COLUMBIA | MAILMAN SCHOOL OF PUBLIC HEALTH

BIOSTATISTICS

Significant Moments

Newsletter of the Mailman School of Public Health Biostatistics Department

November 2020

In this Issue

Message from the Chair

Kiros Berhane, PhD

It is my pleasure to welcome you to the Fall 2020 edition of Significant Moments. It has now been almost a year since I joined the department as the new chair. My inaugural message in the previous issue was full of enthusiasm and optimism about the future of the department. Despite the many new challenges due to the COVID-19 pandemic and the uncertainties we face, my enthusiasm for the future of the department remains high. In fact, I feel even more energized now as I am proud of the way our department, the Columbia University community and the City of New York have been able to handle extraordinary challenges and the way our community is bouncing back from being the most hard-hit city of the world. By any measure, the past several months have been unprecedented in the unique challenges that they have posed to our university community and, indeed, the very fabric of our global society.

This issue highlights the many accomplishments of our department in fulfilling its mission in the face of the pandemic and its significant contributions in dealing with the pandemic. Our educational programs had to go fully online in the middle of the Spring semester, and all operations had to be conducted remotely since mid-March. Despite all this (and thanks to all faculty, staff and students), we managed to maintain the high quality of our teaching programs, kept our community connected through virtual innovations, managed to complete our semester successfully with full celebration of graduating students and have been able to continue our research programs. The need to go online for our educational programs has led to many innovations that have informed the future of our teaching approaches. The department has been contributing significantly to research on COVID-19 through design and analysis of related trials and has created innovative dashboards that provide readily digestible information about the distribution and trends of the pandemic. We continued our strategic planning process, culminating with an expanded leadership structure with two new Vice Chairs for education and research, and enhancements in our educational leadership team. We are pleased that we were able to hire a very promising and talented faculty member – Dr. Daniel Malinsky. We applaud and extend best wishes to our two departing faculty colleagues: Gen Li, on his move to University of Michigan and Xinhua Liu, whose brilliant collaborative contributions we hold in the greatest esteem, as she transitions to Emeritus status.

We made significant strides toward becoming a major player in advancing public health data science. The Public Health Data Science summit in Mid-January was a resounding success, with significant contributions from our department. I had the pleasure of delivering a Grand Rounds Lecture on "Data for Social Justice" as part of the Dean's Special Series marking the 400th Year Anniversary of the beginning of slavery in the United States. We have continued to strengthen our connections with the Columbia Data Science Institute. We added a new track on Public Health Data Science to our MS program, and renamed our certificate program as "Applied Biostatistics and Public Health Data Science".

I am very proud of the way our department and the school as a whole have responded as an integral part of the nationwide and global protests denouncing anti-black violence and systemic racism. The department and School are taking major steps towards becoming a truly diverse and inclusive academic community.

As you will see in this issue, the department has continued to excel in publishing cutting-edge research on both methodologic and collaborative areas, and in securing grants in this very competitive climate. It has continued its strategic progress to maintain its many areas of current strength and charting new directions. Finally, I reiterate my invitation to all of you to remain engaged with the department. We hope to have the privilege of hosting you as visitors (virtually or otherwise) to share your knowledge and wisdom and, hopefully, as potential collaborators, new colleagues and/or future trainees at all levels. Stay safe and healthy!

NEW FACULTY

Interview with Dan Malinsky, Phd

Assistant Professor

You have a rather diverse academic background. Can you describe your path to biostatistics, and what eventually drew you there?

As an undergraduate, I was interested in a bunch of different things: science, music, politics, etc. I thought initially that I would probably end up a physicist, and I even had the opportunity to spend a summer at the Large Hadron Collider in Geneva. However, at the same time I was feeling intellectually distracted by two things: 1) physics seemed divorced from really pressing social/political policy issues, and 2) I was encountering, by chance, perplexing foundational questions about scientific methodology, e.g., what is "the right way" to draw conclusions from data and what principles, if any, may underlie these inferences? I eventually decided to attend the graduate program in "Logic, Computation, and Methodology" at Carnegie Mellon, where I was exposed to a unique mix of philosophy, math, statistics, computer science, and social sciences. I studied causality from a number of different perspectives with an eye towards how methodological choices have an impact on policy debates. Then, as a postdoc at Johns Hopkins I had more direct interactions with the world of biostatistics, where these interests came together in a new way for me. I realized that in biostatistics I could combine policy relevance and methodology in a way that was natural: we care about people's well-being and health, we use empirical methods to learn about the best ways of acting (treatments, interventions, policies), and these things are related since better or more robust methods can contribute (we hope) to better policy decisions.

You grew up in the New York City area, and are an alumnus of Columbia College. How does it feel to return to New York and to Columbia?

It feels surreal, but also very nice. Taking on the role of faculty at a place where I was once a student will definitely be an adjustment. I am a big fan of New York City, and of course happy to be here, near most of my family.

What are your main research interests?

I study methods for making data-driven treatment or policy decisions from observational data. I focus on causal inference, often using graphical models. Sometimes, which is the "right" graph is not obvious and we would like to use the data itself to determine a plausible set of graphs – this is called "causal discovery" or "causal structure learning." Recently, I've also been interested in problems related to "fairness" and "bias" in data science. Statistical tools and machine learning algorithms have the potential to reproduce or amplify disparities that are reflected in the data (or to introduce new disparities). It is important to understand this risk, as well as how to mitigate it, if we are going to responsibly use these tools in practice.

What are your interests outside of work?

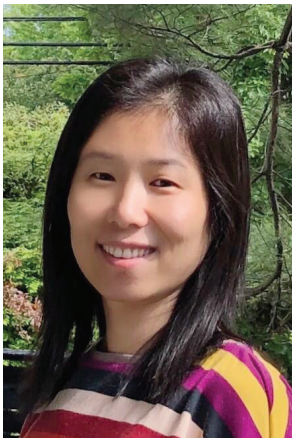
I like music and have really been missing the concert experience in these Covid pandemic days.

What has helped keep you grounded during the pandemic?

I have a dog, a pit bull named Ferdinand. Taking him outside for walks has definitely been an important diversion and nice way to split up my work day.

PROMOTED FACULTY

Interview with Min Qian, PhD



Associate Professor

What are your main areas of methodological interest?

My research is primarily focused on the development of data analytic methods to make better use of "big" data to inform decision making in precision medicine applications. Specifically, I am interested in: i) developing reinforcement learning methods for constructing treatment decision rules; ii) developing statistical inference methods to evaluate the reproducibility of treatment decision rules; iii) improving study design for data collection; and iv) integrating precision medicine methods and mobile health applications.

Why did you choose to work in academia, and how is life in this realm?

The field allows me to "Pursue curiosity, do interesting things, and get paid"—Prof. David Hu, a mathematical biologist (who was also criticized as a "wasteful scientist") at Georgia Tech, in a talk to our local kids. It sounded like an amazing job! In addition to that, I would say that "freedom" and "impact" are two major advantages. I have the freedom to conduct research on what I see fit, to choose who I work with, to learn new things from my wonderful colleagues, and to arrange my own work schedule. I have an impact on students' lives through teaching and mentoring, and on public health by participating in important and interesting medical research.

What is a biostatistician's role in the emergence of data sciences?

In 1997, Prof. Jeff Wu gave the inaugural lecture entitled "Statistics = Data Science?" for his appointment as the H. C. Carver Professor at the University of Michigan. If we had adopted his affirmative answer then, we would have avoided the argument about the role of statisticians in data science.

The Data Science Process is a framework for approaching data science tasks. It includes proposing the research question, obtaining the data, analyzing them, and communicating the results (from Joe Blitzstein and Hanspeter Pfister's Harvard course Computer Science 109). We biostatisticians play a vital role in this process. In my view, we should i) constantly learn and develop new methodologies (mastering not only how to use them, but also why they work); ii) bring a critical perspective to the era of big data (not all data are useful; sophisticated methods may not always be better than simple methods, e.g. deep neural networks may only show their advantages when we have large amounts of data); and iii) be proactive in communicating with clinical researchers, so that we can use appropriate methods to analyze the data and to tell a good story.

What is your educational philosophy?

Teaching has been an integral part of my career at Columbia. Instead of simply imparting to students the knowledge in textbooks, I hope to train them to be independent thinkers. While I firmly believe that a good mentor should advise students in terms of coursework, I consider it equally, or even more, important to help students set up their career plans.

What are your interests outside of work?

Well, these change over time. I'm currently interested in my kids' education, cooking, fitness, and traveling around the world (and have probably stayed too long at home during the pandemic).

PROMOTED FACULTY

Interview with Shuang Wang, PhD

Professor

What are your main areas of methodological interest?

The focus of my research is on the development of statistical and computational methods and their applications to solve scientific problems in genetics, genomics, epigenetics, and multi-omics. In particular, I have developed methods for mapping health outcome-associated differential expression or differential methylation (DM) incorporating network information for different study designs (implemented in software pclogit, NEpiC, pETM, and DisNEP). Recognizing the importance of differential variation (DV) in cancer subtypes, I have developed multiple methods to capture both DM and DV. These include a method to detect differentially methylated regions (DMRs) by borrowing information from neighboring correlated CpGs with DM and DV signals, and an epigenetic distance-based method that accumulates CpG site-level weak DM and DV signals. In addition, I have developed the very first mitotic age (number of lifetime cell divisions) calculator (implemented in software MiAge) using DNA methylation data, based on the stochastic replication errors accumulated in the epigenetic inheritance process during cell divisions. I have also worked on method development for multi-omics data integration to better understand biological processes and have developed an association-signal-annotation boosted similarity network fusion (ab-SNF) method to improve the performance in disease subtyping. More recently, I have begun work on developing statistical and computational methods for electronic health record (EHR) data.

Why have you chosen to work in academia?

I genuinely enjoy what I do here, and the intellectual freedom that an academic job provides. It allows me to determine what I want to work on, from genetics, to epigenetics, to multi-omics. In academia, I have often felt privileged to be able to work with people who are experts in many different disciplines, and that my research is able to change the world for the better. The change might be small, but it is worth the effort. A life in academia is one of study and enrichment: I feel joyful that I am learning new things every day.

Another source of satisfaction in academia is through teaching and mentoring students. It is rewarding to see that I have inspired or had a positive impact on someone.

You work with many mentees. What is your approach?

While every mentee is different, with a particular background and goals, I help each one to develop certain very important universal skills, namely, to communicate effectively, to think critically and be able to ask questions, and to focus and balance different tasks. In addition to these universal skills, I help create concrete plans of action to help mentees reach their goals, and I make myself available to them all the time.

What are your interests outside of work?

I enjoy playing badminton. But I haven't played for more than 6 months due to COVID. I can't wait to get back on the court. I also enjoy hiking with my family and friends. Also due to COVID, we get to explore nearby trails and hike every weekend.

Faculty Awards

IULIANA IONITA-LAZA, Associate Professor of Biostatistics, has been appointed to a leadership role in the **Section on Statistics** in Genomics and Genetics of the American statistical Association. Iuliana's research interests lie at the interface between statistics and genomics. Her primary interest is in developing statistical and computational methods for the analysis of high-dimensional genetic and functional genomics data. She is also involved in applications of these methods to understanding the genetic basis of complex diseases and traits, including autism spectrum disorders and schizophrenia. She is a recognized leader in developing new programs to bring these innovative methods to students.

SHING LEE is Associate Professor of Biostatistics and the Director of the Biostatistics, Epidemiology, and Research Design (BERD) resource at the Irving Institute for Clinical and Translational Research. She has received the **2020 Outstanding Mentorship Award** of the American Statistical Association (ASA). Dr. Lee's research interest is in the implementation of novel designs for early stage trials, and particularly in developing novel statistical methods for targeted and immunotherapeutic cancer agents. She has over ten years of experience in statistical consulting and has assisted numerous investigators from a variety of medical disciplines in the design, conduct and analysis of clinical studies.

IAN MCKEAGUE, Professor of Biostatistics, is **Co-Editor elect of the Journal of the American Statistical Association (JASA)**. Ian's research interests include survival analysis, competing risks models for HIV/AIDS data, Markov chain Monte Carlo and Bayesian methods, empirical likelihood, statistical methods in physical oceanography, functional data analysis, inference for stochastic processes, simultaneous inference, efficient estimation for semiparametric models, missing data, counting processes, image analysis, and spatial point processes. Before coming to Biostatistics at Columbia University in 2004 he was Chair of Biostatistics and Ralph A. Bradley Professor of Statistics at Florida State University. He has been associate editor of the Annals of Statistics and the Journal of the American Statistical Association, and currently serves on the editorial boards of Statistical Inference for Stochastic Processes, and the International Journal of Biostatistics. He is a fellow of the Institute of Mathematical Statistics and a fellow of the American Statistical Association.

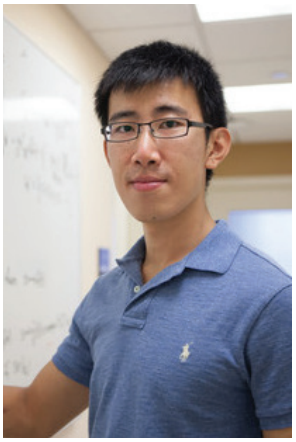
YIFEI SUN, Assistant Professor of Biostatistics, has been awarded the **Sanford Bolton Faculty Scholar Award** for junior faculty. This program, launched in 2018, supports research innovation by a faculty member for a two-year period. It was made possible by the generous bequest of an esteemed alumnus, the late Dr. Sanford Bolton, whose career in pharmaceutical statistics has had lasting impact, thanks to his innovation, his classic book Pharmaceutical Statistics, and his successful translation of statistical ideas to practice. Dr. Sun is expert in Data Science, Longitudinal Studies, Nonparametric Methods, Predictive Modeling/Machine Learning, and Survival Analysis. Her main methodological interest lies in biostatistical methodology and its application to medicine and epidemiology (electronic health records, precision medicine, etc.). She is actively engaged in working with collaborators on scientific problems that arise in research on wearable devices.

YUANJIA WANG, Professor of Biostatistics (in Psychiatry), has been appointed **Chair elect for 2021 of the Health Policy Statistics Section (HPSS) of the American Statistical Association**. The Objectives of HPSS include sponsoring statistical conferences at the regional, national, and international level;. offering assistance for student training opportunities; establishing health policy fellowship programs with industry and government; encouraging members to publish on health policy; and establishing new collaborations using public and private data to study health policy issues.

YING WEI, Professor of Biostatistics, has been named **Fellow of the Institute of Mathematical Statistics (IMS)**. The IMS fosters the development and the dissemination of the theory and applications of statistics and probability. Fellows have demonstrated distinction in research in statistics or probability. Dr. Wei received the award for contributions to the development, dissemination, and application of mathematical statistics.

FACULTY TRANSITIONS

Interview with Gen Li, PhD



Assistant Professor

When did you join Columbia and what was your background before that?

I joined the Department of Biostatistics in July 2015, right after I obtained my PhD in statistics and operations research from the University of North Carolina at Chapel Hill. Before attending UNC, I obtained my bachelor's degree in statistics from Beijing Normal University in China.

How would like your stay at Columbia to be remembered?

Columbia is my first academic home. I underwent a series of transitions here, e.g., from a research assistant to an independent researcher, from a student to an instructor, and from an advisee to an advisor. These transitions were not easy, especially because I came from a statistics background, but I received tremendous help from my colleagues in the department. The first couple of years were truly stressful since I had to learn a great deal from scratch. I had very little experience in grant writing, collaborative research or teaching. Todd, Ying, Jeff and many others were very generously shared their invaluable experience without any reservation. I still remember the days when I caught the last bus home every day and biked to the office on weekends. But the effort was well spent. I established long-term collaborations with various research groups in Mailman and the medical center at large, and received my first NIH grant by the end of my third year and my first R01 by the end of my fifth year. I have led the effort to revamp the MS course Biostatistical Methods II, which has consistently been highly rated over the years. I was also grateful to be the inaugural Sanford Bolton faculty scholar in the department. I owe all these achievements to my great colleagues. I'll carry the things I've learned here with me and always look back on this experience with tons of fondness. I know that Columbia Biostat is always my home, and that amazing things will continue to happen here!

What is your advice for prospective new faculty?

The department provides a great academic and cultural milieu. Colleagues are always friendly and eager to help. If you have any questions – whether as small as how to use the copy machine or as big as how to conceptualize your next grant proposal -- you can always find someone to talk to. So my suggestion is to be proactive. Do not hesitate to seek help whenever you need it. In addition, more senior colleagues usually have invaluable advice on a lot of things, such as how to establish new collaborations and how to supervise students. I found it extremely helpful to chat with colleagues.

What is your next career move?

For family reasons, I will join the University of Michigan, Ann Arbor, as a tenure-track assistant professor in Biostatistics as of August 31, 2020.

FACULTY TRANSITIONS

Interview with Xinhua Liu, PhD

Professor

When did you join Columbia and what was background before that?

I finished my Ph.D. program in Biostatistics at The Johns Hopkins University and returned to Shanghai First Medical University in 1990, where I had worked before. In the summer of 1993 I came to CUMC as Postdoctoral Research Fellow at the HIV Center for Clinical and Behavioral Studies, New York State Psychiatric Institute and Columbia University. After working in the division of Biostatistics and Department of Research Assessment and Training at the New York State Psychiatric Institute for a total of almost 9 years as a biostatistician, I became a faculty member in the department of Biostatistics of the Mailman School of Public Health in the fall of 2003.

How would you like your stay at Columbia to be remembered?

As a friendly and helpful person.

What is your advice for prospective new faculty?

Make as many friends as you can (not only with colleagues, collaborators, administrators, but also with staff, research assistants, teaching assistants, etc.) and appreciate all the people who have been helping you.

What is your next career move?

I do not have the goal of a post-retirement career, but I have planned many activities. The COVID-19 pandemic has delayed my travel plans, so I will spend more time on reading books to satisfy my curiosity and doing exercises to improve my physical strength.

NEW GRANTS

Kiros Berhane

U2RTW010125 (TRANSFER) funded by Fogarty International Center (Role: PI) (Award: 09/25/15-07/3121)
"2/2 - GEOHealth Hub for Research and Training in eastern Africa - U.S."

This application proposes a progressive and tiered training program that will develop researchers and research teams able to carry out the research agenda of the Eastern Africa GEOHealth Hub and to facilitate the translation of the research findings into impactful actions by key stakeholders. The Hub will train 12 lead scientists, three from each of the LMIC participating countries, who will become national leaders in environmental and occupational health research. It will also train multidisciplinary research teams, develop curricular materials for academic and stakeholder institutions, and foster evidence translation and implementation with a long-range goal of establishing a sustainable Hub for the region.

R01-ES029945-01A1 funded by Duke University/ National Institute of Health (Role: Subcontract PI) (Award: 01/01/20-05/31/23)
"Impact of Preconception and Onward Exposure to Air Pollution on Growth Trajectories of Infants and Children"

This project will fill critical knowledge gaps in our understanding of the effect of early life Exposure to Air Pollution, starting from sensitive Preconception periods of gametes maturation and continue through gestational process and infancy, on Birth weight and Growth trajectory in early childhood. Both lower body weight and excessive body growth are significant predictors of childhood obesity.

R21ES029681 funded by the University of Southern California/National institute of Environmental Health Sciences (Role: Subcontract PI) (Award: 05/01/19-04/30/21)
"Developmental origins of child liver injury: Effects of prenatal environmental Exposures"

Child liver injury and fatty liver disease are an important emerging public health problem. The goal of this project is to evaluate the impacts of a broad suite of prenatal environmental exposures on child liver injury. Quantifying the potential contribution of environmental pollutants to child liver disease is of critical importance since many such exposures are modifiable, and early intervention has the potential for significant public health benefit.

Jianhua Hu

R01AI143886-01A1 funded by NIH/NIA (Role: PI) (2019-2024)
"Novel analysis of association between microbiome and treatment infection in AML"

This proposal is devoted to developing a new set of statistically systematic and computationally efficient methods for utilizing complex and high-throughput imaging features to explore the associations with disease, which can potentially make a broad impact in biomedical research.

Ian McKeague

R01ES030966 funded by Research Foundation for Mental Hygiene/National Institute of Environmental Health Sciences (Role: Subcontract PI) (Award: 2020-2024)
"A national birth cohort study of prenatal factors and neurodevelopmental psychiatric disorders"

This study has significant relevance for Public Health, as it is aimed at identifying prenatal risk factors, including markers of maternal Oxidative Stress, in Schizophrenia and Autism spectrum disorders in a large national birth cohort. These factors have never before been investigated in maternal sera in relation to these outcomes. The proposed Research may offer the potential for prevention of these disorders by Public Health measures including reduction of exposure to factors that increase maternal Oxidative Stress, and could also result in an improved understanding of how prenatal insults alter Brain Development in these disorders.

Ying Wei

DMS1953527 funded by National Science Foundation (Role: PI) (Award: 08/15/20-07/31/23)
"Conditional Quantile Random Forest with Biomedical and Biological Applications"

Modern biology and biomedical science are experiencing a wave of machine learning applications as biological data sets become increasingly larger and more complex. Among them, random forest is particularly appealing and has gained great popularity in biology studies, genomic data analysis, and biomedical science. It offers great flexibility in modeling the complex data and associations, while still enjoying certain levels of interpretability and transparent decision mechanism. The proposal aims to develop a new framework of conditional quantile random forest (CQRF), which largely generalize the existing approaches. The proposal will investigate its potential in advancing biology and biomedical science with focused applications analyzing electronic medical records and genomic data. Once carried out, the proposed work may lead to new knowledge discoveries and new precision interventions in biomedical science.

Yuanjia Wang

Supplemental grant to R01GM124104-03S1 funded by NIGMS. Role: Multi-PI (2020-2022).
"Prediction Models for Public Health Intervention Evaluation and Individual Risk Assessment of COVID-19 Patients".

This project aims to develop robust and generalizable analytics to evaluate public health interventions in response to coronavirus disease 19 (COVID-19) pandemic and to assess individual patient risks using multiple sources of data (e.g., official reports of COVID cases, electronic health records). The project will provide quantitative evidence to guide precision public health interventions at the right time for the right subpopulation to effectively contain and mitigate the outbreak. It will also provide quantitative risk assessments of COVID-19 patients to facilitate best clinical management and optimal allocation of healthcare resources.

CONTINUING GRANTS

Melissa Begg

- NIH/NHLBI (R25 HL096260), "BEST-DP: Biostatistics & Epidemiology Summer Training Diversity Program," 2009-2024 (Contact PI; other Multi-PIs)

Ying Kuen (Ken) Cheung

- NIH/NIMH (R01 MH109496), "Novel Methods for Evaluation and Implementation of Behavioral Intervention Technologies for Depression," 2016-2021 (Role: PI)

Min Qian

- NIH/NIMH (R21 MH108999), "Building Multistage Treatment Regimens for Depression after Acute Coronary Syndrome," 2016-2020 (Role: PI)
- NIH/NIDA (R01 DA039901), "Novel Longitudinal Methods for SMART Studies of Drug Abuse and HIV," 2015-2020 (Role: Sub-contract PI)

Yuanjia Wang

- NIH/NIDA (R01 DA035846), "Impulsivity in Cocaine Abuser: Relationship to Drug Taking and Treatment Outcome," 2014-2020 (Role: Multi-PI)
- NIH/NINDS (R01 NS073671), "Statistical Methods for early disease prediction and treatment strategy estimation using biomarker signature," 2011-2021 (Role: PI)
- NIH/NIMH (R21MH117458) "Integrative Learning to Combine Evidence for Personalized Treatment Strategies" 2018-2020 (Role: PI)
- NIH/NIGM (R01GM124104) "Efficient Statistical Learning Methods for Personalized Medicine Using Large Scale Biomedical Data"2018-2022 (Role: Multi-PI)

Ying Wei

- NIH/NHGRI (R01 HG008980), "Develop Quantile Analysis Tools for Sequencing and EQTL Studies," 2016-2020 (Role: PI)

Jeff Goldsmith

- NIH/NINDS (R01 NS097423), "Functional data analytics for kinematic assessments of motor control," 2016-2021 (Role: PI)

Iuliana Ionita-Laza

- NIH/NIMH (R01 MH106910), "Integrative methods for the identification of causal variants in mental disorder," 2016-2020 (Role: Lead PI)
- NIH/NIMH (R01MH095797), "Novel Statistical methods for DNA Sequencing Data, and applications to Autism," 2012-2020 (Role: PI)
- NIH/NIMH (R21MH106888), "Applications of novel statistical methods to CNVs in autism and schizophrenia," 2015-2020 (Role: PI)
- NIH/NIMH (R01MH095797), "Novel Statistical methods for DNA Sequencing Data, and applications to Autism" 2018-2022 (Role: PI)

Ian McKeague

- NIH/NIA (R01AG062401) "Inferential methods for functional data from wearable devices" 2019-2024 (Role:PI)
- NIH/NIMH (R01MH118247) "Maternal exposure to antidepressants and psychiatric outcomes among offspring in a national birth cohort." 2018-2022 (Role: subcontract PI)

Qixuan Chen

- NIH/NIEHS (R21ES029668), "Bayesian exposure-response analysis for immunoassays data with measurement errors" 2019-2021 (Role:PI)

R. Todd Ogden

- NIH/NIMH (R01 MH099003), "Characterizing Placebo Response," 2013-2022 (Role: Sub-contract PI)
- NIH/NIBIB (R01 EB024526), "Advance Modeling Techniques for Brain Imaging Data with PET" 2017-2021 (Role: PI)
- NIH/NIMH R01MH099003 (subcontract to CU) "Biotyping placebo and treatment-specific responses for precision medicine"2018-2022 (Role: Subcontract PI)
- NIH/NIMH R21 MH120534 (subcontract to CU) Nonparametric depth-based methods for analyzing high-dimensional data. Applications to biomedical research"2019-2021 (Role: Subcontract PI)
- NIH/NIMH (P50 MH090964) "Statistical models of suicidal behavior and brain biology using large data sets" 2018-2023 (Role: PI)

Martina Pavlicova

- NIH/NIDA (R01 DA035707), "Evaluating ART for All HIV Seropositives: Can it work with the hardest cases?" 2013-2020 (Role: Sub-contract PI)
- NIH/NIDA (UG1 DA013035), "NIDA Clinical Trials Network: Greater New York Node," 1999-2020 (Role: Sub-contract PI)
- NIH/NIMH P30 MH43520 (subcontract to CU) "HIV Center for Clinical and Behavioral Studies" 2018-2023 (Role: Subcontract PI)

Linda Valeri

- NIH/NIMH (K01MH118477), "Statistical methods for the assessment of social engagement in psychosis using digital technologies" 2018-2022 (Role: PI)

Shuang Wang

- NIH/NLM (R01LM013061), "Big Data Methods for Comprehensive Similarity based Risk Prediction", 2019-2024 (Role: PI)

Yifei Sun

- NIH/NIA U19 AG033655 (subcontract to CU) "Novel Measurment Approaches to Preclinical AD" 2019-2024) (Role: Subcontract PI)
- R01HL150065-01A1 (Role: Subcontract PI) (Award: 08/24/2020-07/31/2024) *Cardiovascular Health After Placental Abruption (CHAP)* The aim of the proposed research is to examine the associations between placental abruption and risks of cardiovascular and cerebrovascular mortality and morbidity later in life and to investigate racial disparities in abruption as determinants of disparities in cardiovascular mortality.
- R21HD102822-01 (Role: subcontract PI) (Award:

08/24/2020-07/31/2022) *The Role of Hypothalamic Pituitary- Adrenal Axis Dysregulation in Preterm Birth* The aim of the proposed research is to contribute to the understanding of the mechanism by which chronic dysregulation of the hypothalamic–pituitary–adrenal (HPA) axis affects the risk of preterm birth (PTB) among trauma-exposed pregnant women.

- The Role of Hypothalamic Pituitary- Adrenal Axis Dysregulation in Preterm Birth
  NIH R21 1R21HD102822-01 08/24/2020-07/31/2022 (Valeri subcontract PI)
  The aim of the proposed research is to contribute to the understanding of the mechanism by which chronic dysregulation of the hypothalamic–pituitary–adrenal (HPA) axis affects the risk of preterm birth (PTB) among trauma-exposed pregnant women.
  2020-2022

Shing Lee

- Funded by SWOG/Hope Foundation "Analysis and visualization of adverse events and patient reported outcomes that reflect overall treatment toxicity Burden" 2020-2021 (Role: PI)

Associate Professor
Chair, Committee on Diversity and Inclusion

Diversity and Inclusion—Going Forward

by Codruta Chiuzan, PhD

We Believe that having diverse representation, perspectives and voices within our department is vital for us to promote and foster an inclusive environment for all faculty, students and staff. Diversity for us includes, but is not limited to gender, race, ethnicity, cultural and socio-economic background, religion, age, physical ability, sexuality, and political preference. The main goals of the Department's Diversity and Inclusion Committee are to encourage diversity, multiculturalism and inclusiveness by creating change through education, collaboration and vigilance.

We Educate Ourselves by understanding racism and its roots, questioning our implicit biases, and challenging our own racial reality and belief systems. Starting two years ago, several of our faculty have participated in the Mailman *Faculty Inclusive Teaching Institute* that provides training on how to create and sustain inclusive classrooms. We have also been actively involved in the Self, Social and Global-Awareness (SSGA) series by volunteering as co-facilitators during the student orientation workshops. Lastly, we are currently developing a departmental climate survey with the intention of taking concrete actions towards a truly anti-racist and inclusive departmental environment. The survey will be distributed to all members of the department (faculty, students and staff) and the outcomes of the assessment will be used to inform our future diversity strategic plan.

We Take Action by getting involved in national and local organizations promoting recruitment of underrepresented students. We have established a collaboration with Baruch College and supported their *Science and Technology Entry Program* (STEP), a NY State Education Department funded pre-college program for middle and high school students who are interested in pursuing careers in the STEM (Science, Technology, Engineering and Math) professions.

In December 2019, our faculty and one of our PhD students, Margaret Gacheru, were invited to present their research projects as part of the program's Career Exploration Series. Margaret presented her research project focusing on "racial differences in patients with complicated grief (CG) with regards to how they cope with grief, symptoms associated with CG, and treatment response."

Margaret Gacheru
PhD Student

At the national level, our department has made significant contributions to the American Statistical Association (ASA) sponsored *StatFest* conference. StatFest aims at encouraging undergraduate students who are members of historically underrepresented groups to pursue careers and graduate studies in the statistical sciences. In the last few years, Justine Herrera and Cody Chiuzan have been part of the organizing committee and have served as panelists on the conference sessions. Every year, we also encourage our own students to attend the conference and share their graduate experience.

Steven Lawrence
MS Student

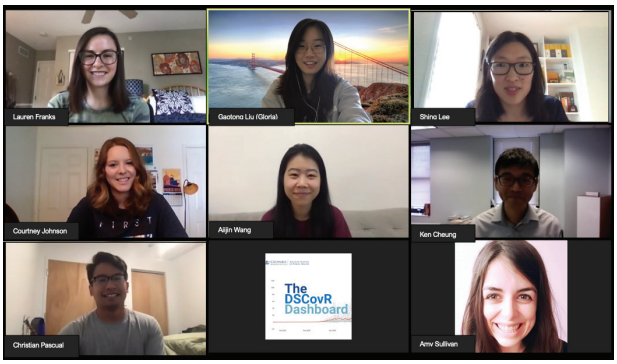
For StatFest 2020, Steven Lawrence, second year Masters student, has been nominated to talk about his training and address diversity issues. As he has previously stated: "Diversity is challenging but it is necessary, and we all have a role in ensuring everyone has a seat at the table."

As a culmination of our efforts to promote diversity, the Department of Biostatistics has been selected, in collaboration with the Department of Statistics, to host StatFest 2022 at Columbia University. This major opportunity will promote partnerships and collaborations amongst organization in academia, government, and industry) to increase recruitment of underrepresented students who are interested in the fields of statistics, biostatistics and data science.

Dashboard 1: The DSCovR Dashboard

Professor Shing Lee, Director, BERD

One goal of the Biostatistics, Epidemiology and Research Design (BERD) Resource of Columbia University's Irving Institute is to accelerate the dissemination of expertise, tools, and educational resources. This year with the pandemic, BERD took on the task of disseminating COVID-19 data in a clear and understandable manner to both the scientific community and general public. Early in the pandemic we were interested in understanding how demographics affected COVID outcomes. Under the guidance of Drs. Shing Lee, Director of BERD, and Ken Cheung, co-Director of Trial Innovation for BERD, staff members Aijin Wang and Lauren Franks took the initiative to assess the reporting of demographics across states and spent long hours compiling this information. We subsequently decided to elicit the help of former students Christian Pascual and Courtney Johnson and current students Amy Sullivan and Gloria Liu to develop an interactive dashboard named Demographics by State COVID-19 Reporting (DSCovR), launched in June 2020. This tool allows policymakers, scientists, and the lay public to track, visualize, and most importantly easily compare state level demographics and time trends for COVID-19 cases and deaths in the US. Early in the pandemic DSCovR dashboard highlighted the availability and reporting of state level demographic information, and racial disparities in COVID-19 cases and deaths.



In the summer, with the focus of the pandemic shifting to re-openings, we obtained policy information on re-openings from state government press releases and executive orders to develop new tools to visualize the various policies implemented by each state along with the number of new cases and deaths over time.

Moreover, we expanded the dashboard to include international death and time trends. This new feature provides worthwhile information for users who have an interest in the global landscape of the pandemic, and allows them to compare the landscape in different countries.

Aijin Wang

In an early project on the effect of gender on COVID outcomes, I realized that the demographics of COVID patients vary drastically by state. Although many states had their own website for COVID reporting, at the time no aggregated dataset contained demographic information from all states. I proposed that we fill this gap. We began to gather the state data to create the dataset, which became the dashboard. I was primarily responsible for data scraping and integration, and also contributed to building the dashboard.

The greatest challenges were to set priorities and construct the datasets. We had to decide which data were crucial, and how to tell a coherent story. Since states had their own website, we started from ground zero, browsing through sites to understand their key features, and constructed a dataset that synthesized their key elements and modified it to accurately reflect changes. We spent hours brainstorming on how to construct the most efficient process and data management system, and evaluated many visualization prototypes. Since our target audience included the general public as well as researchers, simplicity became a priority.

This project provided me with leadership experience and helped me to become better at working in a fast-paced environment while thinking about the big picture. It also taught me how to better communicate with a non-technical audience using numbers and visualizations. I'm still amazed by how my initial idea of aggregating the state level data and sharing them became such a well-constructed project.

Lauren Franks

Over the course of the pandemic, my role in developing and implementing the DSCovR dashboard has evolved with the changing landscape. Initially, I assisted with data collection and visualization, and designing the layout of the dashboard. By the end of

the summer, my focus shifted to the collection and visualization of the policy data, with help from students Amy and Gloria. I knew this project was going to be significant the first time Aijin shared her idea with me. As the idea took shape and we were developing a functional tool; I could see the impact we would have on the COVID-19 landscape. I appreciate how we've been able to be flexible, allowing ideas to change along with the pandemic. Our team has been able to recognize important emerging issues and respond by providing a helpful tool for the public.

My experience working on this project has taught me the value of collaborative work. Our workflow involved constant modifications and open conversations to continually improve the dashboard, with everyone's contributions crucial to developing the final product. Fostering an environment where everyone is comfortable sharing an idea, regardless if you're a student or staff member, is instrumental to producing quality work. I am especially grateful to Drs. Lee and Cheung for their support of the students and staff and for creating an environment that cultivates innovation and creativity.

Gloria Liu

Shing had accepted me to do a practicum with her, but during the pandemic help was needed to develop the DSCovR dashboard. I was honored and glad to participate. I have been mainly responsible for data collection and quality checking, the design and implementation of new visualizations for the policy data, and the maintenance of the dashboard.

The main challenges were to tidy the data which reflected more than 1,000 policies, and to establish the best way to present the data so that they are comprehensive and understandable.

Working with the group, I learned about the importance of teamwork, version control, and how to communicate appropriately and in a timely manner. We often needed to collaborate. Communication with each other was important to avoid repeating the same work. Version control helped me keep track of what had happened previously. Working with my excellent teammates was very interesting. I learned a lot about their ways of thinking. They also shared useful materials. They were so nice, and we had a great time during our Zoom meetings.

Courtney Johnson

Having the opportunity to collaborate on the DSCovR Dashboard has been incredibly meaningful to me, particularly because it has given me a way to use what I've learned at Columbia and have a positive impact. Working on this project has allowed me to contribute to important research and help communicate the information to the public.

I have also been able to apply and expand my knowledge on data visualization. While I was already familiar with software and graphics in this area, to achieve the project goals I had to conduct additional research and learn how to implement new graphical elements. It is always exciting to learn a method hands-on, and even more exciting when the results are tangible and useful. Seeing the outcome of my hard work with colleagues has reinforced my understanding of the importance of collaborative research and has made my work more fulfilling.

Christian Pascual

The most important experience I gained through my work with the DSCovR Dashboard was the chance to push my knowledge in a skill I only had brief exposure to. I was in charge of helping realize the dashboard interface and enhance the users' experience. There were many times when I was asked to address a problem I didn't know how to solve, but I challenged myself to create what the team wanted. Some solutions came quickly, but others required hours of painstaking research and troubleshooting.

Thankfully, my coursework and research helped me develop my resourcefulness, which in turn helped me push through difficult roadblocks. This resourcefulness has had many downstream benefits, in later projects and research. I encourage all my fellow Biostat students to challenge themselves and go the extra mile for their projects; their efforts will surely be recognized and rewarded.

Dashboard 2: NYC Neighborhoods COVID-19 Dashboard

Professor Qixuan Chen

The pandemic has highlighted the importance of public health, and how we as biostatisticians can contribute in our own way to the battle against it. Since the first confirmed case of COVID-19 in NYC on March 1, I have kept a close eye on the developments of cases, hospitalizations, and deaths in the city. I was shocked by the great variations in COVID death rates across NYC neighborhoods. Although many studies have been conducted, and some answers have been found, I believed we could tackle this problem better with a more sophisticated statistical approach. In late April Ziqi Zhou, an MS student in Biostatistics, started working on this as her practicum project with me as her advisor. Later in the summer, another three MS students (Mengyu Zhang, Yuanzhi Yu, and Yuchen Qi) joined us. We devoted a great deal of effort to collecting the data we needed. During this process we found that there was no layperson-friendly website that provided COVID tracking and development information in local neighborhoods. This motivated us to create the NYC Neighborhoods COVID-19 Dashboard (https://msph.shinyapps.io/nyc-neighborhoods-covid).

The Dashboard uses data from the NYC Department of Health and Mental Hygiene to track daily cases, deaths, and tests for every NYC neighborhood by Zip Code and provides data visualizations of distributions and time trends for COVID cases, hospitalizations, and deaths by neighborhoods and demographics. It also shows neighborhood characteristics with comparisons to boroughs and NYC as a whole. We recently added a COVID projection feature which provides 8-week projections of new cases, new hospitalizations, and new deaths.

A major feature of the dashboard is its versatility. Sorting by new cases or incidence rates in the tracker allows us to quickly identify the neighborhoods with the most new or cumulative cases citywide. Interactive maps of new cases and incidence rate by Zip Code enable identification of clusters of neighborhoods with the most virus cases emerging on a daily basis. Using the time trend plot of new cases by Zip Code, we can detect neighborhoods with alarming increases in COVID cases in the past weeks. For example, the dashboard showed there were 50 new cases diagnosed on Oct 3 in Gravesend/Homecrest in Brooklyn. These

contributed to an increase of 435 cases in total from September 18 in this neighborhood.

Since its publication, the dashboard has drawn considerable attention from clinicians and the lay public. As concern mounts over a possible increase of cases in NYC, I believe that in the coming months our dashboard will continue to play a central role in disseminating timely local COVID information to the lay public.

Ziqi Zhou

I was really confused when the COVID-19 virus turned the world upside down. I wanted to use what I have learned as a public health student to do something for our community, and to feel part of it. When Professor Chen suggested that I develop a website to provide localized COVID information and visualization for our New York city communities, I was inspired.

I began to build the website, but this was not easy. I could not finish everything by myself, so I invited my classmates to join me. First we did research on the virus, and then identified the variables we would need. Next we read many papers and selected the specific information we required before starting to code. Then we began to design and develop the website step by step. Fortunately, in our Data Science course we had learned how to use R-Shiny to build sophisticated websites. I was very pleased that what I learned there helped me provide what I needed for the project. While we did not cover everything in the class, it taught us how to learn new procedures quickly on our own. When I faced challenging coding problems, such as

how to embed a video in Shiny, I would search for a solution on the Internet. If I could not find a good one, I would ask my amazing collaborators for help. They always communicated very effectively and thanks to their help I was able to resolve any problems.

This program has been a wonderful success. It greatly improved my R coding, and my research and communication skills. I do not now feel as uncertain as before about key issues regarding COVID. I know that I have been able to make a contribution to the neighborhoods of New York City during this hard time. I am so proud of our work!

Mengyu Zhang

This summer, Professor Chen developed the NYC neighborhoods COVID-19 Dashboard. I am honored to be part of the project. I am responsible for data collection, website building, styling design and part of the data visualization.

Everything was hard at the beginning, but our team is always trying to do better. It took almost a month to collect and clean the data. Because of the diverse data sources and formats, it was difficult to integrate all of the information we collected. On average it took almost six hours to make a chart look readable and sensible. I remember tough times, when we had trouble debugging our code and began to run out of ideas. But I also kept in mind the larger purpose of the project, which is to provide policymakers and the general public with timely information about COVID-19 in NYC. At one point Professor Chen mentioned that some parents were worried about COVID-19 before schools opened in September, and wanted to be prepared if the situation in their neighborhoods became more severe. At that moment I realized that many people can benefit from our work during this difficult time. That gave me a strong sense of mission. This feeling will be the driving force for my work in Public Health in the future.

Yuanzhi Yu

In May, New York was the US city worst hit by the coronavirus. As a student in the Mailman School of Public Health I felt that I should do something, but had to stay at home. By August, the pandemic in New York had been effectively controlled, but the weather was about to become cold and schools, and possibly indoor dining, were about to reopen. This made it difficult to guarantee the outbreak would not rebound. New Yorkers needed to know whether their neighborhood, their kids' school, and the restaurants they go to are safe or not.

Although we faced many problems, our team was excellent and we successfully overcame all the challenges. Completing this dashboard has made me feel that I have done something to help New York reopen, and has also reinforced my belief in using biostatistical knowledge to make important contributions to public health.

Yuchen Qi

When Professor Chen and Ziqi invited me to join their team working on this website designed specifically for the neighborhoods in New York City, I felt very lucky to be part of this project and fill this gap for our community.

We have learnt many techniques about R and website building from Data Science courses, which provided a solid foundation for our work. However, we needed to handle a large amount of complex information on the website, and to make it informative and attractive. This pushed us to go beyond our knowledge and training from course work. We strengthened our capabilities by learning quickly from articles on the Internet and by combining our findings and thoughts during our efficient internal discussions. I benefited a great deal from the insights of my teammates and from the guidance of the faculty in the School.

Dashboard 3: The Survival Convolution Model for Forecasting the COVID-19 Pandemic

Professor Yuanjia Wang

A survival convolution model (SurvCon) developed in the Department of Biostatistics has been helping the COVID-19 Forecast Hub and US Center of Disease Control (CDC) to forecast COVID-19 cases (Figure 1) and deaths in the near future.

The model was created by Professor Yuanjia Wang, PhD student Qinxia Wang, and post-doctoral fellow Shanghong Xie in Biostatistics, together with collaborators at UNC-Chapel Hill. It is now part of the COVID-19 Forecast Hub which predicts the course of the COVID-19 pandemic in the US and provides weekly forecasts to the CDC. The methodology has been reported in Frontiers in Public Health. The open source software is available at the Github website COVID19BIOSTAT.

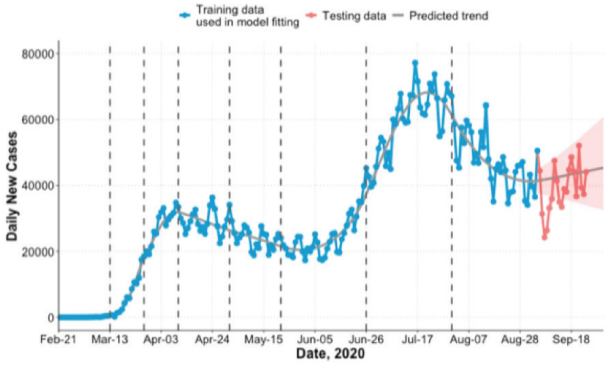


Figure 1. Reported Daily Incident COVID-19 cases and forecasted trend. Model trained using data until 9/4/2020 (blue). Testing data till 9/24 (red). Dashed lines are knots. Model suggests an uptick in COVID new cases since September.

SurvCon uniquely combines nonparametric statistical curve fitting with underlying mechanisms of infectious disease transmissions known from research in epidemiology. It is inspired by the Susceptible-Exposed-Infectious-Recovered (SEIR) models, although it does not involve all of the components of the SEIR. This reduces the parameters and assumptions that SurvCon requires to achieve robustness. Nevertheless, the model does take into account the main features that distinguish SARS-Cov-2 from other coronaviruses, i.e., its substantial rate of pre-symptomatic transmissions. This rate is modeled by piece-wise linear functions placed at meaningful event dates, a procedure which provides flexibility while retaining parsimony. The model is calibrated using official reports of COVID-19 incident cases and incident deaths. It accurately predicted the national-level apex of the first surge of COVID-19 cases in early April. It currently predicts about 225,700 total observed COVID-19 deaths in the US by November 1st, with a 10% chance of fewer than 222,100, and a 10% chance of more than 230,000.

Another unique feature of SurvCon is that it leverages natural experiment designs to study the effects of government non-pharmaceutical interventions (NPIs) such as social distancing, stay-at-home orders, and mask mandates. Such quasi-experiments are often used to estimate the effects of public health interventions or health policies when randomized controlled trials are not feasible. Intervention effects are estimated by comparing transmission rates before and after implementation of an NPI under assumptions of local randomization and continuity (i.e., the trends observed before an NPI would continue had the NPI not been implemented). This approach shows a large effect of NPIs implemented immediately after the declaration of a national public health emergency in the US on March 13th.

Since May, states around the United States have entered a 'reopening' phase. Government responses to the pandemic vary considerably. Since July, our team has been working on refined analyses of state-level data, and has compared the effectiveness of different reopening strategies, their effects on the second surge of COVID cases and deaths, and more recently, the effects of school reopening. New features being developed include leveraging community mobility data provided by Google and Apple to capture changes in population movements during the pandemic, incorporating census and state-level health data to adjust for confounding, and developing causal inference methods to evaluate NPI effects.

Such refined state-level analysis is expected to reveal the heterogeneity of NPI effects across key indicators of COVID-19 (e.g., timing of NPI implementation, urban vs suburban areas, race/ethnicity, poverty levels) on transmission rates. These insights will help guide the implementation of precision public health interventions.

Shanghong Xie

In this project I conducted a literature search, produced figures and tables, maintained our GitHub website, and submitted our death and case predictions weekly to the COVID-19 Forecast Hub for the CDC COVID-19 Ensemble Forecasts.

It is challenging to accurately predict the course of the epidemic, especially its peak and end. Most models of COVID-19 are deterministic, sensitive to initial values, and accurate only for one-week predictions. Our model can capture the trend(s) in the epidemic over time and predict its peak and end dates well, while being simple and robust. It requires only (officially reported) confirmed cases and deaths, without any individual-level information.

I have learnt several lessons from the project. First, we need scientific knowledge of COVID-19 (e.g., incubation distribution, reporting delay distribution) in order to accurately predict the course of the epidemic. Second, it is not easy to have good long-term predictions without incorporating some specific assumptions, given that the public health interventions (mitigation strategies, reopening) are changing over time. Third, the trajectory of the epidemic differs across states, given that they implement different policies to contain it.

Although there are some widely used traditional models of epidemic diseases, biostatisticians can still contribute to this field by modeling disease transmission and by designing study plans for treatment and vaccine trials. I am grateful to have been involved in the project, since our predictions are being used by the CDC for policy making. It has also been interesting to attend the weekly CDC COVID-19 forecasts calls to learn the approaches developed by other teams. In the future, I am enthusiastic about the possibility of conducting other COVID-19 related research, such as developing state and county-level predictions and investigating the effects of school reopening and wearing masks.

Qinxia Wang

I have been working on implementing the SurvCon model using Tensorflow, and on maintaining code to update the model with new data to provide real time forecasts of COVID-19 cases and deaths in the US on a weekly basis. We initially used grid search to provide the best-fitting estimates of the model parameters. However, this became very time-consuming as the pandemic continued and the volume of observed data increased. This encouraged us to look for a more efficient algorithm.

Tensorflow is an open-source library that can automatically compute gradients for any well-specified models and provide fast algorithms. Since I did not have much prior experience with Tensorflow, it took me some time to become familiar with it and implement it in SurvCon. However, my new implementation has significantly improved our computing capacity and has allowed us to provide state-level forecasts with permutations to compute confidence intervals.

One important lesson I have learnt in this process is that I should not be afraid to step out of my comfort zone and try new, unfamiliar tools. It may take me a while to learn them, but they can be beneficial for my research going forward. I also learned that it is important to be highly organized in both coding and project management. Since it is almost certain that we will revisit our code and make changes adaptively, building documented functions and code will save considerable time down the road.

Overall, I really appreciate the opportunity to have worked on this project. I have learned a great deal, and have been privileged to be a part of the research community that brings valuable insights to the pandemic and has a positive impact on it.

Associate Professor

Major Research: Data Science

by Jeff Goldsmith, PhD

The critical role of public health data science has been revealed during the COVID-19 pandemic, and the practice of public health will continue to be shaped by the evolution of data science. It is clear that biostatistics is a key contributor to data science broadly and to public health data science specifically, and that our field can infuse time-proven and rigorous fundamental principles into these emerging disciplines. Several developments in the last year are worth noting.

In January 2020, the Mailman School of Public Health at Columbia University hosted the Data Science in Public Health Summit to examine issues related to research, education, and ethics. In her opening remarks, Dr. Jeannette Wing, Director of Columbia's Data Science Institute, offered her favorite definition of data science as "the science of extracting value from data", while Dean Linda Fried of the Mailman School reiterated the mission of public health: "to use science to raise the floor and the ceiling of health for everyone." Dr. Rob Tibshirani, Professor of Biomedical Data Science and Statistics at Stanford University, offered a keynote address focused on innovative uses of data science methods to advance health. A series of panel discussions addressed key research, educational, and ethical issues surrounding data science within the field of public health; as a reflection of the centrality of our discipline in public health data science, the majority of panelists (including Dr. Kiros Berhane and Dr. Jeff Goldsmith) were biostatisticians. The Summit was recorded, and all presentations and panel discussions can be viewed at https://tinyurl.com/yavhmlcf.

Meanwhile, the department took two concrete steps to establish specific training in public health data science. First, the existing *Applied Biostatistics* MPH certificate was updated and renamed, in an effort led by Dr. Christine Mauro, as the *Applied Biostatistics and Public Health Data Science* certificate. Second, the department has introduced the *Public Health Data Science MS* Track to complement the five existing tracks; Dr. Min Qian will be the track director. These changes reflect recent updates in the department's course offerings to formalize training in data science, and to respond to the growing demand for data science skills in current and prospective students. They have all been approved by the New York State Education Department.

Vice Chair of Education
Professor of Biostatistics
(In Psychiatry)

The Teaching Revolution

by R. Todd Ogden, PhD

In mid-March, in response to the global pandemic, the Department of Biostatistics was forced to convert all Spring 2020 courses to fully online delivery. This extreme step was necessary to protect the health of our students, faculty, and staff, as well as that of the broader community. In taking this action we were careful to follow the guidelines established by Columbia University and the State of New York, guidelines based on the best available science.

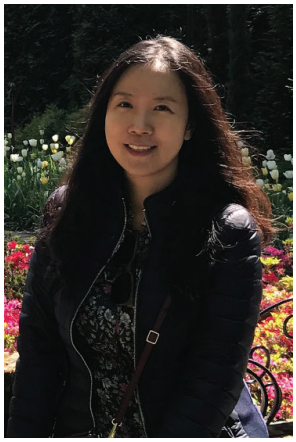
While an online format can be an effective method for course delivery, we realize of course that this is not the educational experience that our students were anticipating. This is indeed disappointing, but as a faculty we are committed to providing the best experience possible for each student, despite any challenges posed by external circumstances. These challenges were significantly disruptive to all, involving sudden changes in living situations and family situations, not to mention threats to health and wellbeing, but by all accounts, members of the Biostatistics family rose together to meet these challenges, and to continue to fulfill our educational mission. This transition to online format was both unexpected and rather abrupt, but our faculty members did their utmost to adjust their course delivery techniques mid-stream, and overall, the result has been continued excellence in training our students.

As the public health crisis continues, our course offerings in the Fall 2020 semester are primarily being offered in a fully online format. Naturally, this has caused considerable difficulty for students, faculty, and staff. Students are scattered across multiple time zones, some faculty are juggling challenges with childcare, but by and large, as we have all worked together to adapt to this format, the quality of our instruction remains high. We greatly appreciate the patience and dedication to their education that is being exhibited by our students. We value the commitment of both our faculty instructors and our graduate teaching assistants to their duties. We look forward with great anticipation for the day when we can once again freely gather together in person, as teachers and scholars, but until that day, we will continue to do our best to deliver the best possible educational experience, while protecting the health of students, faculty, staff, our families, and our neighbors.

The experience of the last few months, while very disruptive, has also forced us (and colleagues worldwide) to reflect and think about how best to design the delivery of our educational programs to be nimble and responsive to any potential pandemics and other natural disasters. The lessons educators are learning from the COVID-19 experience are already reshaping the way we think about in-person and/or on-site educational programs. In the short term, there is still uncertainty about the timing and pace of how we will be returning to the pre COVID-19 state of campus life. Our department will continue to brainstorm about lessons learned from the past few months to retain best practices, enhance effectiveness of our online/hybrid delivery of education, and maximize readiness for any future challenges.

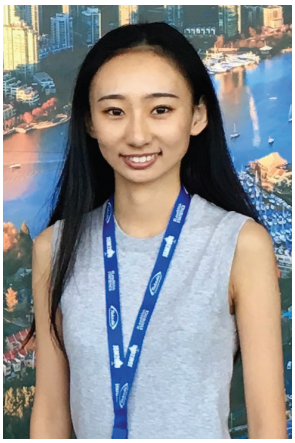
Yi Yang

I am working with Dr. Iuliana Ionita-Laza as a Postdoctoral Research Scientist on the development of statistical methods for sequencing data and electronic health record data, and applications to datasets from collaborative studies. I graduated from the University of Minnesota with a Ph.D. in Biostatistics. My dissertation focused on Bayesian hierarchical models for multi-variant and multi-trait genome-wide association studies. Before that, I was a lecturer at Fuzhou University in China teaching undergraduate courses in statistics and database systems. I completed my BS in management information systems at Zhejiang University in China and earned a Masters of Social Work from New York University in 2013.



Minji Lee

I recently joined the Department as a post-doctoral research scientist working on multi-omics data integration to improve patient risk prediction, under the direction of Professor Shuang Wang. I received my Ph.D. from the Department of Statistics at the University of Florida. I have a broad interest in statistics, but most of my research has centered on multivariate analysis, sufficient dimension reduction, Bayesian methodology, and methods for analysis of (incomplete) longitudinal data. Apart from these topics, I have developed an interest in the optimization of monitoring HIV treatment. I am originally from Ulsan, South Korea. I received a BS in Mathematics education and a BA in Education at Korea University, and an MS in Mathematics from North Carolina State University in 2013.



Xiaoxuan Cai

I am a first-year post-doctoral research fellow working with Professor Linda Valeri in the Biostatistics department. I graduated from the department of Biostatistics at Yale University, where I worked with Forrest W. Crawford on causal inference in the context of infectious disease, when outcomes are propagating within communities. My research interest focuses on developing statistical tools to solve real-world problems in public health, and I am now working on the developing statistical methods for causal inference on mobile health data. In my free time, I love hiking and making crafts.

Thevaa Chandereng

I am a post-doctoral research scientist in the Department of Biostatistics at Columbia University, working with Ying Kuen Cheung at Columbia and Karina Davidson at Northwell Health. My research has been broadly in the areas of clinical trials, machine learning, and time series. I received my Ph.D. in statistics in 2020 from the University of Wisconsin under the supervision of Rick Chappell. During my Ph.D., I spent an internship at Medtronic Statistics Group in 2018-2019. Outside of work, I enjoy being physically active and playing video games. I am very honored and excited to be part of Columbia Biostatistics.

Department Data: Students

Number of 2020 graduates (including February 2020 and October 2019)

DrPH: 3
PhD: 7
MS: 104
MPH: 15

Number Returning for Fall 2020

DrPh: 8
PhD : 22
MPH: 19
MS: 102
MPH Applied Certificate: 30

Number Incoming for Fall 2020

DrPH: 1
PhD: 5
MPH: 14
MS: 106

Where our 2020 graduates are pursuing a doctoral degree:

- Columbia University, Biostatistics
- Institute of Cancer Research (UK), Clinical Trial Statistics
- Penn State University, Biostatistics
- Teachers College at Columbia University, Health Education
- University of California, San Diego, Biostatistics
- University of Minnesota, Biostatistics
- University of North Carolina-Chapel Hill, Nutrition Research
- University of Pittsburgh, Biostatistics
- University of Southern California, Biostatistics
- University of Texas Health Science Center, Biostatistics

Where our 2020 graduates have found jobs:

- Icahn School of Medicine, Assistant Professor
- NYU Langone Health, Assistant Professor
- Genesis Research, Associate Scientist
- Montefiore Health System, Biostatistician
- Mount Sinai Health System, Sr. Clinical Research Associate
- Murphy Medical Associates, Biostatistician
- Dana-Farber Cancer Institute, Statistician
- Memorial Sloan Kettering Cancer Center, Assistant Research Biostatistician
- Memorial Sloan Kettering Cancer Center, Bioinformatics Engineer
- Cleveland Clinic, Data Scientist
- Pfizer, Statistical Programming and Analysis Intern
- Beth Israel Deaconess Medical Center
- Columbia University Irving Medical Center, Statistical Analyst
- IQVIA Biotech, Associate Biostatistician
- USC Keck School of Medicine, Biostatistician
- Tiktok, Saftey Project Specialist
- Emory University, Biostatistician
- Everest Clinical Research, Statistical Programmer
- Research Foundation for Mental Hygiene, Biostatistician Data Analyst
- EDETEK, Statistical Programming Intern
- ProHEALTH Care, Business Analyst
- Regeneron Pharmaceuticals, Data Analyst
- Albert Einstein College of Medicine, Associate
- ICAP, Data Analyst
- Medidata Solutions, Data Scientist
- New York State Psychiatric Institution, Data Scientist
- Emmes, Associate Biostatistician
- The Michaels Companies, Inc., Software Engineer
- Concerto HealthAI, Research Scientist
- Foundation Medicine, Biostatistician
- University of Florida, Data Management Analyst
- LLX Solutions LLC, Statistician
- Analysis Group, Analyst
- ByteDance, Data Engineer
- Michael Allen Company, Research Associate
- Cardiovascular Research Foundation, Biostatistician
- Boehringer Ingelheim, Statistical Programmer Co-op
- Aetna, Data Scientist
- Fred Hutchinson Cancer Research Center, Postdoctoral Researcher
- Uber, Research Scientist
- Visa, Staff Data Scientist
- Colorado School of Public Health, Assistant Professor
- Columbia University Irving Medical Center, Postdoctoral Research Scientist
- Hong Kong University of Science and Technology, Research Assistant Professor

Student Awards and Defenses

Sanford Bolton-John Fertig Award for a distinguished doctoral dissertation in Biostatistics

REBECCA ANTHOPOLOS, PHD for Bayesian Modeling of Latent Heterogeneity in Complex Survey Data and Electronic Health Records

Joseph L Fleiss Memorial Prize in Biostatistics

WODAN LING, PHD for Quantile Regression for Zero-Inflated Outcomes.

Chair's Award for Outstanding Master's Students in recognition of outstanding academic and research achievements

ANNIE CLARK MS-TM for Causal relationship between dieting and BMI in adolescence through young adulthood.

BAOYI SHI MS-TM for Functional Data Analysis of Sex Effect on Impulse Response

Functions of Major Depressive Disorder Patients

MADELINE CANNON MPH for Factors associated with Mass Drug Administration impact on P. falciparum prevalence

XINYU YAN MS-TM for NeuroRCT: Statistical analysis methods for neuroimagingoutcomes in randomized controlled trials

TL1 Fellowship that allows doctoral students to gain knowledge and skill-sets that may be outside their primary academic or clinical discipline.

ERIN MCDONNELL

REBECCA SILVA

Doctoral Defenses from January 2020-September 2020

ANUSORN (DEW) THANATAVERRAT, DRPH, "Cluster Analysis for Zero-Inflated Data"

EUN JEONG OH, PHD, "Optimal treatment regimes for personalized medicine and mobile health"

XIAOQI LU, PHD, "GGQ-learning for indefinite horizon problem with L1 penalty"

The Biostatistics Computing Club

by Angel Garcia de la Garza

The Columbia Biostatistics Computing Club hosts seminars focusing on computational topics often encountered in biostatistics research. These sessions provide hands-on learning at various skill levels, focusing on bringing new students up to speed and on others addressing more advanced problems. Each of the sessions is run by a student volunteer who prepares tutorials on topics of interest, including R, Illustrator, and LaTeX.

In the past, we have hosted monthly meetings on a wide range of topics, including the terminal, R packages such as ggplot, ggmaps, and Shiny. This year, we have reorganized the club to host biweekly sessions due to the shift to online-only events and the increased interest in the club. This year we plan to have sessions on SQL, building packages in R and Python. We will also collaborate with the Cornell Computing Club and Mailman's Career China Club.

Our overarching goal is to teach students potentially useful skills in their research or work in the industry. This year's organizers are Angel Garcia de la Garza, Muhire Kwizera, Charlotte Fowler, Rebecca Silva, Gavin Ko, Bryan Bunning, and Amy Pitts.

The Graduate Student Research Seminar

by Melanie Mayer

The graduate student research seminar (GSRS) offers graduate students in Biostatistics an opportunity to practice presenting their research to fellow students in order to gain presentation experience, receive feedback and disseminate current research being conducted in the department. Historically, students have used this space to practice for events such as upcoming conferences, oral exams, dissertation defenses and job talks.

Last year, in addition to having multiple doctoral candidates present, we held some special sessions. Faculty members gave speed talks to showcase projects that have potential for student engagement and doctoral candidates gave speed talks on recently completed summer internship experiences. This year we plan on repeating these successful events.

This semester the GSRS, which will be held monthly, will have the added benefit of giving students a space to interact with one another and have dialogue during these remote learning times. Traditionally GSRS has been restricted to doctoral candidates, but due to the flexibility of virtual meetings we will extend the seminars to masters students this semester. We are excited to expand the reach of the presentations and expose masters students to research conducted at the doctoral level, especially those who may be considering pursuing a further degree!

Student Research Projects

Steven Lawrence, MS candidate

This summer, you worked at Mount Sinai on a COVID study. Can you share with us how you got involved with the project and what your role in it was?

My mentor Dr. Emma Benn was assembling a team to provide disparity analytics to Mount Sinai over the summer concerning COVID 19. I joined the project, thinking that it was a great opportunity to address an ongoing crisis, given that many other summer internships had been canceled because of the pandemic. My role was to apply advanced programming in R to visualize the demographics, outcomes, and neighborhood-level factors of the Mount Sinai Health System (MSHS) COVID-19 patient population. I also examined the temporal changes in COVID-19 outcomes as a function of geography and sociodemographic factors. Additionally, I provided consultation related to R programming to data analysts, to ensure the reproducibility and transparency of analyses and visualizations.

What types of challenges did you face while working on the study?

The challenges I faced included dealing with the density of detail in the datasets and keeping up with the marriage of "operations" and research. For example, the status of a patient being COVID positive was determined in multiple ways, therefore we had to create an operationalized variable. Operations is a term that was new to me in the hospital setting, where multiple variables had to be operationalized; that is, would be used across the institution for reproducibility efforts in research and reporting. We were also informed that our findings may invoke immediate change. There were many possible approaches but given the timeline we had to focus on what would help inform best practices in the future should there be another outbreak.

What did you find most interesting about your involvement in the project?

I enjoyed the intensity of our work, given that it might have an immediate impact; and knowing that the skills that I am learning in school can be applied to a current crisis. I also feel that I grew a lot from the collaborative experience where data scientists, chief officers, medical personal and statisticians came together with various perspectives which informed how we viewed the data, and made meaningful inferences that we could not have developed on our own.

Did you learn any lessons that you think will help you in the future?

Most of all, I learned firsthand that what I am learning is very important for the world we live in today, and for the future. I also came to appreciate how to give and take when working with colleagues from different backgrounds. Lastly, I learned that a difference in outcomes may not constitute a clinically meaningful disparity; we need to be careful to understand the complexities surrounding this idea in order to produce good statistics and good science.

Valeria Mazzanti, MPH candidate

This summer, you worked with Dr. Cody Chiuzan on a Smell and Taste COVID study. Can you share with us how you got involved with the project and what your role in it was?

While I was searching for practicums, summer internships and research projects, COVID-19 made its great entrance into our lives. I felt helpless and frustrated, feeling it was my duty to do something as a public health student during a public health crisis. I decided to make the best use of the tools my MPH had given me, and to focus my job hunt on projects that could help the situation. I attended a Biostatistics Town Hall via Zoom late in the Spring semester. We split into breakout rooms where students and faculty discussed how to improve our learning environment while being

spread around the world. Here I met and bonded with Dr. Chiuzan. I emailed her that evening asking to meet and learn about her career and research interests. She described several projects she planned for the summer, including helping an NYP doctor analyze his data. My role became to support her in anything needed, from cleaning data in Excel to coding in R for both data management and analysis. I even had the opportunity to create statistical models at the end of the project!

What types of challenges did you face while working on the study?

Our dataset was massive and very messy. Variables were coded differently from what we needed: we spent much more time than expected on data cleaning and management. We encountered many missing observations, and multiple responses to specific questions, such as participants reporting both "Distorted" and "Odd" senses of smell as COVID-19 symptoms. We consulted frequently with the principal investigator about modifying his variables, for example by grouping all "non-normal" smell answers into one category "Altered". It was interesting to confront these issues, which had often been mentioned in my courses but which I had never actually seen in real life examples.

What did you find most interesting about your involvement in the project?

I discovered many interesting things on top of the fact that COVID-19 really does alter people's sense of smell and taste, and why and how that happens. Being exposed to the working relationships between doctors and biostatisticians was also interesting. I learned how difficult it can be to communicate with someone with a completely different academic or professional background. Dr. Chiuzan and the collaborating doctor often had to explain and elaborate on questions they asked each other, or ways in which we modified the dataset. We always had to be very clear and explain each step so that everyone could be on the same page about what we needed next. It was fun to work with such a dedicated team and to meet everyone involved!

Did you learn any lessons that you think will help you in the future?

The biggest lesson came at the beginning when I received a list of tasks to complete using RStudio. I had previous exposure to RStudio, but not in biostatistics, so I had absolutely no idea where to start. I resolved some issues but was stuck for hours on others. I felt embarrassed to ask Dr. Chiuzan because I thought she would be disappointed that I could not teach myself how to resolve them, but when I finally asked, she was incredibly supportive and understanding. She said she could have imagined this set of instructions to be too steep a learning curve for me to complete on my own. Moving forward, she always provided many resources for new tasks to help me get oriented with the new software. It was incredibly helpful to learn that I can always ask questions, and that doing so at the beginning benefits the entire rest of the collaboration.

Staff Spotlight

Congratulations IVY CHEN and JUSTINE HERRERA on receiving the 2020 Mailman School Staff Award for Excellence!

This award recognizes outstanding Columbia Mailman School employees who demonstrate the highest standards of excellence and extraordinary performance. Thank you Ivy for your stellar work to XXXX. Thank you Justine for your exemplary work to lead our academic advising efforts.

Job well done!!!

IVY CHEN
Job Title

JUSTINE HERRERA
Job Title

Alumni Spotlight

MANISHA BRAHMACHARY, MS, PhD
Associate Director of Biostatistics, Sanofi

Can you tell us a bit about your career path and what led you to the role you're in today?

I currently work for Sanofi as associate director in biostatistics, specializing in biomarkers for the company. The essence of my career path is that of a data scientist, which is the current jargon for someone who analyzes data using statistical tools such as machine learning and develops tools to facilitate analyses of big data. My choice of this path has been driven essentially by my desire to have freedom in my career. Very early on, I knew that I wanted a career where I could work anywhere in the world, and on a variety of projects that would allow me to be creative scientifically. I began my career as a biologist, and while biology remains at the core of what I do even now, I realized that being a lab scientist would not be my most fulfilling path.

Is there something that surprised you about the role when you first started?

Even if you have a great idea, you must align with many people and functions to make it happen. This is a necessity in large organizations.

What do you enjoy most about the work you do? What are you most excited about right now?

I enjoy solving problems creatively. This involves programming and coming up with new ways to look at the data and get insights. I am excited to design a tool to help solve a problem on a public health-related issue.

What skills do you think are most important for someone interested in a job like yours?

Programming skills: R, Python, SQL, Unix shell scripting, Cloud computing.

Basic understanding of algorithms

Statistical training (Classical statistics, Machine learning)

What do you wish you'd known when you were starting out in your career?

I wish I had mentors earlier in my career. Good mentors who are willing to invest in you can help you realize your strengths, weaknesses and your calling in life.

Alumni Spotlight

SHARINA WILLIAMS, MS, DRPH
Research Scientist at Nathan S. Kline Institute for Psychiatric Research

How did your experience in the department help you prepare for your current position?

I spent considerable time in the department, completing the MS Theory & Methods and DrPH programs in 2009-2018. During that time I worked full time, as a research assistant and program coordinator at the College of Dental Medicine, then as a data analyst in the Mailman Epidemiology and Health Policy & Management departments. I was also an instructor in Biostatistics. To balance those commitments with my academic responsibilities, I had to be very organized. This helped hone my time management skills. I also gained valuable experience in collaboration and consultation with my advisor Dr. Qixuan Chen and with Dr. Peter Muennig. Finally, participation in department student and community building activities provided opportunities to develop my interpersonal skills, and exposure to organizational nuances not available in textbooks or classrooms.

What do you enjoy most about the work you do? What are you most excited about right now?

I enjoy projects in development psychology; intervention research; and intersectional stigma. These allow for interesting statistical applications and have broadened my experience. Another part of my work involves community services research with the Office of Mental Health. This is particularly rewarding as it can have a more direct impact on public health programs and practice.

What are some big projects you're working on now or that you've finished up in the last few months?

One project collects biologic data to quantify allostatic load or the wear and tear that accumulates in the body due to exposure to chronic stressors. This represents the first biologic data collection point of a longitudinal survey collecting a wealth of psychosocial and behavioral exposure data over 30 years in a sample of Black and Latinx respondents first sampled as students at 11 East Harlem middle and high schools. Last year I was awarded a diversity supplement to apply statistical methods to quantify longitudinal exposures and predict outcomes of interest and to evaluate the psychometric properties of our biologic measures. I am excited about how this supplement can contribute to the aims of the parent grant.

What skills, abilities, and personal attributes are essential to success in your field?

Aside from a keen eye for details, being able to understand and best apply statistical methodology to varied research questions, and the ability to connect research to public health policy and practice, I have found it valuable to exercise patience, have an open mind, and remain flexible in my work. As I exercise these skills, I learn new approaches to challenges and discover opportunities where one might have envisioned a dead-end.

What do you wish you'd known when you were starting out in your career?

I wish I had truly understood the time commitment required as a researcher and academic. There are enough tasks and responsibilities to fill every hour of the day. While I enjoy my work, I find that I must pause and reboot and give my brain needed rest to enable me to continue to approach my work with enthusiasm.

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