Status Report

Exposure to perfluoroalkyl acids and markers of kidney function in children and adolescents

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July 25, 2012

This report summarizes findings relating concentrations of PFOA (C8) and other perfluoroalkyl acids (PFOS, PFNA, PFHxS) in serum and markers of kidney function among children and adolescents aged 1 to 17 years living in the Mid-Ohio Valley. We analyzed data from the questionnaires and blood tests collected in the C8 Health Project in 2005-2006 for 9,660 children. In addition, we were able to estimate PFOA exposure (but not PFOS, PFNA, or PFHxS exposure) at time points prior the C8 Health Project survey for 6,060 children that provided researchers with their residential histories. This allowed us to compare estimated PFOA exposure during in utero development and early childhood with kidney function during later childhood and adolescence.

A recent study of adults in the U.S. reported associations between increased concentrations of PFOA and PFOS in serum and decreased kidney function. Adults with higher exposure also had increased risk of developing chronic kidney disease. Chronic kidney disease is an important health problem that frequently leads to kidney failure, and is an important risk factor for cardiovascular disease. In children, chronic kidney disease may eventually require dialysis or kidney transplantation. We measured kidney function by calculating the estimated glomerular

filtration rate (eGFR) for each participant using their reported height and results of their blood tests. A lower than normal eGFR is indicative of decreased kidney function.

The average eGFR was well within the normal range, with 0.3% of participants with an eGFR below normal for their age and sex. Levels of PFOA, PFOS, PFNA, and PFHxS measured in serum were each associated with decreased eGFR after adjustment for age, sex, smoking status, and other factors that may also affect eGFR. In contrast, estimated levels of PFOA in serum at birth, during the first ten years of life, in the three years prior to enrollment in the C8 Health Project, and at the time of enrollment were not related to eGFR measured in 2005-2006. In other words, we observed an association between increased measured levels of PFOA in serum and reduced kidney function, but this association was not present when we used predicted serum PFOA levels.

One possible explanation for these results is that individuals with reduced kidney function are not able to metabolize and excrete PFOA from their bodies as well as those with normal kidney function. If this is the case, lower eGFRs would lead to higher measured levels of PFOA, and possibly higher levels of other perfluoroalkyl acids in serum. Our analyses using measured serum PFOA and eGFR are limited as both are measured at the same time (cross-sectional), so we are unable to determine if PFOA exposure or decreased kidney function occurred first. Predicted levels of PFOA in serum are not affected by differences in metabolism, so these analyses do not have the same limitations. However, there is likely some misclassification in our predicted concentrations of serum PFOA that may also affect our analyses.

In conclusion, although we observed an association between measured levels of PFOA in serum and reduced kidney function in children and adolescents, our findings highlight the possibility that this association and resulting increased concentrations of PFOA may be a consequence of, rather than a cause of, decreased kidney function.