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Commentary

Commentary on the association of polychlorinated biphenyls with hypertension

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Since preparing “Association of polychlorinated biphenyls with hypertension in the 1999–2002 National Health and Nutrition Examination Survey” (Everett et al., 2008, doi:10.1016/j.envres.2008.05.006), polychlorinated biphenyl (PCB) data for the 2003–2004 National Health and Nutrition Examination Survey (NHANES) has been made available to the public. Hence it is now possible to analyze the association of PCBs and hypertension in 6 years of the NHANES (1999–2004). We have evaluated the same 11 PCBs as we did in Everett et al. (2008) again in the 1999–2004 NHANES. We use the same lower and upper cut-points for each PCB. The definition of hypertension, laboratory analyses of PCBs, and control variables used remain the same as before.

The unweighted number of persons assessed for hypertension ranged from 3398 to 3712 depending on the chemical being analyzed. When three chemicals were evaluated together to determine one or more PCBs elevated (the PCBs with significant separate adjusted logistic regressions) the unweighted number of participants was 3326. For the analysis of one or more elevated PCBs, 69.6% had no PCBs elevated and 30.4% had one or more PCBs elevated.

Demographic characteristics of the 1999–2004 NHANES are shown in Table 1. The proportion of participants that have elevated PCBs (as shown in Table 2) varied by age, gender, race-ethnicity, and body mass index (BMI). The demographic trends are the same as before except for the BMI categories. The proportion with elevated PCBs is higher in each age, gender, race-ethnicity and BMI category than before.

Adjusted logistic regressions for the 1999–2002 NHANES and the 1999–2004 NHANES are shown in Table 2. The adjusted associations for the 1999–2004 data were significant for PCBs 126, 74 and 118. Interestingly, none of the non-dioxin-like PCBs were

significantly associated with hypertension in the 1999–2004 NHANES.

One or more elevated PCBs had an adjusted odds ratio of 1.45 (95% CI 1.07–1.97) compared to no PCBs elevated in an adjusted logistic regression. When the number of PCBs elevated was analyzed as a continuous variable (0–3 elevated PCBs) the odds ratio per elevated PCB was 1.26 (95% CI 1.07–1.47). The proportion of the 1999–2004 NHANES with one elevated PCB was 16.5%, with two elevated PCBs was 8.7%, and with three elevated PCBs was 5.2%. The prevalence of one or more elevated PCBs was 30.4% or 46 million out of 152 million persons ≥ 20 years old in the non-institutionalized US population.

Table 1Demographics of persons having and not having elevated polychlorinated biphenyls (PCBs) in the 1999–2004 NHANES^a

	Normal	Elevated PCBs
Age (years) (%)		
20–44	88.7	11.3
45–64	60.7	39.3
≥ 65	26.2	73.8
Gender (%)		
Male	77.6	22.4
Female	62.3	37.7
Race-ethnicity (%)		
Non-Hispanic white	69.0	31.0
Non-Hispanic black	63.2	36.8
Hispanic and other race	76.1	23.9
Body mass index (kg/m ²) (%)		
<25	73.5	26.5
25–29.9	69.1	30.9
≥ 30	65.5	34.5

^a Elevated PCBs being defined as PCB 126 > 59.1 pg/g lipid adjusted, PCB 74 > 22.7 ng/g lipid adjusted, or PCB 118 > 12.5 ng/g lipid adjusted.

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Table 2Adjusted association of polychlorinated biphenyls and hypertension in the 1999–2002 NHANES and 1999–2004 NHANES^a

	1999–2002		1999–2004	
	Odds ratio	95% CI	Odds ratio	95% CI
PCB 169 pg/g lipid adjusted				
≤27.0	1.00	–	1.00	–
27.1–46.4	1.06	0.77–1.46	1.13	0.86–1.48
>46.4	1.31	0.82–2.08	1.29	0.86–1.94
PCB 126 pg/g lipid adjusted				
≤26.1	1.00	–	1.00	–
26.2–59.1	1.13	0.92–1.39	1.14	0.93–1.39
>59.1	2.45	1.48–4.04	1.76	1.19–2.59
PCB 74 ng/g lipid adjusted				
≤12.4	1.00	–	1.00	–
12.5–22.7	1.13	0.77–1.66	1.21	0.88–1.65
>22.7	1.65	1.05–2.61	1.52	1.01–2.28
PCB 118 ng/g lipid adjusted				
≤12.5	1.00	–	1.00	–
12.6–27.5	1.36	0.99–1.89	1.39	1.06–1.82
>27.5	2.30	1.29–4.08	1.95	1.25–3.03
PCB 156 ng/g lipid adjusted				
≤12.5	1.00	–	1.00	–
12.6–15.4	1.41	0.90–2.20	1.29	0.86–1.93
>15.4	1.31	0.81–2.11	1.24	0.82–1.88
PCB 99 ng/g lipid adjusted				
≤12.5	1.00	–	1.00	–
12.6–17.1	1.05	0.71–1.55	1.05	0.74–1.49
>17.1	1.49	1.04–2.15	1.35	0.98–1.84
PCB 138 & 158 ng/g lipid adjusted				
≤41.1	1.00	–	1.00	–
41.2–66.0	1.34	0.83–2.18	1.29	0.90–1.83
>66.0	1.75	1.12–2.73	1.49	0.99–2.23
PCB 153 ng/g lipid adjusted				
≤55.6	1.00	–	1.00	–
55.7–96.0	1.03	0.68–1.58	1.06	0.73–1.54
>96.0	1.45	0.90–2.33	1.32	0.86–2.01
PCB 170 ng/g lipid adjusted				
≤17.2	1.00	–	1.00	–
17.3–27.1	0.89	0.59–1.35	0.93	0.66–1.33
>27.1	1.52	1.02–2.26	1.32	0.89–1.94
PCB 180 ng/g lipid adjusted				
≤28.2	1.00	–	1.00	–
28.3–71.2	0.93	0.65–1.32	1.05	0.77–1.43
>71.2	1.38	0.89–2.14	1.29	0.84–1.99
PCB 187 ng/g lipid adjusted				
≤12.4	1.00	–	1.00	–
12.5–21.7	1.00	0.69–1.46	1.03	0.77–1.39
>21.7	1.56	1.05–2.31	1.29	0.94–1.78

^a Adjusted for age, gender, race-ethnicity, smoking status, body mass index, exercise, total cholesterol, and family history of heart attack.

The results for the 1999–2004 NHANES indicate dioxin-like tetrachlorobiphenyl (PCB 74) and dioxin-like pentachlorobiphenyls (PCB 126 and PCB 118) are associated with hypertension. Dioxin-like

hexachlorobiphenyls (PCB 169 and PCB 156) and non-dioxin-like PCBs are not associated with hypertension in the 1999–2004 NHANES. Also, the proportion of elevated PCBs was greater among those participants with BMI ≥ 30 kg/m² than those with BMI < 25 kg/m². Obesity interactions with PCBs need to be evaluated further.

Reference

Everett, C.J., Mainous III, A.G., Frithsen, I.L., Player, M.S., Matheson, E.M., 2008. Association of polychlorinated biphenyls with hypertension in the 1999–2002 National Health and Nutrition Examination Survey. *Environ. Res.* 108, 94–97.