# Daphne H. Liu

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## EDUCATION

**PhD in Statistics** **December 2023**
*University of Washington, Seattle, WA*

- Statistics in the Social Sciences track
- ***Thesis***: Statistical Methods for the Analysis and Prediction of Hierarchical Time Series Data with Applications to Demography
- ***Advisor***: Adrian E. Raftery
- ***Honors***: Center for Statistics and the Social Sciences Blalock Fellowship 2016-2017

**BA in Mathematics** **May 2016**
*Cornell University, College of Arts and Sciences, Ithaca, NY*

- Minor in Asian American Studies
- Semester abroad at University College London
- ***Honors****: cum laude* in Mathematics, distinction in all subjects

## RESEARCH INTERESTS

- Bayesian statistics
- Statistical demography
- Predictive modeling
- Dynamics of education, family planning, and fertility

## PROFESSIONAL EXPERIENCE

**Academic Collaborator,** United Nations Population Division **June 2023 – Present**
Develop Bayesian methods and software in R to create annual conditional probabilistic projections of fertility given a range of hypothetical policy intervention scenarios targeting women's education and access to family planning.

**Survey Statistician (Intern)**, U.S. Census Bureau **December 2022 – Present**
Conduct research in the Center for Economic Studies as part of the Economic Measurement and Research Internship program. Current projects include:

1. Development of methods for evaluation of sampling designs using simulation studies in R to support the Census Household Panel project.
2. Validation and comparison of different methods in Python and R for prediction of race and ethnicity for individual survey respondents when self-response is missing.

**Consultant,** University of Washington **2021 – 2023**
Acted as an expert statistical consultant for a project examining the relationship between the labor market and female reproductive behavior in China in 1982–2015. Analyzed survey and census data using multilevel survival analysis. Addressed the client's missing data concerns using multiple imputation.

**Research Assistant**, University of Washington **2017 – 2023**

1. Evaluated how women's education and access to family planning can impact fertility decline in high-fertility countries to improve current probabilistic projections of fertility. Used regression and time series methods in R to evaluate quasi-causality and the possible effects of education and

family planning policy outcomes on fertility.
2. Created a Bayesian hierarchical model for conditional probabilistic projections of fertility for five-year time periods, conditional on policy interventions targeting women's education and access to family planning. Estimated models using Markov chain Monte Carlo (MCMC) methods and assessed model performance using out of sample validation.
3. Developed Bayesian methods for multiple imputation of missing data in multilevel time series data with nonlinear relationships, using school enrollment rates as a motivating dataset. Estimated models using MCMC methods and assessed model performance through simulation studies.

**Teaching Assistant**, University of Washington **2019 – 2022**
Led weekly discussion sections, graded homework, and held office hours for CSSS/STAT/SOC 563 "Statistical Demography," which covered topics including modeling age-specific demographic rates, statistical modeling and forecasting of fertility, mortality, migration, and population, and reconstructing vital rates from imperfect data.

**Student Trainee (Statistician)**, U.S. Census Bureau **Summer 2018**
Analyzed American Community Survey paradata using SQL, Excel, and SAS at the Los Angeles Regional Office (LARO) through the Pathways Internship Program, focusing on letter request data and field representative performance adjustment data. Analyzed meeting evaluation data from the 2018 LARO field supervisor meeting using qualitative and quantitative methodologies. Compiled reports of all findings and presented to the regional office.

## JOURNAL PUBLICATIONS

Liu, D. H. and Raftery, A. E. (2024), Bayesian Projections of Total Fertility Rate Conditional on the United Nations Sustainable Development Goals. *Annals of Applied Statistics*, 18(1): 375-403. DOI: 10.1214/23-AOAS1793

Liu, D. H. and Raftery, A. E. (2020), How Do Education and Family Planning Accelerate Fertility Decline? *Population and Development Review*, 46: 409-441. DOI: 10.1111/padr.12347

- Selected citations:
  - United Nations Department of Economic and Social Affairs, Population Division (2021). Global Population Growth and Sustainable Development.
  - United Nations Population Fund (2023). State of World Population 2023.
- Media coverage:
  - Eckart, Kim for UW News (2020, September 8). How birth control, girls' education can slow population growth.
  - Schenk, Zoe (2020, October 5). Birth control: Empowering women and slowing population growth. *The Daily of the University of Washington.*

## PREPRINTS

Liu, D. H. and Raftery, A. E., Multiple Imputation of Hierarchical Nonlinear Time Series Data with an Application to School Enrollment Data. arXiv:2401.01872.

## OTHER PUBLICATIONS

Liu, D. H. and Raftery, A. E. (2021, May 29). Accelerating fertility decline through education and family planning. *N-IUSSP*.

## CONFERENCE PRESENTATIONS

Liu, D. H. and Raftery, A. E. (2022, April 6–9). "Bayesian Projections of Total Fertility Rate Conditional on the United Nations Sustainable Development Goals." In *Population Association of America Annual Meeting*, Atlanta, GA.

Liu, D. H. and Raftery, A. E. (2021, December 5–10). "Bayesian Projections of the Total Fertility Rate for Improvements in Education and Family Planning." In *IUSSP International Population Conference*, virtual.

Liu, D. H. and Raftery, A. E. (2021, May 5–8). "Bayesian Projections of the Total Fertility Rate for Improvements in Education and Family Planning." In *Population Association of America Annual Meeting*, virtual. (Poster presentation)

Liu, D. H. and Raftery, A. E. (2020, April 23–25). "How Do Education and Family Planning Accelerate Fertility Decline?" In *Population Association of America Annual Meeting*, virtual.

Liu, D. H. and Raftery, A. E. (2019, April 10–13). "Assessing the Impact of Potential Policies on Fertility in High-Fertility Countries Using Granger Causality and Bayesian Hierarchical Models." In *Population Association of America Annual Meeting*, Austin, TX. (Poster presentation)

## SERVICE

**Graduate Student Representative** **2018 – 2019**
*Department of Statistics, University of Washington*
Served as a liaison between graduate students and faculty. Planned new student orientation, prospective student visit days, and department social events. Attended weekly faculty meetings and relayed information to graduate students. Provided support, guidance, and resources for other graduate students.

**Statisticians and Biostatisticians of Underrepresented Genders (SBUG) Officer** **2017 – 2021**
*University of Washington*
Planned events and meetings designed to highlight the contributions of and support women and non-binary students in Biostatistics and Statistics. Founding officer.

**Diversity Committee Student Representative** **2017 – 2020**
*Department of Statistics, University of Washington*
Acted as a student liaison for issues of diversity, equity, and inclusion pertaining to the Department of Statistics. Founding member.