Drinking water exposures to per- and polyfluoroalkyl Substances (PFASs) in the Nurses’ Health Study (NHS)

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Background
Exposure to PFASs in humans is wide-spread, and cumulative epidemiological evidence has suggested both immunotoxicity and metabolism disturbance. Drinking water standards are being proposed by regulatory agencies, but important knowledge gap still exists – we attempt to bridge drinking water exposure to biomarker and health outcomes, using archived samples from NHS.

Methods
We work closely with a case-control project investigating risk of type 2 diabetes associated with PFASs exposure. Selected drinking water samples (n=110) that have matched serum PFASs measurements are retrieved. PFASs concentrations are analyzed as below:

Results

![Image of PFASs compounds detected in the 40 water samples from NHS 1988-90 collection. Color bars are normalized by standard deviation.](image)

![Image of Correlation among PFASs in 40 NHS drinking water samples.](image)

![Image of Method limit of detection for drinking water PFASs analysis.](image)

Table 1. Summary of analysis of 40 archived NHS water samples from 1989/1990

<table>
<thead>
<tr>
<th>PFPeA</th>
<th>PFHxA</th>
<th>PFHpA</th>
<th>PFOA</th>
<th>PFNA</th>
<th>PFDA</th>
<th>PFBS</th>
<th>PFOS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Detect</td>
<td>20%</td>
<td>73%</td>
<td>28%</td>
<td>50%</td>
<td>40%</td>
<td>23%</td>
<td>8%</td>
</tr>
<tr>
<td>Median</td>
<td>7.27</td>
<td>40.95</td>
<td>8.54</td>
<td>1.27</td>
<td>4.66</td>
<td>0.70</td>
<td>2.02</td>
</tr>
<tr>
<td>Max</td>
<td>32.63</td>
<td>161.04</td>
<td>11.16</td>
<td>17.42</td>
<td>37.49</td>
<td>1.76</td>
<td>2.43</td>
</tr>
</tbody>
</table>

Discussion & next steps
- Health-based drinking water PFOA 1 ng/L, 20 times lower than the LOD of EPA’s monitoring program
- Offline SPE + HPLC-MS/MS is sufficiently sensitive

Upon the completion of analysis of both drinking water and serum samples, the relative importance of drinking water as an exposure source will be evaluated:

![Image of Discussion & next steps diagram.](image)

Important policy questions, such as identifying major sources of drinking water contamination in the U.S. will benefit from extension of current project. The publicly funded data (EPA’s UCMR3) will guide additional sample retrieval from “hot-spots” of PFASs contamination. We will then investigate the relationship between living in proximity to various types of point sources (manufacturer, military base, airports, etc) and exposure to PFASs from drinking water.

References

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