Status report

Changes in serum PFOA/PFOS and serum lipids between 2005 and 2010 in the Mid-Ohio Valley

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This report summarizes findings relating changes over approximately 4.5 years in PFOA (C8) and changes in lipid measurements in the serum of a sample of adults living in the Mid-Ohio Valley. It also summarizes the findings for another perfluoroalkyl compound, PFOS. High total cholesterol, high LDL cholesterol and low HDL cholesterol are known risk factors for cardiovascular disease.

We have analyzed data from the questionnaires and blood tests collected in the C8 Health Project in 2005-06 and the follow-up study of the Science Panel in which a sample of adults from the 2005-6 survey were invited back and provided blood samples in 2010. On average, the level of both PFOA and PFOS in serum fell by about one half between the two studies, from initial average values (expressed as geometric means) for these participants of 74.8 ng/mL for PFOA and 18.5 ng/mL for PFOS to 30.8 for PFOA and 8.2 for PFOS. The decline in PFOA was due to the ending of contamination of the public drinking water supplies, while PFOS serum levels was falling during the same years at a rate in line with the general decline in the US population. PFOA levels in the US population are approximately 3.9 ng/mL.
For 560 adults who did not report taking medicines for lowering cholesterol in either the first or second survey we looked at changes in total cholesterol, LDL, HDL and triglycerides.

Changes in each lipid measurement were analyzed in relation to the change in PFOA and PFOS. In each case measures for main analyses were log-transformed; the log transformation better captures the shape of the relationship between lipids and PFOA in the Science Panel's earlier analyses of the C8 Health Project data. Account was also taken of other potential explanatory factors, such as age, gender, time between measurements and fasting status.

There was little change in lipid levels overall, with mean total cholesterol changing from 196.0 at baseline to 196.3 mg/dL at follow up, and serum LDL cholesterol, from 112.4 mg/dL at baseline to 113.8 mg/dL at follow up. The main finding from modeling the relationship between PFOA and LDL cholesterol was that a decrease in LDL cholesterol was associated with a decrease in PFOA, whereby a 50% drop in PFOA predicted a 3.6% decrease in LDL cholesterol. This was statistically significant with a 95% confidence interval of 1.4% to 5.9%. We also looked at the change in LDL in relation to three equal categories of percent drop in PFOA, comparing the modelled shift in LDL in each group to the group that had changed least (median drop of 36% PFOA). In the category with a median drop of 57%, the LDL fell by a further 1.6% (95% CI -3.4% to 6.4%) and in the category with median drop in PFOA of 72%, the LDL fell by a further 4.5% (95% CI -0.3% to 9.1%).

Similarly, halving PFOS predicted a decrease in LDL cholesterol of 5.1% (95% CI 2.4%-7.9%). It is difficult to distinguish between the effects of PFOA and PFOS as fall in one is highly correlated with a fall in the other, but allowing for the two exposures together, we observed a slightly lower effect of PFOA on LDL levels.

A similar but weaker (not statistically significant) pattern was found for change in total cholesterol. We did not find evidence for associations between changes in HDL cholesterol or triglycerides and changes in PFOA.

Previous analyses of lipids in relation to PFOA in the mid Ohio Valley population have shown significant associations between PFOA (and PFOS) and LDL, total cholesterol and triglycerides in cross sectional analyses. These new results are useful because studying change of outcome in relation to change in exposure is less likely to be readily explained by other causes. Hence these new findings will be helpful for the Science Panel's evaluation of any probable links of C8 to cardiovascular diseases.