Status report: A Cross-Sectional Analysis of Type II Diabetes in a Community with Exposure to Perfluorooctanoic acid (PFOA)

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Revised, Nov 17, 2008
Summary:

Background: An increased number of deaths from diabetes, compared to those expected, has been seen in a previous study of workers exposed to perfluorooctanoic acid (PFOA). To investigate this issue further, we analyzed the relationship between serum PFOA and self-reported type II diabetes in residents of six water districts in Ohio and West Virginia contaminated with PFOA. We also looked at the sub-group of participants for whom medical validation of their reported diabetes was available. Finally we also looked at the relationship between PFOA and fasting glucose levels, among those who did not have diabetes. High fasting glucose indicates an increased risk of future diabetes.

Methods: The study population included adults ≥20 years of age, who participated in a community health survey (the C8 Health Project) in 2005-2006 (N=54,468). Participants reported whether or not they had diabetes at that time, and if they did, their age at diagnosis. They also provided a blood sample in which serum PFOA and glucose levels were measured. We conducted a case-control analysis of prevalent type II (adult-onset) diabetes, in which the level of PFOA was compared between diabetics and non-diabetics. The primary analysis was restricted to long-time residents of contaminated water districts (≥20 years, n=13,922), to maximize the likelihood that serum PFOA levels in 2005-2006 reflected previous exposure. Diabetes cases (n=1,005) in this analysis were restricted to those with medical record validation and with a least ten years residence in a contaminated water district prior to their diagnosis. We also analyzed the entire population for diabetes prevalence, without regard to length of residence. Finally, we studied the association between serum PFOA and fasting glucose in 2005-2006. This analysis was restricted to adult subjects who reporting not having eaten for at least six hours...
prior to their blood draw (N=21,642). In this last analysis we excluded those who reported having diabetes.

**Results:** Median (50\textsuperscript{th} percentile) serum PFOA levels were 28 ng/ml among all subjects, and 49 ng/ml in long-term residents, compared to approximately 5 ng/ml in the general US population. There were 4,278 prevalent diabetes cases reported by C8 Health Project participants, of which 3,529 were medically verified. The prevalence of self-reported adult diabetes in this population (7.8\%) was similar to age-adjusted prevalence in Ohio (7.8\%) and W. Virginia (9.8\%). In the analysis of long-term residents, after adjusting for other variables related to diabetes, we observed little association between serum PFOA in 2005-2006 and the prevalence of medically-verified type II diabetes. In an analysis using ten categories of PFOA, the risk of prevalent diabetes by increasing level serum PFOA did not shown a consistent increase with increasing PFOA. Taking the lowest category of PFOA as baseline (risk of 1.00), the ratio of risks (odds ratios) by increasing category of PFOA were 0.71, 0.60, 0.72, 0.65, 0.65, 0.87, 0.58, 0.62, 0.72.

We conducted further analyses including all adults in the C8 Health Project, without regard to length of residence in contaminated water districts. These also did not show any relation between level of PFOA and the proportion of people with diabetes (odds ratios 1.00, 0.74, 0.67, 0.62, 0.67, 0.69, 0.73, 0.68, 0.64, 0.62 for medically verified cases). Finally, there was also no consistent association between fasting serum glucose and serum PFOA.

**Conclusions:** Our findings do not demonstrate an association between PFOA and either type II diabetes or fasting glucose level. However, these data are limited by their cross-sectional nature, because we cannot be sure the serum level of PFOA in 2005-2006 correctly reflects the exposure level preceding the onset of diabetes. Therefore based on these data we cannot exclude the possibility of a true relationship between PFOA and the occurrence of diabetes. Future work
will include follow-up studies in which we will look at the occurrence of new diabetes and also estimate more precisely historical exposure to PFOA.