

## A Strong Dose-Response Relation Between Serum Concentrations of Persistent Organic Pollutants and Diabetes: Results From the National Health and Nutrition Examination Survey 1999–2002

Response to Porta

We thank Dr. Porta (1) for his interest in our study (2). As our study was cross-sectional, a possibility of reverse causality needs to be carefully evaluated. The most critical issue he raised is weight changes, which were not considered in our report. Body weight loss increases both serum and adipose tissue concentrations of persistent organic pollutants (POPs) (3,4), and diabetic patients are advised to attempt weight loss as a nonpharmacologic intervention. Conceivably, the strong relation between POPs and prevalence of diabetes could be explained by weight loss among diabetic patients. The National Health and Nutrition Examination Survey collected information on body weight 1 and 10 years before examination. Additional adjustment for weight change over the past 1 or 10 years attenuated the original odds ratios (ORs) to 12.8, 10.8, 26.5, and 26.7 or 9.1, 6.7, 16.0, and 15.8. BMI itself may be another important issue in rela-

tion to the possibility of reverse causality because BMI could be inversely related to clearance of POPs (4) and since diabetic patients are more obese. Thus, diabetic patients may increase accumulation of POPs in their body. However, one study reported no significant difference between the average elimination rates of diabetic and nondiabetic individuals (5). In addition, we adjusted for both BMI and waist circumference. Thus, decreased elimination does not appear to explain our finding.

We agree that one of the most surprising results would be that the prevalence of diabetes itself was quite low and that obesity was not associated with diabetes among subjects with very low levels of POPs, suggesting that POPs contained in the adipose tissue, not obesity, may be a key to diabetes. Some of our findings may be criticized due to the cross-sectional design. However, the lack of association between obesity and diabetes among subjects with very low levels of POPs is unlikely to be a cross-sectional bias. Although *Diabetes Care* does not allow figures in response letters, the requested figure depicting the interaction between obesity and POPs can be drawn from our publication and looks very persuasive.

Regarding Dr. Porta's other questions, wealthier individuals (higher poverty income ratio) had lower concentrations of DDE but higher concentrations of PCB153. ORs adjusted only for age were 14.4, 18.3, 45.5, and 47.0, with little change on further adjustment for sex and race/ethnicity. Several methods of combining the six POPs yielded conclusions similar to those we presented.

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DOI: 10.2337/dc-06-1720

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