CDC/ATSDR
Multi-Site PFAS Health Study

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Study Overview

● New 5-year study with 7 sites; all have PFAS in water supplies
  ○ El Paso County, CO
  ○ Parchment/Cooper Township, MI, and North Kent County, MI
  ○ Montgomery and Bucks Counties, PA
  ○ Gloucester County, NJ
  ○ Hyannis, MA, and Ayer, MA
  ○ Hoosick Falls, NY, and Newburgh, NY
  ○ Orange County, CA

● each site will recruit 1000 adults and 300 children for clinical measurements
● shared core protocol, common IRB, and centralized data management
● each site performs local groundwater modeling and historical exposure reconstruction (Shin et al., 2011ab)
● additional site-specific community engagement and research activities
Core Protocol Measurements

- Questionnaire
  - Including residential histories and water consumption
  - Self-reported disease histories, validated by medical records
- Fasting blood and urine samples, shipped to CDC
  - PFAS concentrations
  - Biomarkers of immune response, lipid metabolism, kidney function, thyroid function, liver function, and glycemic parameters
- Body measurements and blood pressure
- Neurobehavioral testing
- Educational records
- Medication list
Orange County, CA

- Over **500,000 people** are served by water systems within 10 miles of UC Irvine Medical Center that had at least one water measurement exceeding 70 ppt PFOA+PFOS in UCMR3
  - Anaheim, Orange, Yorba Linda
- Local water utilities use seasonally varying combinations of groundwater, surface water, and/or imported water
- Groundwater supply and quality carefully managed by Orange County Water District (OCWD), but discovered to have PFAS during UCMR3 monitoring
Orange County Groundwater Basin

Recharge from Santa Ana River (mostly WWTP effluent), advanced treatment local recycled water, and imported surface water from northern California and the Colorado River.

OCWD, 2009
Triangulation: External vs. Internal Exposure

- Measured exposure biomarkers often viewed as gold standard
  - but may be subject to physiological confounding or reverse causation in some health association studies—especially for PFAS (Longnecker, 2010; Watkins et al., 2013; Steenland et al., 2018)

- External exposure estimates have more measurement error
  - but error is likely to be non-differential, and associations unlikely to affected by physiological confounding or reverse causation (Weisskopf and Webster, 2017)

- Both approaches have threats of bias, but of different types
  - Ideally, do epidemiology using both metrics, and compare results
  - Can put epidemiological effect estimates on same scale using pharmacokinetic models
Other Site-Specific Activities at UC Irvine

- Additional water, soil, and/or stored blood PFAS measurements
- Developing pharmacokinetic models for PFAS in humans
  - Literature-based, validated by linkage of UCMR3 with NHANES biomonitoring data
  - Simplified web-based models (e.g., https://www.ics.uci.edu/~sbartell/pfascalc.html)
  - An R package for PFAS pharmacokinetics allowing time-varying exposures
- Further development of formal Bayesian statistical methods for pharmacokinetic calibration of individual historical exposure estimates using measured biomarkers (e.g., Bartell, 2003; Shin et al., 2014)
- Prospective follow-up of children (cut from budget in Year 1)
Projected Timeline for California Site

- Groundwater modeling and pharmacokinetic modeling underway
- Participant recruitment and clinical measurements on hold for all sites until approval of core protocol by OMB and CDC IRB
  - randomized study invitations vs. targeted recruitment?
- Clinical visits in Years 2-3
- Complete exposure reconstruction and epidemiological analyses in Years 4-5

_Epidemiological analyses using pooled data from all sites at study end_
PFAS Research Funding and Disclosure

- CDC/ATSDR Cooperative Agreement (U01-TS000308)
- National Institutes of Health (R21-ES023120)
- Research and Education in Green Materials Program at University of California, Irvine (UC-44157)
- C8 Class Action Settlement Agreement (Circuit Court of Wood County, WV)

Dr. Bartell has served as an expert witness for plaintiffs in two medical monitoring lawsuits for PFAS in New Hampshire.