BIOSTAT BULLETIN

UCLA Department of Biostatistics Quarterly Newsletter

Prepared by Emilie Campos, Caesar Li, and Ami Sheth on behalf of the Biostatistics Student Association

MESSAGE FROM THE CHAIRS

Dear Students,

We hope your Spring quarter of 2021 is going well and you are looking forward to the summer.

After a challenging and turbulent year that affected us in sobering ways, there are reasons to feel optimistic about the summer. The US has fully vaccinated over 40% of its population with over 50% now having received at least one dose. Plans for resuming our longstanding conception of everyday life are being discussed, and it is heartening to hear assurances from public health experts that pandemic restrictions can be lifted. Nevertheless, recognizing that every case count refers to a real person, it is not yet time to let down our guard. Almost 60% of Californians are yet to be fully vaccinated and about 43% of Californians have not yet received their first dose. These statistics demand that we continue to act responsibly out of consideration for our own health and that of our fellow citizens.

The previous year was also witness to reprehensible acts of violence and bigotry, including incidents of police brutality against people of color, wide-ranging antipathy and violence targeting Asian Americans, and recent aggression directed at people based only on their identification with Palestinians or Israelis. Acts of abuse and violence targeting individuals on the basis of identity have no place in civil society and must be condemned. All of us have a role to play in ensuring a pleasant and welcoming environment on campus, and we view our field as having a role to play in bringing conceptual clarity to the meaning of identity.

Our Department's commitment to equity, diversity and inclusion (EDI) is reflected in our recent formal establishment of a departmental EDI committee. The committee is chaired by Professor Christina Ramirez, and it includes Professor Tom Belin and Professor Catherine Crespi as faculty representatives and Ms. Mingfei Dong as a student representative. We encourage all of you to reach out to the EDI committee with regard to any concerns, suggestions or feedback that you wish to share and that you think will play a constructive role in enhancing and ensuring a pleasant and inclusive academic experience in our department.

We would also like to take a moment to recognize a number of splendid student achievements. School-wide FSPH awards were announced this quarter and featured several Biostatistics awardees. We extend our warmest congratulations to Crystal Shaw and Qi Qian for being selected as recipients of Raymond Goodman Scholarships, to Doug Morrison for being the winner of the Carolbeth Korn Prize, and to Juhyun Kim for being selected to receive a Dean's Outstanding Student Award. We also congratulate Joanna Boland on her being awarded a Graduate Student Mentorship through the UCLA Graduate Division, Do Hyun Kim on being awarded a fellowship supported by the Genomic Analysis and Interpretation Training Program that bridges our department with the Department of Human Genetics, and Wenxi Yu for receiving an Abstract Scholarship from the American Thoracic Society (ATS).

We also continue to appreciate and to be impressed by the efforts of the BSA for their several initiatives that enrich the student and faculty experience in our Department. Regular "Coffee with the Chairs" gatherings and BSA-organized social events have been enormously meaningful in cultivating a sense of community during this challenging year. As always, we look forward to reading the rest of the Spring 2021 Newsletter. We reiterate our commitment to the well-being of our students and to supporting future BSA initiatives, and we salute those of you who have devoted time and energy to these collective efforts that benefit us all.

We wish all of you the very best for the rest of Spring quarter, and we hope that the summer brings yet more opportunities for growth and renewal. Please stay well and healthy, and in anticipation of an upcoming academic year where we can channel resilience into resurgence, let us all look forward to meeting in person in the Fall quarter.

Sudipto Banerjee, Chair
Thomas R. Belin, Vice Chair

CONGRATS 2021 GRADS

The 2021 virtual commencement will take place on June 11 at 3:00pm. Dr. Elaine Batchlor will deliver the 2021 commencement address.

MASTER OF PUBLIC HEALTH

Olivia Grace Golston
Kaitlyn Rohsuanne Huang
Derek Yeh-Shin Lee
Brett Michael Young

MASTER OF SCIENCE

Ricardo Alexandro Aguilar
Valentina Rojwil Arputhasamy
Mingfei Dong
Juehao Hu
Yilan Huang
Edward Yu
Evan Yoon Jun
Xinyang Li
Andy Zhang Liu
Nan Liu
Yuetong Lyu
Wenlan Pan
Qi Qian
Ami Sheth
Diyang Wu
Yutong Wu
Yu Xia
Naining Xu
Mingjia Yao
Hanyan Yuan
Hang Zeng
Xiaojing Zhang
Kevin Ziehl

DOCTOR OF PHILOSOPHY

Alec Michael Chan-Golston (Sudipto Banerjee, Chair)
Bayesian Estimation of Finite Population Quantities from Spatially Correlated Data under Ignorable and Nonignorable Survey Designs

Nadejda Fedortsova (Thomas R. Belin, Chair)
Strategies for Analyzing Ordinal Quality-of-Life Data with Application to Patient's Assessment Of Own Functioning Inventory

Christopher Austin German (Janet Sinsheimer and Hua Zhou, Co-Chairs)
Statistical Methods for Genome-Wide Association Studies on Biobank Data

Juhyun Kim (Hua Zhou, Chair)
Elucidating the Genetic Architecture of Complex Traits with Variance Component Models

Douglas Ezra Morrison (Ronald S. Brookmeyer, Chair)
Statistical Challenges in Incidence Estimation using Cross-Sectional Data and Multi-Biomarker Assay Algorithms

Bingling Wang (Sudipto Banerjee and Qing Zhou, Co-Chairs)
Structure Learning of DAGs from Observational Data with Multivariate Spatial Processes and with Non-invertible Functional Relationships

Jason Wang (Robert E. Weiss, Chair)

Justin Randall Williams (Catherine Crespi, Chair)
Methods for Estimating Causal Effects for Multivariate Continuous Exposure

Wenxi Yu (Grace Kim and Hua Zhou, Co-Chairs)
Domain Knowledge-Assisted Methods for a Weakly Supervised Task: Automated Diagnosis of Idiopathic Pulmonary Fibrosis using High Resolution Computed Tomography Scans

Zizhao Zhang (Weng Kee Wong, Chair)
Using Competitive Swarm Optimizer with Mutated Agents to Find Optimal Experimental Designs

2020-2021 Biostat Student Awards

Carolbeth Korn Prize
Douglas Morrison

Dean's Outstanding Student Award, Biostatistics
Juhyun Kim

Raymond Goodman Scholarship
Qi Qian
Crystal Shaw

Delta Omega Honorary Society in Public Health, Iota Chapter
Qi Qian
Mingfei Dong
Yilan Huang
Justin Williams
Juhyun Kim
Douglas Morrison

Graduate Research Mentorship Award
Joanna Boland

Abstract Scholarship from the American Thoracic Society (ATS)
Wenxi Yu

STUDENT-LED PUBLICATIONS

REGRESSION WITH INTERVAL-CENSORED COVARIATES: APPLICATION TO CROSS-SECTIONAL INCIDENCE ESTIMATION

BY DOUGLAS MORRISON

A method for generalized linear regression with interval-censored covariates is described, extending previous approaches. A scenario is considered in which an interval-censored covariate of interest is defined as a function of other variables. Instead of directly modeling the distribution of the interval-censored covariate of interest, the distributions of the variables which determine that covariate are modeled, and the distribution of the covariate of interest is inferred indirectly. This approach leads to an estimation procedure using the Expectation-Maximization (EM) algorithm. The performance of this approach is compared to two alternative approaches, one in which the censoring interval midpoints are used as estimates of the censored covariate values, and another in which the censored values are multiply imputed using uniform distributions over the censoring intervals. A simulation framework is constructed to assess these methods' accuracies across a range of scenarios. The proposed approach is found to have less bias than midpoint analysis and uniform imputation, at the cost of small increases in standard error.

EVALUATION OF SELECTIVE SURVIVAL AND SEX/GENDER DIFFERENCES IN DEMENTIA INCIDENCE USING A SIMULATION MODEL

BY CRYSTAL SHAW

Dementia research is susceptible to bias arising from selective survival, a process that results in individuals with certain characteristics disproportionately surviving to old age. Spurious associations between risk factors and dementia may be induced when factors associated with longer survival also influence dementia incidence. The objective of the present paper is to assess the role of selective survival in explaining reported sex/gender differences in dementia incidence.

The decision analytical model used a simulated cohort of US participants aged 50 years and without dementia at baseline, followed for incident dementia through age 95 years. Selective survival was induced by a selection characteristic (eg, childhood social disadvantage or Alzheimer genetic risk) that influenced both mortality and dementia incidence at varying magnitudes. Data analysis was performed from April 2018 to May 2020. Sex/gender was conceptualized as the combination of biological sex and social consequences of gender, and dementia incidence rate ratios (IRRs) for women compared with men in simulations are reported. In all simulations, it was assumed that there would be no true effect of sex/gender on dementia incidence; all observed sex/gender differences were due to selective survival.

At baseline, the simulation included 100 000 participants aged 50 years (51 000 [51%] women, mirroring the 1919-1921 US birth cohort of non-Latino White individuals at age 50 years); distributions of the selection characteristic were standard normal (mean [SD], 0.0 [1.0]) at baseline. Observed sex/gender differences in dementia incidence in individuals aged 85 years or older ranged from insignificant (IRR, 1.00; 95% CI, 0.91-1.11) to consistent with sex/gender differences (20% higher risk for women [IRR, 1.20; 95% CI, 1.08-1.32]) reported in an extant study. Simulations in which bias was large enough to explain prior findings required moderate to large differential effects of selective survival (eg, hazard ratio for selection characteristic on mortality at least 2.0 among men, no effect among women). These results suggest that selective survival may contribute to observed sex/gender differences in dementia incidence but do not preclude potential contributions of sex/gender-specific mechanisms. Further research on plausibility of selection characteristics with outcomes of the magnitude required for selective survival to explain sex/gender differences in dementia incidence and sex/gender-specific mechanisms represent an opportunity to understand prevention and treatment of dementia.

MODERN SIMULATION UTILITIES FOR GENETIC ANALYSIS

BY SARAH S. JI AND CHRIS A. GERMAN

Background: Statistical geneticists employ simulation to estimate the power of proposed studies, test new analysis tools, and evaluate properties of causal models. Although there are existing trait simulators, there is ample room for modernization. For example, most phenotype simulators are limited to Gaussian traits or traits transformable to normality, while ignoring qualitative traits and realistic, non-normal trait distributions. Also, modern computer languages, such as Julia, that accommodate parallelization and cloud-based computing are now mainstream but rarely used in older applications. To meet the challenges of contemporary big studies, it is important for geneticists to adopt new computational tools.

Results: We present TraitSimulation, an open-source Julia package that makes it trivial to quickly simulate phenotypes under a variety of genetic architectures. This package is integrated into our OpenMendel suite for easy downstream analyses. Julia was purpose-built for scientific programming and provides tremendous speed and memory efficiency, easy access to multi-CPU and GPU hardware, and to distributed and cloud-based parallelization. TraitSimulation is designed to encourage flexible trait simulation, including via the standard devices of applied statistics, generalized linear models (GLMs) and generalized linear mixed models (GLMMs). TraitSimulation also accommodates many study designs: unrelateds, sibships, pedigrees, or a mixture of all three. (Of course, for data with pedigrees or cryptic relationships, the simulation process must include the genetic dependencies among the individuals.) We consider an assortment of trait models and study designs to illustrate integrated simulation and analysis pipelines. Step-by-step instructions for these analyses are available in our electronic Jupyter notebooks on Github. These interactive notebooks are ideal for reproducible research.

Conclusion: The TraitSimulation package has three main advantages. (1) It leverages the computational efficiency and ease of use of Julia to provide extremely fast, straightforward simulation of even the most complex genetic models, including GLMs and GLMMs. (2) It can be operated entirely within, but is not limited to, the integrated analysis pipeline of OpenMendel. And finally (3), by allowing a wider range of more realistic phenotype models, TraitSimulation brings power calculations and diagnostic tools closer to what investigators might see in real-world analyses.

BSA UPDATES

Hello Summer! 😎 Congrats to us all for finishing out this full year of remote learning and working! It's been a unique and challenging experience, but in true Bruin spirit, our we all rose to the challenge and persevered. BSA is proud of what we were able to accomplish this year despite being completely remote. We assisted in building an online community in our slack workspace to facilitate smooth and efficient communication, we hosted many virtual socials for students as well as faculty, organized coffee with the chair events, and hosted alumni career panels. There is no substitute for gathering in-person, though, so we are eagerly anticipating our return to campus in the 2021-2022 school year! Our events committee will be hard at work this summer planning events in accordance with university guidelines for group gatherings!

We're saying goodbye to two of our board members this year! Congrats to John (Social Chair) and Doug (VP of Financial Affairs) for successfully defending their dissertations! We wish them all the best and are so thankful to have worked with them on BSA these past two years!

The board has decided to reorganize the structure of BSA next year. We are shifting to three committees lead by chairs: Events/Party Planning Committee (chair: Milan Filipovic), Student Rep Committee (chair: TBD), and Outreach & Communications Committee (chair: Emilie Campos). We hope this more fluid structure will encourage more students to join our board. Please reach out to us if you would like more information on our committees and how to join. We would love to have you!

Take some well-deserved R&R this summer—we'll see you in the fall!

Emilie Campos and Crystal Shaw, BSA Co-Presidents

Announcing the 2021-2022 BSA Board

Milan Filipovic, Social Chair

Lillian Chen, Student Rep

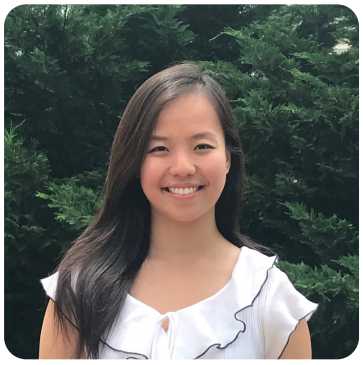
Tina Arputhasamy, Event Planning

Ami Sheth, Event Planning

Emilie Campos, Outreach & Communications

Crystal Shaw, Career & Professional Development

Caesar Li, Committee Member



Jane Pan, Historian

If you would like to get involved in planning social events or representing the wants and needs of your peers, please join our team! We are always welcoming new board members.