The clinical content of preconception care: environmental exposures

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Links between environmental exposures and risk of disease or other health harm have been increasingly acknowledged for numerous outcomes ranging from cancer development to childhood asthma. Adverse reproductive and developmental effects have also been linked to environmental exposures. The Institute of Medicine (IOM) describes a patient’s environment as comprising 3 sectors—the home, the community, and the workplace—wherein chemical and physical hazards may be encountered via various media such as contaminated soil, water, and air.1,2 Although the American College of Obstetrics and Gynecology (ACOG) Ante Partum Record already includes environmental history queries regarding smoking and alcohol use,3 a broader review of the patient’s home, community, and work life must be added to gain a more complete picture. Diet history including fish consumption can be considered under the “home” environment and drinking water source under “community.” Specifics of work duties and agents handled enable tailored recommendations to optimize the woman’s health and that of her future pregnancy. Routine assessment of hobbies, habits, and home and work environments might identify exposures associated with adverse reproductive consequences that can be minimized during the preconception period. Although the effects on human pregnancy of many of the chemicals in occupational use are unknown, several classes of elements and compounds—such as heavy metals and organic solvents—have been implicated in a variety of reproductive disorders.

**Recommendation.** It is prudent to educate women for whom pregnancy is a possibility about environmental hazards, and to provide them with the facts available about the teratogenic potential or reproductive toxicity of any chemical or environmental agent to which they are exposed. **Strength of recommendation:** A; **quality of evidence:** III.

**Mercury**

National norms exist for mercury levels in both blood and urine collected during the National Health and Nutrition Examination Survey (NHANES) conducted by Center of Disease Control (CDC).4 Measures of mercury exposure in women of childbearing age generally fall below levels of concern. Several scenarios, however, if elicited during history taking at the preconception visit, merit follow-up and possibly intervention. Exposure to methylmercury is of particular concern because it is a well-established human neurotoxin and the developing fetus is most sensitive to its adverse effects.5-7 Methylmercury bioaccumulates through the food chain so that concentrations are highest in large predatory fish. Exposure occurs primarily through consumption of seafood, freshwater fish, and shellfish.8-12 Thus, consumption of fish high in mercury, which has been organified and concentrated through the food chain and is found in highest concentrations in large game fish, is of concern during the preconception period. The 2004 United States Environmental Protection Agency (EPA) and the Food and Drug Administration (FDA) issued a joint consumer advisory regarding methylmercury in fish and shellfish, advising pregnant women, those likely to become pregnant, and those breastfeeding to avoid any consumption of shark, swordfish, King mackerel, and tile fish.13 Other fish consumption (such as tuna) should also be limited but is allowed in up to 2 meals of 6 ounces each per week. Counseling about fish consumption is especially important in nonmeat eating patients and those who supplement a meager diet with fish that the family catches (subsistence fish eaters). The National Academies of Science’s IOM has issued a more recent recommendation on seafood con-

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II. Lead

Lead is a known neurotoxin, especially for vulnerable populations such as young children and the fetus. Lead is most commonly found in lead-based paint, occupational settings, and contaminated soil. Hobbies may also provide a source of lead exposure, as may use of dishes and pottery with lead glaze (see below). Exposures, even early in pregnancy, can pose a risk to the fetus. Lead levels of 10-15 μg/dL may lead to central nervous system (CNS) damage; hydroceles; skin tags; hemangiomas, lymphangiomas, and undescended testicles in males; miscarriage; and stillbirth. Adverse effects of elevated maternal blood lead levels (BLLs) during pregnancy include spontaneous abortion, intrauterine demise, premature delivery, intrauterine growth restriction, and postnatal neurologic sequelae. The New York State Health Department has used questionnaires and BLLs as part of routine screening in pregnancy since 1995. Other states have subsequently adopted their approach.

**How effective are the current treatments?** Treatment such as chelation has been reported in pregnancy but is reserved only for symptomatic women with very high levels of lead in their blood.

**Impact of preconception care:** For women of childbearing age who are not pregnant, no recommendations and little data exist. A risk-assessment questionnaire that incorporates questions about potential lead exposure may be useful in identifying areas of risk reduction for further counseling. Recommendations for women with affirmative responses should include screening of any children in the household, education about methods of environmental cleanup, removal from the exposure source, and nutritional counseling—such as increasing the amount of iron and calcium in the diet—to reduce absorption of ingested lead. These recommendations have been extrapolated from pediatric data and are not promoted by national organizations nor studied in this population.

**Recommendations by other groups:** No national organizations currently recommend screening pregnant women for elevated BLLs. The United States Preventive Services Task Force recommends against routine screening for elevated BLLs in asymptomatic pregnant women.

**Recommendation.** There is insufficient evidence to recommend that all women should be screened for elevated lead for the purpose of improving perinatal outcomes. However, women exposed to high levels of lead or with a history of known high lead levels, including childhood lead poisoning, should be counseled on the risk of lead to the unborn child. For women with a history of high BLLs, it is reasonable to test the BLL and, if elevated, to initiate activities to lower the levels before conception.

**Strength of recommendation:** C; quality of evidence: II-2.
Soil and water hazards
Hazards encountered in the soil, water, or air often originate from a current or former industrial source. Polluted sites that are tracked on the US EPA’s National Priority Listed (NPL) site program, generally do not result in human health effects to the wider community but may threaten residents of a home in close proximity by allowing for soil or drinking water contamination. Although not uniformly true, many residents know when they are living near an NPL or toxic waste site. Documentation of chemical intrusion into soil or drinking water can be obtained from local health departments. Another community-based environmental hazard is the patient’s source of drinking water. If the source of water is a private well, documentation of water quality should be sought. Private wells are not regulated for water quality by the EPA, in contrast to public water sources. Several reports of adverse pregnancy outcomes have been attributed to contaminated well water.

Recommendation. During preconception visits, women should be advised about BPA avoidance in their diet. Strength of recommendation: B; quality of evidence: II.

Workplace exposure
The workplace represents the principal opportunity for exposure to environmental reproductive or developmental toxicants. Although some chemicals are regulated by public health agencies, the majority of chemicals considered for regulation are not evaluated for reproductive endpoints. Therefore, many chemicals with unambiguous reproductive or developmental effects are still in regular commercial use and thus pose a risk to women before pregnancy. Several employment sectors with such toxicants in common use—including laboratory and clinical healthcare, printing, and dry cleaning—employ women in large numbers. Healthcare especially presents exposure opportunities to undisputed reproductive and developmental toxicants, including hazardous anticancer and antiviral agents. Aspects of other industrial sectors, including the use of pesticides and herbicides in the agricultural sector, the use of solvents and heavy metals in the manufacturing sector, and the use of solvents and inks in the printing sector, also present potential risks to unprotected workers. An initial evaluation of a patient’s job-related exposures can be obtained by screening questions regarding employment and job sectors. If there is a potential chemical, biologic, or physical agent hazard identified, then a more detailed assessment can be made by asking about frequency of exposure, duration, timing, and exposure route (inhalation, dermal contact, or ingestion). This assessment should include questions about the use of additional protective apparel or the use of a respirator for some job tasks. However, there are some jobs in which both governmental safety and health agencies and professional organizations recommend alternative duty (ie, different job duties without exposure to hazards of concern) for pregnant workers or those actively trying to conceive, such as nurses who handle cancer chemotherapeutic agents and workers with organic solvent exposure. The work of the patient’s partner should also be inquired about as secondary contamination of the household or maternal exposure opportunity is posed during laundering of work clothes.

Recommendation. During preconception visits, women should be asked about the work environment. If potential exposures are identified, consultation with an occupational medicine specialist may assist in carrying out a more detailed investigation regarding recommendations for work modification. Strength of recommendation: B; quality of evidence: III.

Household exposures
A woman’s residential activities and hobbies pose potential risks for her before pregnancy. Hobbies of concern include those involving solvents such as oil-based paints; heavy metals, such as lead, which are used in stained glass work; and paint-stripping agents that often contain methylene chloride, which metabolizes to carbon monoxide and can be toxic to the fetus. Jewelry mak-
ing and metal tempering can involve the melting and soldering of metals and should also be avoided. Pesticides, herbicides, and rodenticides are among the chemical hazards most likely to be encountered in the home. Application of any of these should be avoided by the preconception patient. A home may be secondarily contaminated by a family member’s soiled work clothes and shoes that are brought home and contain pesticides or other toxins. Painting projects with nonlatex-based paints that are solvent based and contain metals for pigment and antifouling agents, common in exterior paints, should be avoided. Some home-rehabbing projects are also potentially hazardous. The use of heat guns to remove old paint and wallpaper from walls containing lead-based paint should be avoided.

**Recommendation.** During preconception visits, women should be asked about the home environment. If potential exposures are identified, consultation with the home environment. If potential exposure opportunities identified in the preconception visit may allow tailored recommendations to be made to the patient to modify exposure and thus reduce the risk of an adverse outcome.

**REFERENCES**
31. National Institute for Occupational Safety and Health. NIOSH alert: prevention occupational exposures to antineoplastic and other hazardous


