Status Report: PFOA and immune biomarkers in adults exposed to PFOA in drinking water in the mid Ohio valley

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This status report summarises the relationship between C8 and several markers of immune status and inflammation in the mid Ohio population exposed to PFOA and studied by the C8 Science Panel as part of its court appointed role.

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Background

Perfluorooctanoic acid (PFOA, also known as C8) is a fluorinated compound which is used in several industrial and commercial applications. It is, persistent and ubiquitous in environmental and biological samples. In laboratory toxicity studies, PFOA has been shown to cause damage to the immune system in mice. There is very little information on immune status in relation to PFOA in humans.

PFOA has been used in the manufacturing of several chemicals at a chemical plant in Washington, West Virginia since 1951. A survey in a group of residents from the Ohio and West Virginia communities in the vicinity of the plant was conducted in 2005-2006: the C8 Health Project. The current study is an analysis of immune markers in the blood from adults included in that survey.

Methods

Analyses were carried out on information gathered for 56,315 participants 18 years and older who participated in the C8 Health Project. They had been selected if they had consumed drinking water for at least one year from sources in areas documented to have PFOA contamination. Information on demographic, personal characteristics such as height weight and smoking habits, was collected by questionnaire. Serum was collected and analysed for PFOA and a range of immune markers, including immunoglobulin of several types (IgG, IgM, IgA, and IgE), total antinuclear antibodies (ANA) and C reactive protein (CRP).

Suppression of the immune system can lead to increased susceptibility to disease and a decrease in immunoglobulins can provide an indication of immune-suppression. For example, a reduction in IgA might be expected to be linked to an increase in upper

respiratory infections. ANA are antibodies which when increased may indicate an increase in the risk of autoimmune diseases. CRP is a marker of inflammation which can be caused by many diseases, a reduction of CRP may indicates an weakness or inhibition of inflammatory response.

Statistical analyses were conducted, to investigate if there was an association between PFOA and these immune markerss, by multivariate statistical models relating the immune marker (after log transformation) to PFOA, with adjustment for age, smoking behaviour, alcohol use, body mass index and ethnic group. Males and females were assessed separately.

Results

PFOA levels were, as has already been reported for this population, much higher than normal background levels. The range of values for immunoglobulins, ANA, and CPR ranges were largely within normal reference ranges.

Several statistically significant associations between levels of immunoglobulins and C8 were found: For IgA the pattern of association indicated a significant decreasing trend with increasing PFOA; this was also apparent for IgE but only in females. For IgG there was not a consistent trend with PFOA. ANA shows a positive significant relationship with increasing PFOA. CRP showed a strong downward trend with increasing PFOA.

Discussion

The associations found between this immune biomarkers and PFOA do not necessarily indicate that PFOA is the cause of changes observed. These are cross sectional data with exposure and immune biomarker measured at the same point in time, so we recommend caution in interpretation: one cannot be sure of the time relationships of changing PFOA concentrations and immunoglobulin levels. Furthermore the magnitude of the changes across the observed exposure range is small and most values remain within normal

ranges. Nonetheless several of these immune markers show a pattern of decrease
(immunoglobulins A and E, and CRP) or in the case of ANA an increase, with higher
blood levels of PFOA, suggesting that there may be a relation between immune function
and PFOA exposure in exposed persons While this cannot be directly interpreted as
indicating an increase in disease risk in this population, it warrants further investigation.

Further ongoing work by the Science Panel, will address directly the relationships
between PFOA (measured or estimated before disease onset) and some more sensitive
indicators of disturbance in immune function, and the incidence of diseases whose risks
are sensitive to immune-suppression. These include infectious disease, asthma, auto-
immune disease and rheumatoid arthritis.