OBSTETRICS

Blood mercury concentrations in pregnant and nonpregnant women in the United States: National Health and Nutrition Examination Survey 1999-2006

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BACKGROUND: Prenatal exposure to methylmercury is associated with adverse neurologic development in children. We examined total blood mercury concentrations and predictors of higher blood mercury concentrations in pregnant and nonpregnant women.

METHODS: We analyzed data from 1183 pregnant and 5587 nonpregnant women aged 16-49 years from the 1999-2006 National Health and Nutrition Examination Survey (NHANES). We estimated geometric mean blood mercury concentrations and characteristics associated with higher mercury concentrations (≥3.5 μg/L) in crude and adjusted linear and logistic regression models.

RESULTS: After adjusting for age and race/ethnicity, geometric mean blood mercury concentrations were clinically similar but significantly lower for pregnant (0.81 μg/L; 95% confidence interval [CI], 0.71—0.91) and nonpregnant women of childbearing age (0.93 μg/L; 95% CI, 0.87—0.99); 94% of pregnant and 89% of nonpregnant women had blood mercury concentrations below 3.5 μg/L. The most significant predictor of higher blood mercury concentrations for both pregnant and nonpregnant women was any seafood consumption vs no consumption in the last 30 days (odds ratio, 18.7; 95% CI, 4.9—71.1; odds ratio, 15.5; 95% CI, 7.5—32.1, respectively). Other characteristics associated with ≥3.5 μg/L blood mercury concentrations were older age (≥35 years), higher education (greater than high school), and higher family income to poverty ratio (3.501+) for both pregnant and nonpregnant women.

CONCLUSION: Pregnancy status was not strongly associated with blood mercury concentrations in women of childbearing age and blood mercury concentrations above the 3.5 μg/L cut were uncommon.

Key words: mercury, NHANES, pregnant, seafood

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Mercury is a naturally-occurring element that is widespread in the environment and exists as elemental, inorganic, and organic mercury (methylmercury; MeHg).[1] Inorganic and elemental mercury, measured in urine, are usually associated with dental amalgams, occupational exposures, and herbs and medicines adulterated with inorganic mercury.[2] MeHg exposure, which can be estimated by measuring concentrations in blood and hair comes almost exclusively from consumption of fish or shellfish.[1,3-5] Studies have consistently reported that increasing frequency of seafood intake is the single most influential predictor of blood MeHg concentrations.[6-9]

Fetuses are a high-risk group for MeHg exposure because of the increased susceptibility of the developing brain to environmental insults.[1,10] Three long-term studies, the Seychelles Island study,[11-13] the Faroe Islands study,[14-16] and a third study conducted in New Zealand,[17-19] have investigated MeHg in children who were prenatally exposed to MeHg through maternal seafood consumption. MeHg dose-related deficits in tests of memory, attention, and language were observed in children of different ages.[13-16,19] Given that permanent damage to the developing brain can occur, MeHg exposure in pregnant women is a source for concern.[10] The US Environmental Protection Agency (EPA) set the reference dose (RfD)—a dose which is unlikely to have deleterious effects—for MeHg at 0.1 μg/Kg/day.[20]

Total blood mercury (BHg) includes all form of mercury and is used in biomonitoring as a proxy for MeHg, although the distribution of mercury types in blood can vary.[6,21,22] Although the RfD varies by body weight, the value 5.8 μg/L (ppb) for BHg has been widely used in place of a weight-specific value in studies of mercury concentrations and health outcomes.[23] Originally, it was thought that cord blood and maternal blood mercury levels were equivalent when calculating the RfD[20]; however, studies comparing maternal and cord blood concentrations of MeHg have found that cord-blood mercury is higher than maternal blood mercury. According to the EPA, a review of the literature identified 21 studies that

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TABLE 1
Characteristics of US pregnant women and US nonpregnant women in NHANES 1999-2006

Variable	Pregnant women		Nonpregnant women		*P* value[a]
Total mean blood mercury, μg/L	0.71 (0.63–0.79)		0.92 (0.85–0.99)		< .0001
Total mean blood mercury adjusted for age and race, μg/L	0.81 (0.71–0.91)		0.93 (0.87–0.99)		.0001
Total, n[b]	1183		5587		
Age, n, %[b] (95% CI)[c]					< .0001
16-25	551	41.6 (37.0–46.4)	2386	25.9 (24.4–27.5)	
26-35	558	49.4 (43.8–55.0)	1209	26.6 (25.0–28.2)	
36-49	74	9.0 (5.9–13.6)	1992	47.5 (45.5–49.5)	
Race, n, %[b] (95% CI)[c]					< .0001
NonHispanic white	526	56.3 (50.3–62.1)	2189	66.8 (63.5–70.0)	
NonHispanic black	183	15.1 (11.5–19.6)	1405	12.7 (10.8–15.0)	
Mexican American	350	16.0 (13.0–19.5)	1494	8.7 (7.2– 10.4)	
Other race and/or multiracial	124	12.7 (8.8–18.0)	499	11.8 (9.7–14.2)	
Education level, n, %[b] (95% CI)[c]					.07
Less than high school graduate	374	23.1 (19.4–27.2)	2017	20.3 (18.8–21.9)	
High school graduate or GED	259	18.7 (15.2–22.7)	1218	22.9 (21.3–24.5)	
Greater than high school	549	58.2 (53.3–36.0)	2347	56.7 (54.4–59.0)	
Missing	1	—[d]	5	—[d]	
Family income to poverty ratio,[e] n, %[b] (95% CI)[c]					.09
0-1.3	399	25.6 (21.7–29.9)	1849	23.6 (21.4–25.9)	
1.301-3.5	389	35.5 (31.7–39.6)	1853	32.8 (30.7–35.0)	
3.501+	319	32.1 (27.0–37.7)	1516	38.2 (35.5–40.9)	
Missing	76	—[d]	369	5.4 (4.5–6.5)	
Fish or shellfish consumption in the past 30 days, n, %[b] (95% CI)[c]					.05
Yes	849	73.0 (67.2–78.0)	4160	78.1 (76.0–80.1)	
No	292	23.6 (19.2–28.6)	1226	18.7 (17.0–20.6)	
Missing	42	—[d]	201	3.2 (2.5–4.0)	
Fish consumption in the past 30 days, n, %[b] (95% CI)[c]					.03
Yes	700	62.5 (56.8–67.8)	3545	68.8 (66.6–71.0)	
No	441	34.1 (29.4–39.2)	1843	28.1 (26.1–30.2)	
Missing	42	—[d]	199	3.1 (2.5–4.0)	
Shellfish consumption in the past 30 days, n, %[b] (95% CI)[c]					.13
Yes	545	46.1 (41.0–51.4)	2769	51.4 (48.6–54.2)	
No	596	50.4 (45.5–55.4)	2615	45.4 (42.7–48.1)	
Missing	42	—[d]	203	3.2 (2.6–4.1)	

CI, confidence interval; *GED*, General Education Development; *NHANES*, National Health and Nutrition Examination Survey.

[a] *P* values for χ^2 test; [b] Unweighted n; [c] Weighted row percentage; [d] Estimates suppressed because minimum degrees of freedom (12) for strata not met; [e] Family income to poverty ratio is the total household income divided by the poverty threshold for the year of the interview.

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