Xindi (Cindy) Hu *ScD*

xindy.hu@gmail.com • +1 (617) 637-6729 • Linkedin • GitHub • 4310 Adeline St, Emeryville, CA 94608

EDUCATION

Harvard T.H. Chan School of Public Health — Boston, MA

Doctor of Science in Environmental Health, major in Risk and Decision Sciences — *May '18*

Committee: *Drs. Elsie Sunderland (chair), Joseph Allen, Brent Coull, Philippe Grandjean*

Thesis: *From Source To Dose: Modeling Human Exposure To Poly- and Perfluoroalkyl Substances*

Harvard T.H. Chan School of Public Health — Boston, MA

Master of Science in Environmental Health — *May '14*

Advisor: *Dr. Elsie Sunderland*

Thesis: *Exposure to perfluorinated alkylates from fish consumption in high-end fish consumers in the U.S.*

Peking University — Beijing, China

Bachelor of Science in Environmental Sciences, minor in Biological Sciences — *July '12*

HONORS & AWARDS

- Women in Science Incentive Prize, *The Story Exchange*, 2021.
- Finalist for the Digital Media Award, *National Institute of Health Care Management Foundation*, 2021.
- Data viz award, *Association of Public Data Users*, 2019.
- Travel award, *Harvard GSAS Science Policy DC Trip*, 2018.
- Travel award, *International Society for Environmental Epidemiology*, 2017.
- Graduate Consortium on Energy and Environment, *Harvard University Center for Environment*, 2015-2017.
- Travel award for Eating Disorder Coalition Lobby Day on Capitol Hill, *Harvard School of Public Health*, 2015.
- Student Sustainability Grant, $5,000, *Harvard Office of Sustainability*, 2014.
- National Scholarship (The highest honor scholarship granted to no more than 5 students out of all 12,000 undergraduates), *National Ministry of Education in China*, 2011

EXPERIENCE

Mathematica — Oakland, CA

Lead Data Scientist — *Oct '18 – present*

- Lead the development of both the front end and back end API of an interactive web application to quantify individual-level COVID-19 risks, 19 and Me. The app ranks first in Google search results for "COVID risk calculator" and was featured in *Nature Technology Feature*, and a finalist of the NIHCM Foundation Digital Media Award of 2021.
- Evaluate the impact of the Healthy Davis Together program in reducing COVID-19 transmission in Davis, CA. Performed statistical analysis using the synthetic control method to estimate the counterfactual of Davis without the intervention.
- Lead the development of a web-based tool to understand the health impact of extreme weather events among the U.S. Medicaid beneficiaries, ClimaWATCH. This tool allows users to explore how climate change may have exacerbated existing health inequalities. Tech stack includes AWS and R shiny.

- Develop a machine-learning model to predict the susceptibility of contamination by poly- and perfluoroalkyl subtances in private drinking water wells, using 2000+ measurements in the state of New Hampshire.
- Visualize spatial variability in a wide range of indicators including antibiotics prescription rate and drinking water quality using R, ArgGIS, and D3. Winner of the APDU Data Viz Award of 2019.

Harvard John A. Paulson School of Engineering and Applied Sciences — Cambridge, MA

Postdoctoral Research Fellow — *June '18 – Sep '18*

- Analyze the disease burden of drinking water chemical contamination using advanced spatial analyses in a national cohort of more than 120,000 American women.
- Predict the occurrence of heavy metals in drinking water for private well users in the continental US with a hybrid hydrogeochemical and machine learning model.
- Examine the spatial variability of drinking water quality and sources of contamination among 36,000+ samples using spatial regression, and lead a group paper with experts from regulatory agencies, academic institutions and NGOs.

RAND Corporation — Santa Monica, CA

Summer Associate — *Jun '16 – Sep '16*

- Evaluated an urban planning agency's public engagement strategy by conducting a social network analysis of 600 million tweets, using Twitter API, text mining and sentiment analysis.
- Assessed the climate impact of multiple land use policy scenarios by conducting GIS analyses in the Robust Decision Making methodology. Presented the final finding through an R-shiny application.

Mexican National Institute of Public Health — Cuernavaca, Mexico

Summer Biostatistics Intern — *July '13 – Sep '13*

- Designed and implemented statistical analysis on a large panel dataset to investigate the effect of prenatal exposure to heavy metals on infant's psychoneurological behaviors in a fishing community. Collaborated with researchers from Mexico and the US to publish a teaching case in Spanish.

TECHNICAL SKILLS

Machine learning, spatial statistics, longitudinal analysis, causal inference, impact evaluation, Bayesian statistics, social network analysis

Python, R, SQL, AWS, ArcGIS, QGIS, Web-development, HTML, CSS, JavaScript D3

TEACHING

2023 Data visualization workshop, Boston University School of Public Health

2019 Guest lecture, Health Policy, Penn State University

2019 Guest lecture, Environmental Studies, Bennington College

2017 Guest lecturer, Water Pollution, Harvard T.H. Chan School of Public Health

2015 Teaching assistant, Atmospheric Environment Seminars, Harvard T.H. Chan School of Public Health

2014 Teaching assistant, Risk Assessment, Harvard T.H. Chan School of Public Health

RESEARCH MENTORING

2021 Jennifer Sun, Harvard John A. Paulson School of Engineering and Applied Sciences, Major in Environmental Sciences and Engineering

2019 Mona Dai, Harvard John A. Paulson School of Engineering and Applied Sciences, Major in Environmental Sciences and Engineering

2017 Adela Chovancova, Harvard Extension School, Major in Biotechnology

2017 Beverly Ge, Harvard College, Major in Environmental Science and Public Policy

2017 Alina McIntyre, Tufts University, Major in Community Health

2015 Jahred Liddie, Harvard College, Major in Environmental Science and Public Policy

PROFESSIONAL SERVICE

Professional Activities

Consultant, Covington & Burling LLP (2017)

Leadership

Session Chair, Society of Environmental Toxicology and Chemistry Europe (2018)

Organizing committee member, Chinese Environmental Scholars Forum (2017)

Organizing committee, Nudging Toward a Cleaner Future, Harvard Behavioral Insight Student Group (2016)

Chair, Environmental Health Student Advisory Committee (2015)

President, Chinese Students and Scholars Association (2013-14)

Student Leadership Circle (2013)

Reviewer

Member of U.S. Environmental Protection Agency EJScreen Scientific Advisory Panel (2023)

Judge for BE.Hive: Climate Change Needs Behavior Change (2019)

Peer-reviewer for *PLOS Biology, Science of the Total Environment, Environmental Science & Technology, Environmental Science & Technology Letters*

PUBLICATIONS

Journals (peer-reviewed)

[23] Keshaviah, A., Huff, I., **Hu, X. C.**, Guidry, V., Christensen, A., Berkowitz, S., ... & Musse, I. Separating signal from noise in wastewater data: An algorithm to identify community-level COVID-19 surges in real time. *Proceedings of the National Academy of Sciences*, 2023, 120(31), e2216021120.

[22] Dai, M. Q., Geyman, B. M., **Hu, X. C.**, Thackray, C. P., & Sunderland, E. M. Sociodemographic Disparities in Mercury Exposure from United States Coal-Fired Power Plants. *Environmental Science & Technology Letters* 2023, 10 (7), 589-595 DOI: 10.1021/acs.estlett.3c00216

[21] **Hu, X. C.**, Dai, M., Sun, J., Sunderland, E. M. The utility of machine learning models for predicting chemical contaminants in drinking water: Promise, challenges and opportunities. *Current Environmental Health Reports* 2023. Mar;10(1):45-60. doi: 10.1007/s40572-022-00389-x. Epub 2022 Dec 17. PMID: 36527604; PMCID: PMC9883334.

[20] Ha, G. L., Block, R., Gillespie, S., Patel, M., Keshaviah, A., **Hu, X. C.**, ..., Lennon, R. P. Lack of Trust Appears to Drive "Racial" Differences in COVID-19 Vaccine Confidence. *Annals of Behavioral Medicine* 2022, Vol. 56, No. SUPP 1, pp. S315-S315.

[19] Lennon, R. P., Zgierska, A. E., Miller, E. L., Snyder, B., Keshaviah, A., **Hu, X. C.**, ... & Van Scoy, L. J. Lower intent to comply with COVID-19 public health recommendations correlates to higher disease burden in following 30 days. *Southern Medical Journal*, 2021, 114(12), 744.

[18] **Hu, X. C.**,Ge, B., Ruyle, B.J., Sun, J., Sunderland, E.M. A Statistical Approach for Identifying Private Wells Susceptible to Perfluoroalkyl Substances (PFAS) Contamination. *Environmental Science & Technology Letters* 2021, 8 (7), 596-602.

[17] Keshaviah A., **Hu, X. C.**, Henry, M. Developing a Flexible National Wastewater Surveillance System for COVID-19 and Beyond. *Environmental Health Perspectives* 2021, 129:4 CID: 045002 https://doi.org/10.1289/EHP8572.

[16] Ruyle, B.J., Pickard, H.M., LeBlanc, D.R., Tokranov, A.K., Thackray, C.P., **Hu, X.C.**, ...,Sunderland, E. M. Isolating the AFFF Signature in Coastal Watersheds Using Oxidizable PFAS Precursors and Unexplained Organofluorine. *Environmental Science &Technology* 2021, 55(6), 3686-3695.

[15] De Silva, A. O., Aarmitage, J. M., Bruton, T., Dassuncao, C., Heiger-Bernays, Wendy, **Hu, X. C.**, ..., Sunderland, E. M. PFAS Exposure Pathways for Humans and Wildlife: A Synthesis of Current Knowledge and Key Gaps in Understanding. *Environmental Toxicology and Chemistry* 2021, 40: 631-657. https://doi.org/10.1002/etc.4935.

[14] Lennon, R.P., Fraleigh, R., Van Scoy, L.J., Keshaviah, A., **Hu, X. C.**, Snyder, B.L., Miller, E.L., Calo, W.A., Zgierska, A.E. and Griffin, C. Developing and testing an automated qualitative assistant (AQUA) to support qualitative analysis. *Family Medicine and Community Health*, 2021, 9(Suppl 1).

[13] Goyal, R., Luca, D., Klein, P.W., Morris, E., Mandsager, P., Cohen, S.M., **Hu, C.**, Hotchkiss, J., Gao, J., Jones, A. and Addison, W. Cost-Effectiveness of HRSA's Ryan White HIV/AIDS Program?. JAIDS Journal of Acquired Immune Deficiency Syndromes, 2021, 86(2), pp.174-181.

[12] Goyal, R., **Hu, C.**, Klein, P.W., Hotchkiss, J., Morris, E., Mandsager, P., Cohen, S.M., Luca, D., Gao, J., Jones, A. and Addison, W.. Development of a mathematical model to estimate the cost-effectiveness of HRSA's Ryan White HIV/AIDS Program. JAIDS Journal of Acquired Immune Deficiency Syndromes, 2021, 86(2), pp.164-173.

[11] **Hu, X. C.**, Tokranov, A. K., Liddie, J., Zhang, X., Grandjean, P., Hart J. E., ...& Sunderland, E. M. Tap water contribution to plasma concentrations of poly- and perfluoroalkyl substances (PFAS) in a nationwide prospective cohort of US women. *Environmental Health Perspectives*, 2019, 127(6), 067006.

[10] Sunderland, E. M., **Hu, X. C.**, Dassuncao, C., Tokranov, A. K., Wagner, C. C., & Allen, J. G. A review of the pathways of human exposure to poly- and perfluoroalkyl substances (PFASs) and present understanding of health effects. *Journal of exposure science & environmental epidemiology*, 2019, 29(2), 131-147.

[9] Dassuncao, C., **Hu, X. C.**, ...& Sunderland, E. M. Shifting global exposures to poly- and perfluoroalkyl substances evident in longitudinal birth cohorts from a seafood consuming population. *Environmental Science &Technology*, 2018, 52 (6), 3738-3747.

[8] **Hu, X. C.**, Dassuncao, C., ...& Sunderland, E. M. Can profiles of poly- and perfluoroalkyl substances (PFASs) in human serum provide information on major exposure sources? *Environmental Health*, 2018 17:11.

[7] Dassuncao, C., **Hu, X. C.**, ...& Sunderland, E. M. Temporal shifts in poly- and perfluoroalkyl substances (PFASs) in North Atlantic pilot whales indicate large contribution of atmospheric precursors. *Environmental Science &Technology* 2017, 51(8), 4512-4521.

[6] **Hu, X. C.**., Andrews, D. Q., Lindstrom, ...& Sunderland, E. M. Detection of poly-and perfluoroalkyl Substances (PFASs) in US drinking water linked to industrial sites, military fire training areas, and wastewater treatment plants. *Environmental Science &Technology Letters* 2016, 3(10), 344-350.

[5] Zhang, X., Lohmann, R., Dassuncao, C., **Hu, X. C.**, ...& Sunderland, E. M. Source attribution of poly-and perfluoroalkyl substances (PFASs) in surface waters from Rhode Island and the New York Metropolitan Area. *Environmental Science &Technology Letters* 2016, 3(9), 316-321.

[4] Tong, Y., Zhang, W., Chen, C., Chen, L., Wang, W., **Hu, X.**, Wang, H., Hu, D., Ou, L., Wang, X. and Wang, Q., 2014. Fate modeling of mercury species and fluxes estimation in an urban river. *Environmental pollution*, 184, pp.54-61.

[3] Tong, Y., Zhang, W., Hu, D., Ou, L., **Hu, X.**, Yang, T., Wei, W., Ju, L. and Wang, X. Behavior of mercury in an urban river and its accumulation in aquatic plants. *Environmental Earth Sciences*, 2013, 68, pp.1089-1097.

[2] **Hu, X.**, Gao, F., Hu, J. Health risk assessment of iodine status in Chinese residents. *Asian Journal of Ecotoxicology* 2012, 7(3):285-291.

[1] Tong, Y., Zhang, W., **Hu, X.**, ...& Wang, X. Model description of trophodynamic behavior of methylmercury in a marine aquatic system. *Environmental Pollution* 2012:166, 89-97.

Book chapters

[2] **Hu, X. C.**, Sunderland, E. M. Mercury. Chapter in Lippmann, M. ed., *Environmental toxicants: human exposure and their health effects (4th Edition)*. John Wiley & Sons, 2020.

[1] Cifuentes, E., Steve Rothenberg, ..., **Hu, X.** et al. Controversy associated risks the ingestion of contaminated fish and measures to protect health in Lake Chapala, Mexico. Teaching case for Instituto Nacional de Salud Publica (in Spanish), Cuernavaca, Mexico, Sep 2015.

Reports and policy briefs

[5] **Hu, X. C.**, Keshaviah, A., Harrison, E. The Costs of Wastewater Monitoring in Low- and Middle-Income Countries. Mathematica, Washington, DC, 2023.

[4] Keshaviah, A., Vincent, P., **Hu, X. C.**, Maccarone, A., Hotchkiss, J., Huff, I., Zhou, H., Vohra, D. The Effects of Healthy Davis Together: A COVID-19 Response Program. Mathematica, Washington, DC, 2022.

[3] Keshaviah, A., Karmali, R. N., Vohra, D., Huffman, T., **Hu, X. C.**, Diamond, M.B. The Role of Wastewater Data in Pandemic Management. Mathematica, Washington, DC, 2022.

[2] Dassuncao, C., Devries, R., **Hu, X. C.**, Keshaviah, A. Expanding the Use of Wastewater Epidemiology Tools to Improve Water Quality, Identify Service Populations Under Stress, and Promote One Water Goals for a Thriving City. Water Research Foundation, Denver, CO, 2022.

[1] Keshaviah, A., **Hu, X. C.**, Henry, M. Testing Municipal Wastewater to Flexibly Monitor Health and Safety. Mathematica, Washington, DC, 2020.

Conference Presentations

[18] **Hu, X.**, Dai, M. Improve Drinking Water Quality and Public Health with Geospatial Data Science. (Invited Talk). Geographic Data Science Lab Brown Bag Seminar Series. University of Liverpool, May 2023.

[17] **Hu, X.** et al., Developing and validating an individual-level risk calculator for COVID-19 in the United States. American Public Health Association annual meeting, Boston, MA, Nov 2022.

[16] **Hu, X.**, A Machine Learning Approach for Identifying Private Wells Susceptible to Chemical Contamination. (Invited Talk). Spatial Data Science Conference, New York, NY, Oct 2022.

[15] **Hu, X.**, A Data Science Approach for Identifying Drinking Water Toxicants. MEMCARE Superfund Research Center Speaker Series. Harvard T.H. Chan School of Public Health. Dec 2020.

[14] **Hu, X.**, Mapping the Invisible: Using Data to Improve Drinking Water Quality and Public Health. (Invited Talk). Next in Water program at Radcliffe Institute for Advanced Study, Harvard University, Oct 2020.

[13] **Hu, X.**, Human exposure to PFAS in drinking water. SETAC PFAS meeting, Durham, NC, Aug 2019.

[12] **Hu, X. et al.**, What is in my water? APDU Data Viz Award Presentation. Washington, DC, July 2019.

[11] **Hu, X. et al.**, Testing wastewater for better community health and safety. The 2nd Annual Community Information Exchange Summit, San Diego, CA, April 2019.

[10] **Hu, X. et al.**, Tap water intake of poly- and perfluoroalkyl substances (PFASs) in relation to serum concentrations in a nationwide prospective cohort of U.S. women. SETAC Europe, Rome, Italy, May 2018.

[9] **Hu, X. et al.**, Predicting exposure to chemical mixtures in drinking water for private well owners. Dana-Farber Cancer Institute and Frontier Science and Research Technology Foundation Marvin Zelen Memorial Symposium, Boston, MA, April 2018.

[8] **Hu, X. et al.**, Tap water contributions to serum concentrations of poly- and perfluoroalkyl substances (PFASs) in a nationwide prospective cohort of U.S. women. (Invited Talk). Geological Society of America Northeastern section meeting, Burlington, VT, March 2018.

[7] **Hu, X. et al.**, Can Profiles of Poly- and Perfluoroalkyl Substances (PFASs) in Human Serum Provide Information on Major Exposure Sources? Superfund Research Program meeting, Philadelphia, PA, Dec 2017.

[6] **Hu, X. et al.**, Geospatial examination of chemical mixtures in drinking water and mortality in women in the Nurses' Health Study. International Society of Environmental Epidemiology, Sydney, Australia, Sep 2017.

[5] **Hu, X. et al.**, Predicting exposure to chemical mixtures in drinking water for private well owners. International Society for Environmental Epidemiology, Sydney, Australia, Sep 2017.

[4] **Hu, X. et al.**, Advanced Data Integration for Epidemiologic Modeling in Benefit-Cost Analysis: Addressing the Challenge to Evaluate Preventive Interventions for Emerging Diseases. Society for Benefit-Cost Analysis, Washington, DC, March 2017.

[3] **Hu, X. et al.**, Sources of human exposure to poly- and perfluoroalkyl substances (PFASs). Society of Environmental Toxicology and Chemistry, Orlando, FL, Nov 2016.

[2] **Hu, X. et al.** Spatial variation of PFOS in drinking water in the United States (Webinar). Green Science Policy Institute, Berkeley, CA, Oct 2015.

[1] **Hu, X.** Two-step shrinkage-based regression strategy for assessing health effects of chemical mixtures in environmental epidemiology. NIEHS workshop, RTP, NC, July 2015.

Blogpost

Mar 8, 2021 Mathematica Blog: "Honoring the Leadership of Women During a Pandemic"

Nov 16, 2020 Mathematica Blog: "Updating the COVID-19 Risk Score Calculator to Reflect Recent Evidence"

May 7, 2020 Mathematica Blog: "19 and Me: A COVID-19 Risk Calculator"

May 4, 2020 Mathematica Blog: "Innovating Together in the Midst of COVID-19"

March 25, 2020 Mathematica Blog: "In Montana, Wastewater Testing Sheds New Light on Opioid and Methamphetamine Use"

July 31, 2019 On the Evidence, a Mathematica Podcast: What is in Our Water? New Research on Forever Chemicals in Drinking Water and Their Public Health Implications.

April 17, 2018 Harvard Science in the News: "The Most Widely Used Pesticide, One Year Later"

March 2, 2015 Harvard Science in the News: "Call for the pass of chemical safety reform"

Data visualization

July 31, 2023 Covid-SURGE Toolkit: Using Wastewater Data to Monitor Outbreaks

Oct 1, 2021 ClimaWATCH: An Interactive Tool to Boost Climate Adaptation and Resilience

Dec 13, 2020 COVID-19 Wastewater Dashboard: A case study in North Carolina

May 7, 2020 19 and Me: A COVID-19 Risk Calculator

Dec 17, 2017 Think before you drink: "An interactive website on the quality of U.S. drinking water"

MEDIA COVERAGE

Nov 28, 2022 Environmental Health News: "Where did the PFAS in your blood come from? These computer models offer clues"

June 24, 2021 Story Exchange: "She's on a Quest to Understand What's in Your Drinking Water"

June 24, 2021 STAT news: "Next steps for wastewater testing to help end this pandemic and prevent the next one"

June 22, 2021 Everyday Health: Potentially Toxic Chemicals Called PFAS Are Common in Cosmetics, Study Finds

Mar 5, 2021 Science Daily: Uncovering hidden forever chemicals New tool finds and fingerprints previously undetected PFAS compounds in watersheds on Cape Cod

Dec 21, 2020 Nature Technology Feature: "What's your risk of catching COVID? These tools help you to find out"

Oct 26, 2020 The Harvard Crimson: "Scientists Speak on Water's Role in Climate Change, Public Health and Planetary Science at Radcliffe Institute Event"

Feb 15, 2019 Environmental Health Perspectives Science Selection: "Guiding Communities Affected by PFASs: Tools for Tackling Contaminated Drinking Water"

June 28, 2019 Popular Science:"Immigrant children in U.S. detention camps could face yet another health hazard: contaminated water"

July 18, 2017 InDepthNH:"Shea-Porter Urges Congress to Fund PFC Water Health Study, Including at Pease"

Aug 9, 2016 Washington Post: "Researchers find unsafe levels of industrial chemicals in drinking water of 6 million Americans"

Aug 9, 2016 Harvard Gazette: "Unsafe levels of toxic chemicals found in drinking water of 33 states"

Aug 9, 2016 CNN: "Study: Public water supply is unsafe for millions of Americans"

Dec 13, 2013 Harvard T.H. Chan School of Public Health: "Exchange program helps turn public health theory into practice"

REFERENCES

Elsie M. Sunderland, PhD
Fred Kavli Professor of Environmental Chemistry; Professor of Earth and Planetary Sciences
Harvard John A. Paulson School of Engineering and Applied Sciences
ems@seas.harvard.edu
(617)496-0858

Brent Coull, PhD
Professor of Biostatistics
Harvard T.H. Chan School of Public Health
bcoull@hsph.harvard.edu
(617)432-2376

Bradley H. Pollock, MPH, PhD, FACE
Rolkin Chair in Public Health Sciences; Chair, Department of Public Health Sciences; Distinguished Professor
UC Davis Medical Center
bpollock@ucdavis.edu
(800)282-3284

Marc Nascarella, PhD, MS, CPH
Associate Professor of Health Sciences; Director of Health Sciences Research
Massachusetts College of Pharmacy and Health Sciences
marc.nascarella@mcphs.edu
(617)732-2227