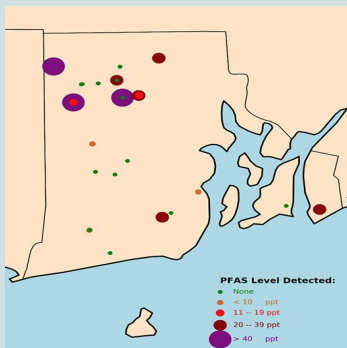


Does PFAS in primary source drinking water lead to increased concentrations in the body, bioaccumulation and adverse health effects as compared to those with uncontaminated waters?

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Background:

- Per- and polyfluoroalkyl (PFAS) substances are a class of man-made chemicals that persist in soil and water (Per- and Polyfluoroalkyl Substances, 2020).
- Commonly used in nonstick items and aqueous fire fighting foam, PFAS chemicals have been linked to a number of serious, adverse health effects (Figure 3).
- As a result, numerous studies have ensued to evaluate safe levels of toxicity, specifically in drinking water.
- EPA sets the legal limit at 70ppt, while Harvard researchers suggest only 1ppt is acceptable (EPA) (Grandjean & Budtz-Jørgensen 2013).
- The Rhode Island Department of Health recently evaluated the State's drinking water sources for five types of PFAS chemicals. 87% of Rhode Islander's had their primary water source tested and in 44% of those sources, PFAS were found.



Hypothesis: There is a statistically significant difference between the concentration of PFAS in blood, health experiences, and bioaccumulation trends of those who live in contaminated areas versus those who do not.

Figure 1. A high concentration, indicated by the larger purple circles, of PFAS in Rhode Island is shown.

Motivation:

If it is known that PFAS in certain quantities is detrimental to human health, and PFAS has been found in drinking water in Rhode Island, this begs the question of how it has impacted concentrations in people and their subsequent health. This will contribute to the growing body of scholarly work to help determine what the safe legal limit is. It can also provide a basis for clean up measures and better water management plans.

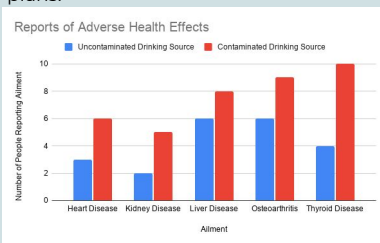


Figure 2. Hypothetical data indicating to increased adverse health effects when persons get their primary drinking water from a contaminated source.

Natural Experiment Design:

- Data collection
- We will recruit Rhode Islanders from residing in the tested water supplies to participate in an exposure study. We will utilize social media, flyers and radio to recruit volunteers.
- Participants will be given a comprehensive survey asking them a variety of questions about their health, where they live, any known additional exposures to PFAS (such as employment at a chemical production facility), and personal info.
- With consent, we will collect blood samples from participants.
- We will repeat the survey and serum collection for the following two years with willing participants.
- We will measure the PFAS concentration - for the five types identified in the water sources - in the serum samples in nanograms/milliliter.



Figure 3. Common items that contain PFAS, showing how pervasive these toxic chemicals are in our society, and the many household items they are present in.

Intended analysis:

- Will will categorize and compare the blood samples of those who do not get water from a contaminated source (control group) and those who do (treatment group). We will perform a t-test to determine if contaminated versus clean water sources play a statistically significant role in determining PFAS serum concentration.
- We will similarly perform a t-test to determine if there has been statistically significant bioaccumulation over the three years, specifically for those who get water from a contaminated source
- Final we will utilize ANOVA test to determine at what threshold of PFAS serum concentrations does any one adverse health effect (ex. infertility) become prevalent. Strength of inference could be increase by a χ^2 test indicating categorically, any PFAS contamination produces adverse health outcomes.

Limitations: It is unclear how soon adverse health effects will manifest and our timeframe could be too short.

