless steel containers. Also, BPA is the chemical used for the inner coating in some metal food cans with a lining that appears white. The National Toxicology Program's official statement states

TABLE 2
Reducing Exposure to Environmental Hazards During the Childbearing Period

What Childbearing Women Need to Know	What Childbearing Women Can Do	Resources
Workplace Workers are exposed at higher doses in some occupations such as beauty salon, dry cleaner, printing, farm work, and laboratory and clinical medicine.	Request an environmental exposures history by health-care provider at a preconception / pregnancy health visit. May consult an occupational medicine specialist.	March of Dimes (www.marchofdimes.com) Agency for Toxic Substances & Disease Registry, Toxic Substances Portal (http://www.atsdr.cdc.gov/substances/index.asp) – For information about a specific chemical type in the chemical name Environmental Working Group’s <i>Shopper’s Guide to Pesticides</i> (www.foodnews.org) The U.S. Food and Drug Administration’s <i>Food Web</i> page (www.fda.gov/Food/default.htm)
Food Eat fruit and vegetables for source of vitamins and minerals. Choose low-fat meats and low-fat dairy products for sources of protein & calcium. Fish is a source of Omega-3 fatty acids.	Eat organic foods or choose local farmers’ produce when possible. Rinse and scrub produce. Choose meat, poultry, and dairy lower in fat. Pick fish low in mercury and other contaminants.	Environmental Working Group’s <i>Skin Deep: Cosmetic Safety Database</i> (www.cosmeticdatabase.com). Rates products on a 1-to-10 scale. U.S. Environmental Protection Agency’s <i>Ground Water & Drinking Water</i> Web page (www.epa.gov/safewater) <i>The Green Guide</i> ’s 2007 article, “Tapped Out,” on bottled water (www.thegreenguide.com/food/buying/tapped-out)
Cosmetics, Personal Care Products, and Baby Products Minimize use of products higher in hazardous chemicals.	Visit The Campaign for Safe Cosmetics Web site (www.safecosmetics.org). Limit number of products for baby. Test tap water.	Beyond Pesticides (www.beyondpesticides.org)
Water Determine quality in your area. Most bottled water is not regulated. Using fewer plastic bottles reduces the need for recycling.		
Pest Control Household pesticides, garden pesticides, mothballs, animal flea collars, and other products to reduce pests can cause health problems such as asthma.	There are simple nonhazardous ways to reduce pests, such as thorough cleaning, storing food in sealed containers, and garbage disposal.	
Safe Nursery If remodeling, note paints, adhesives, and new carpets give off toxic gases. Check for organic cotton baby products and clothes and choose products that are nonpolyvinyl chloride (non-PVC) plastic.	Choose healthier building materials for projects. Find a nursery checklist for a green lifestyle in <i>The Green Guide</i> (www.thegreenguide.com).	Toxic-Free Legacy Coalition’s <i>Less-Toxic Home Repair & Construction Materials</i> Web page (www.pollutioninpeople.org/safer/products/buildingmaterials) Mindy Pennybacker’s 2007 article, “Green Room to Grow In,” published in March/April 2007 in Volume 119 of <i>The Green Guide</i> (www.thegreenguide.com/doc/119/greenroomtogrow).

Primary source:

• The Collaborative on Health and the Environment. (2007). *Women’s health & the environment toolkit*. Retrieved October 6, 2008, from <http://www.womenshealthandenvironment.org>

that there is “negligible concern that exposure to bisphenol A will cause reproductive effects in non-occupationally exposed adults” (National Institute of Environmental Health Sciences, 2009, “What Did the NPT Conclude?” para. 5). In a media statement, the National Toxicology Program recommends that, if parents and caregivers are concerned, and because some animal studies suggest that infants and children are most vulnerable to BPA effects, it is a personal choice to minimize eating food canned in

metal containers coated with BPA (National Institute of Environmental Health Sciences, 2009).

In addition to the suggestions and resources included in Table 2, resources for promoting a healthy child and resources for health professionals are available from the Healthy Child Healthy World Web site (www.healthychild.org) and in a new book for parents by author Christopher Gavigan (2008), titled *Healthy Child Healthy World: Creating a Cleaner, Greener, Safer Home*. Creating a healthier

environment for children begins with preparing their nursery. Remodeling projects can be done using safe products, such as paint without toxic fumes (volatile organic compounds). Mindy Pennybacker's (2007) published article in *The Green Guide*, titled "Green Room to Grow In," includes a checklist of 10 green necessities for the nursery.

WHAT CHILDBIRTH EDUCATORS CAN DO

Childbirth educators and environmentalists are often concerned about scaring pregnant women with information regarding environmental hazards. Fears of potential negative outcomes from environmental hazards or birth certainly exist but, like childbirth education, environmental health education serves women and their families best by being honest and direct (Lothian, 2008). By alerting childbearing families to issues that potentially involve their health and giving them resources, childbirth educators respect expectant parents' ability to make the best health-conscious decisions. Furthermore, childbirth educators better serve families by educating themselves about potential environmental hazards and prevention strategies.

Childbirth educators may benefit from learning more about what most environmental health advocates refer to as the "precautionary principle" (Gilbert, 2005). In 1998, worldwide participants at the Wingspread Conference on the Precautionary Principle adopted the following philosophy: "When an activity raises threats of harm to human health or the environment, precautionary measures should be taken even if some cause and effect relationships are not fully established scientifically" (Science & Environmental Health Network, 1998, para. 9). The Wingspread statement on the precautionary principle is similar to Lamaze International's approach to normal, natural, uninterrupted birth as an ideal for healthy birth practices for most mothers and babies. For example, using chemicals to start labor, when there are no medical indications, could cause harm if the result leads to an infant who is born less than full term and, consequently, may be less likely to experience optimal health during the first year of life (Amis, 2009). Caution should be exercised with elective induction because no evidence suggests that elective induction is safe. The emphasis needs to be on human health, and the precautionary principle gives a framework for making ethical decisions related to bioethics. Gilbert's (2005) list of the four basic concepts of the precautionary principle applies during pregnancy and birth:

- *Taking preventive action in the face of uncertainty*
- *Shifting the burden of responsibility (proof) of demonstrating safety to the proponents of an activity*
- *Exploring a wide range of alternatives to possibly harmful actions*
- *Increasing public participation in decision making* (Gilbert, 2005, para. 5)

In 2003, the American Nurses Association adopted the precautionary principle, stating "that if it is within one's power, there is an ethical imperative to prevent rather than merely treat disease, even in the face of scientific uncertainty" (para. 1). For example, it is known that, during pregnancy, consuming small amounts of alcohol can harm the developing fetus. Therefore, pregnant women are advised to not drink any alcohol because no safe limit can be determined. Unlike the European Union, the United States does not have a chemical policy. Many environmental activists suggest that public policy change is the best preventive approach.

Childbirth educators are also encouraged to use Table 1 and Table 2 in this article as helpful handouts for their class participants. Table 1, "Environmental Hazards," summarizes some known environmental hazards, some potential health effects, and a few prevention strategies. Table 2, "Reducing Exposure to Environmental Hazards During the Childbearing Period," summarizes some facts known about environmental hazards, what can be done, and a few excellent resources and prevention strategies. An example of a classroom teaching strategy would be to assign different environmental health Web sites and then ask class participants to give a summary of the types of information that can be found on each site.

Childbirth educators can also add to their knowledge by reading Sandra Steingraber's (2001) award-winning account of environmental hazards and pregnancy, *Having Faith: An Ecologist's Journey to Motherhood*. From an ecologist's point of view, Steingraber offers important information about fetal development while evoking the excitement and fears of her own pregnancy and compelling her readers to care how the environment affects human reproduction. Much like Lothian and DeVries (2005) in their book, *The Official Lamaze Guide: Giving Birth with Confidence*, Steingraber tells the truth in a way that makes us have faith in the birthing process.

Childbirth educators might also reconsider how and when they introduce particular topics in their

To view Lamaze International's approaches to pregnancy, birth, and parenting, go to the organization's Web site (www.lamaze.org) and click on the link, "Who We Are."

Visit the Lamaze Web site (www.lamaze.org) to view and download the evidence-based papers that address each of the six Lamaze Healthy Birth Practices.

curriculum. Currently, most organized childbirth education classes begin at the end of pregnancy. Many organizations, including Lamaze International (www.lamaze.org), recommend appropriate changes in how and when childbirth education is delivered. Lamaze's weekly pregnancy e-mail—which features information, practical tips, and inspirational stories to help guide pregnant women—could be an ideal source for basic environmental health information that women could access early in pregnancy. The challenge continues in finding new ways to inform childbearing women about potential risks and precautionary behaviors, whether it is medicalized childbirth or environmental hazards.

CONCLUSION

Childbirth educators are in the unique position of spending time with pregnant women to answer their and their family members' questions and serving as a trusted resource. Information regarding environmental hazards is a growing body of literature about which childbirth educators can become more knowledgeable. By learning more about environmental hazards and their potential effects on reproductive health and on health in general, childbirth educators can serve as more literate informants for families. In addition to the Lamaze Web site (www.lamaze.org), which provides evidence-based information about birth, many other informative and evidence-based resources related to environmental hazards can be shared with childbearing families (see Table 2).

REFERENCES

- Abelsohn, A., Gibson, B. L., Sanborn, M. D., & Weir, E. (2002). Identifying and managing adverse environmental health effects: 5. Persistent organic pollutants. *Canadian Medical Association Journal*, 166(12), 1549–1554.
- American Academy of Pediatrics [AAP] Committee on Environmental Health. (2003). *Pediatric environmental health* (2nd ed.). Elk Grove Village, IL: American Academy of Pediatrics.
- American Nurses Association. (2003, October). *American Nurses Association adopts precautionary approach*. Retrieved May 1, 2007, from <http://www.nursingworld.org/MainMenuCategories/OccupationalandEnvironmental/environmentalhealth/PolicyIssues/PrecautionaryApproach.aspx>
- Amis, D. (2009, July). *Healthy birth practices from Lamaze International – #1: Let labor begin on its own*. Retrieved September 10, 2009, from <http://www.lamaze.org/Portals/0/carepractices/CarePractice1.pdf>
- Budtz-Jorgensen, E., Grandjean, P., & Weihe, P. (2007). Separation of risks and benefits of seafood intake. *Environmental Health Perspectives*, 115(3), 323–327.
- Calafat, A. M., Wong, L.-Y., Kuklenyik, Z., Reidy, J. A., & Needham, L. L. (2007). Polyfluoroalkyl chemicals in the U.S. population: Data From the National Health and Nutrition Examination Survey (NHANES) 2003–2004 and comparison with NHANES. *Environmental Health Perspectives*, 115(11), 1596–1602.
- Collaborative on Health and the Environment. (2007). *Women's health & the environment toolkit*. Retrieved October 6, 2008, from <http://www.womenshealthandenvironment.org>
- Environmental Working Group. (2005). *Body burden: The pollution in newborns*. Retrieved July 1, 2008, from <http://www.ewg.org/reports/bodyburden2/>
- Environmental Working Group. (2009). *Skin deep: Cosmetic safety database*. Retrieved November 7, 2008, from <http://www.cosmeticdatabase.com>
- Environmental Working Group. (n.d.). *Shopper's guide to pesticides – The full list: 47 fruits & veggies*. Retrieved October 7, 2009, from <http://www.foodnews.org/fulllist.php>
- Foster, W. G. (2008). Fetal and early postnatal environmental contaminant exposures and reproductive health effects in the female. *Fertility and Sterility*, 89(Suppl. 1), e53–e54.
- Gavigan, C. (2008). *Creating a cleaner, greener, safer home*. New York: Penguin Group.
- Gilbert, S. G. (2005). Viewpoint: Public health and the precautionary principle. *Northwest Public Health Newsletter*, 22(1–Spring/Summer). Retrieved August 27, 2009, from http://www.nwpublichealth.org/docs/nph/s2005/viewpoint_s2005.pdf
- Gomara, B., Herrero, L., Ramos, J. J., Mateo, J. R., Fernandez, M. A., & Garcia, J. F., et al. (2007). Distribution of polybrominated diphenyl ethers in human umbilical cord serum, paternal serum, maternal serum, placentas, and breast milk from Madrid population, Spain. *Environmental Science & Technology*, 41, 6961–6968.
- Grandjean, P., & Weihe, P. (2008). Developmental origins of environmentally induced disease and dysfunction. *Basic & Clinical Pharmacology & Toxicology*, 102(2), 71–72.
- Greater Boston Physicians for Social Responsibility. (2001a). *Out of harm's way: Preventing toxic threats to child development – Health care provider fact sheet*. Retrieved January 29, 2009, from http://www.psr.org/site/DocServer/providers5.30.01_links.pdf?docID=5201
- Greater Boston Physicians for Social Responsibility. (2001b). *Out of harm's way: Preventing threats to child development – Why breastfeeding is still best for baby*. Retrieved November 8, 2008, from http://www.psr.org/site/DocServer/breasthealth5.30.01_links.pdf?docID=5204
- Greater Boston Physicians for Social Responsibility. (2002). *Out of harm's way: Preventing toxic threats to child development – Creating a healthy environment for your child's development*. Retrieved January 29, 2009, from <http://www.psr.org/site/DocServer/CHeasyeng6pg.10.18.pdf?docID=5202>

Expectant mothers are encouraged to sign up for Lamaze's weekly pregnancy e-mail, "Lamaze... Building Confidence Week by Week." To subscribe to this feature, go to the Lamaze Web site (www.lamaze.org) and click on the "Weekly Pregnancy Email" link.

- Healthy Child Healthy World. (n.d.) *Chemical encyclopedia. Environmental tobacco smoke (ETS)*. Retrieved November 29, 2008, from http://healthychild.org/resources/chemical-pop/environmental_tobacco_smoke/
- Hertz-Picciotto, I., Park, H. Y., Dostal, M., Kocan, A., Trnovec, T., & Stram, R. (2008). Prenatal exposures to persistent and non-persistent organic compounds and effects on immune system development. *Basic & Clinical Pharmacology & Toxicology*, 102, 146–154.
- Jedrychowski, W., Masters, E., Choi, H., Sochacka, E., Flak, E., Mroz, E., et al. (2007). Pre-pregnancy dietary vitamin A intake may alleviate the adverse birth outcomes associated with prenatal pollutant exposure: Epidemiologic cohort study in Poland. *International Journal of Occupational and Environmental Health*, 13(2), 175–180.
- Lothian, J. A. (2008). Navigating the maze – Childbirth education at the crossroads. *The Journal of Perinatal Education*, 17(2), 45–49.
- Lothian, J. A., & DeVries, C. (2005). *The official Lamaze guide: Giving birth with confidence*. Minneapolis, MN: Meadowbrook Press.
- March of Dimes. (2009). *Professionals & researchers – Preconception health and healthcare*. Retrieved January 14, 2009, from <http://www.marchofdimes.com/professionals/preconception.asp>
- Mastorakos, G., Karoutsou, E. L., Mizamtsidi, M., & Creatsas, G. (2007). The menace of endocrine disruptors on thyroid hormone physiology and their impact on intrauterine development. *Endocrine*, 31(3), 219–237.
- McDiarmid, M. A., Gardiner, P. A., & Jack, B. W. (2008). The clinical content of preconception care: Environmental exposures. *American Journal of Obstetrics and Gynecology*, 199(Suppl. 6), S357–S361.
- McDiarmid, M. A., & Gehle, K. (2006). Preconception brief: Occupational/Environmental exposures. *Maternal and Child Health Journal*, 10(Suppl. 1), S123–S128.
- National Academies. (2008, December 18). *EPA should pursue cumulative risk assessment of phthalates and other chemicals*. Retrieved January 7, 2009, from <http://www8.nationalacademies.org/onpinews/newsitem.aspx?RecordID=12528>
- National Institute of Environmental Health Sciences. (2009, June 16). *Since you asked—Bisphenol A. Questions and answers about the National Toxicology Program's evaluation of Bisphenol A*. Retrieved September 14, 2009, from <http://niehs.nih.gov/news/media/questions/sya-bpa.cfm>
- National Library of Medicine. (2008). *Perchloroethylene*. Retrieved October 6, 2008, from http://toxtown.nlm.nih.gov/text_version/chemicals.php?id=22
- Ottawa Citizen. (2007, May 4). *Bisphenol A warning bells. Female sex hormone disturbingly omnipresent in consumer products*. Retrieved October 6, 2008, from <http://www.ewg.org/node/21564>
- Pennybacker, M. (2007). Green room to grow in. *The Green Guide*, 119(March/April), 1–3. Retrieved January 28, 2009, from <http://www.thegreenguide.com/doc/119/greenroomtogrow>
- Science & Environmental Health Network. (1998). January 26). *Wingspread conference on the precautionary principle*. Retrieved September 10, 2009, from <http://www.sehn.org/wing.html>
- Shaner, H. (2002). Green birthdays: Reducing harmful exposures. *Journal of Pediatric Nursing*, 17(3), 222–225.
- Steingraber, S. (2001). *Having faith: An ecologist's journey to motherhood*. New York: Perseus Publications.
- Suzuki, G., Nakano, M., & Nakano, S. (2005). Distribution of PCDDs/PCDFs and co-PCBs in human maternal blood, cord blood, placenta, milk and adipose tissue: Dioxins showing high toxic equivalency factor accumulate in the placenta. *Bioscience, Biotechnology, and Biochemistry*, 69(10), 1836–1847.
- U.S. Environmental Protection Agency. (2009). TSCA [Toxic Substances Control Act] statute, regulations & enforcement. Retrieved January 28, 2009, from <http://www.epa.gov/compliance/civil/tsca/tscaenfstareq.html>
- U.S. Food and Drug Administration [FDA]. (2009a, June 18). *FDA authority over cosmetics*. Retrieved August 30, 2009, from <http://www.fda.gov/Cosmetics/GuidanceComplianceRegulatoryInformation/ucm074162.htm>
- U.S. Food and Drug Administration [FDA]. (2009b, July 31). *Food*. Retrieved August 30, 2009, from <http://www.fda.gov/Food/default.htm>
- U.S. Food and Drug Administration [FDA]. (2009c, April 30). *Questions and answers: Food protection plan*. Retrieved August 30, 2009, from <http://www.fda.gov/Food/FoodSafety/FoodSafetyPrograms/FoodProtectionPlan2007/ucm132688.htm>
- Wigle, D. T., Arbuckle, T. E., Turner, M. C., Bérubé, A., Yang, Q., & Liu, S., et al. (2008). Epidemiologic evidence of relationships between reproductive and child health outcomes and environmental chemical contaminants. Part B. *Journal of Toxicology and Environmental Health*, 11(5–6), 373–517.
- Woodruff, T., & Walker, C. L. (2008). Fetal and early postnatal environmental exposures and reproductive health effects in the female. *Fertility and Sterility*, 89(Suppl. 2), e47–e51.
- Yaktine, A. L., Harrison, G. G., & Lawrence, R. S. (2006). Reducing exposure to dioxins and related compounds through foods in the next generation. *Nutrition Reviews*, 64(9), 403–409.
- Zhao, G., Xu, Y., Li, W., Han, G., & Ling, B. (2007). Prenatal exposures to persistent organic pollutants as measured in cord blood and meconium from three localities of Zhejiang, China. *The Science of the Total Environment*, 377(2–3), 179–191.

MICHELE ONDECK is a clinical education specialist at Magee-Womens Hospital of UPMC and a member of its environmental initiatives team. She is also the director of the University of Pittsburgh Childbirth Educator Program. JUDITH FOCARETA is the coordinator of environmental initiatives at Magee-Womens Hospital of UPMC.