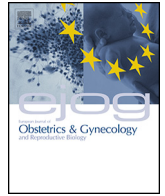


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Environmental health attitudes and behaviors: findings from a large pregnancy cohort study



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ABSTRACT

Objective: Environmental chemicals are widely found in food and personal care products and may have adverse effects on fetal development. Our aim was to examine women's attitudes about these chemicals and ask whether they try to limit their exposure during pregnancy.

Study design: A multi-center cohort of women in the first trimester of pregnancy completed questionnaires including items on attitudes and behaviors related to environmental chemicals. Multivariable logistic regression models were used to examine: (1) whether sociodemographic variables predict environmental health attitudes and behaviors; and (2) whether women's attitudes about environmental chemicals affect their lifestyle behaviors, particularly diet and personal care product use. **Results:** Of the 894 subjects, approximately 60% strongly agreed that environmental chemicals are dangerous and 25% strongly felt they were impossible to avoid. Adjusting for covariates, educated women were more likely to believe that environmental chemicals are dangerous (OR 1.74, 95% CI 1.13, 2.66), and that belief, in turn, was associated with a number of healthy behaviors including choosing organic foods, foods in safe plastics, and chemical-free personal care products, and limiting fast food intake. Younger women were more likely to believe that environmental chemicals are impossible to avoid (OR 1.04, 95% CI 1.00, 1.08).

Conclusions: Women's attitudes about environmental chemicals may impact their choices during pregnancy. Overcoming a lack of concern about environmental chemicals, particularly among certain sociodemographic groups, is important for the success of clinical or public health prevention measures.

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1. Introduction

In 2013, several of the leading professional organizations of obstetricians and fertility specialists issued statements acknowl-

eding that environmental chemicals present significant reproductive health risks and calling for the clinical community to integrate environmental health awareness and assessment as a routine part of pre-conception and prenatal care [1,2]. These statements emphasized that exposure to environmental chemicals like phthalates, bisphenol A (BPA), and pesticides may be of particular concern during pregnancy [3–6]. For some chemicals like phthalates, all populations of pregnant women studied in the U.S., Europe, and Asia have measurable levels, indicating the potential magnitude of the issue [7–11]. Nevertheless, it remains unclear whether these concerns have reached pregnant women and if so, whether they take any measures to avoid such exposures [12].

Thus far, most research on this question has focused on fish consumption advisories aimed at limiting exposure to methylmercury, a developmental neurotoxin. Women's awareness of

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methyl mercury toxicity and the consumption advisories. Their awareness was strongly related to geographic and sociodemographic factors [13–15]. Even among women aware of the advisories, however, only a minority reduced their fish consumption accordingly during pregnancy [15], and in one study, awareness of advisories was not associated with hair mercury levels among sport fish consumers [16]. These results suggest: (1) that women's awareness of the risks of chemicals and their motivation to make behavioral changes during pregnancy are two important challenges to reducing exposures; and (2) any clinical or public health measures to increase environmental health awareness and reduce exposures must consider sociodemographic variation.

As the fish consumption literature suggests, diet is an important, potentially modifiable source of chemical exposures. Diet is a major source of exposure not only to methylmercury, but to pesticides, BPA, and phthalates, among other chemicals [17–21]. Personal care product (PCP) use is a second significant, potentially modifiable, source of chemical exposure. Many PCPs contain environmental chemicals as inert ingredients [22] and PCP use patterns are associated with urinary concentrations of phthalate metabolites, phenols, and parabens [23–26]. By limiting product use, forgoing certain products (such as nail polish), or choosing “chemical-free” formulations, women may be able to limit their exposures. In a recent study of pregnant Old Order Mennonites, a population with very low PCP use (including no cosmetics), phthalate metabolite levels were far lower than in the general U.S. population [20].

Thus there is reason to believe that women may be able to reduce their exposure to certain environmental chemicals through their lifestyle choices, and that the recommendations provided for clinicians in the recent statement on exposure to toxic environmental agents may be useful in this respect [1]. In order to successfully translate those recommendations into behavioral changes, however, we need to better understand the extent to which women are concerned about environmental chemicals, whether they make lifestyle choices accordingly, and whether sociodemographic factors (such as race, education, and age) contribute to these attitudes and behaviors. Here we investigate these questions in a large cohort of women in their first trimester of pregnancy.

2. Materials and methods

2.1. Overview of recruitment and relevant study activities

From 2010 to 2012, women were recruited into The Infant Development and the Environment Study (TIDES) from obstetrical clinics affiliated with academic medical centers in four U.S. cities: Minneapolis, MN; Rochester, NY; San Francisco, CA; and Seattle, WA. Study personnel attended obstetrical clinics and approached potentially eligible women in examination rooms. Eligibility criteria included: less than 13 weeks pregnant, singleton pregnancy, English-speaking (or Spanish-speaking at the CA center), age 18 or over, no serious threat to the pregnancy, and plans to deliver at a study hospital. The institutional review boards at all institutions approved TIDES prior to study implementation and all subjects signed informed consent.

Participants completed a questionnaire in each trimester, usually at home through a secure, internet-based portal (with an alternative paper-and-pencil option). The questionnaires included items on demographics as well as factors potentially influencing exposures during pregnancy. Women received \$10 for each prenatal questionnaire completed. The data for the current analyses come exclusively from the first-trimester questionnaire. In total, 969 women enrolled and 894 women (92%) provided first-

trimester questionnaire data. Seventy consented women dropped out before completing the first questionnaire, while four women did not provide first-trimester questionnaire data but completed other study activities and remained in the study.

2.2. Demographic data

For these analyses, married women were grouped with women who reported “living as married”, while separated, divorced, and single women were grouped together. Ethnicity was dichotomized as Hispanic or non-Hispanic and race was dichotomized as black or not black. Age was reported to the nearest year and yearly household income was grouped into four categories ranging from <\$15,000 to >\$75,000. Education was dichotomized as graduated college or more versus less than college.

2.3. Environmental health attitudes

Subjects answered two questions on general attitudes about environmental health and chemicals on a 5-point scale (strongly agree, agree, neither agree nor disagree, disagree, strongly disagree). These questions were developed de novo because we know of no validated questionnaire on environmental health awareness and attitudes. The first question asked the extent to which they agreed that “Chemicals in the environment can pose health risks” and the second asked the extent to which they agreed that “Chemicals in the environment are in so many things that it's impossible to avoid them.” After reviewing the distribution of responses, for both questions, we dichotomized to women who responded “strongly agree” versus all other respondents.

2.4. Environmental health behaviors

Subjects reported on health behaviors during pregnancy, including diet and PCP use. Dietary questions included items on frequency of choosing organic and chemical-free foods and foods in safe plastics (always, usually, sometimes, rarely, never). For each of these, women who responded “always/usually” were compared to all other respondents. Women also reported frequency of fast food consumption during pregnancy, and based on their responses, were dichotomized into less than two times per week versus two or more times per week. For PCP use, subjects were first asked how often they try to make sure that the PCPs they buy are organic, ecofriendly, chemical-free, or environmentally friendly, and based on the distribution of responses, subjects were dichotomized as “always/usually/sometimes” versus “rarely/never”. They were asked how many days in the previous week they had applied any one of 25 specific PCPs including nail polish and perfume. Based on their responses, we created three variables: (1) used nail polish within previous week (yes/no); (2) used perfume within previous week (yes/no); and (3) total number of types of PCPs used in the previous week. We then defined women in the highest quartile of PCP use (22 or more different products used) as high PCP users while women who used fewer than 22 different products per week were defined as lower PCP users.

2.5. National Health and Nutrition Examination Survey (NHANES)

To assess the generalizability of our results, we compared the TIDES cohort to that of 721 pregnant women participating in the National Health and Nutrition Examination Survey (NHANES), a nationally representative survey of health in the U.S. population. For this comparison, we pooled the datasets of three distinct NHANES cycles: 2001–2002, 2003–2004, and 2005–2006 cycles [27,28].

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