Climate & Health

NEWSLETTER   *Fall 2022*

The **Climate and Health Program**, launched in 2008, has a mission to foster innovative scholarship on the human health dimensions of climate change impacts and vulnerabilities, and to provide information of direct value in climate adaptation and mitigation planning. We train PhD and DrPH students, and postdoctoral scientists in the design and conduct of cutting-edge research on mechanisms linking climate to ill-health as well as on methods for assessing health impacts and benefits of future climate policy scenarios. We also offer the first ever MPH certificate in climate and health.

TABLE OF CONTENTS

Successful thesis defense by PhD candidate, Sebastian Rowland

Sebastian Rowland completed his PhD in May 2022. His thesis, titled "The Twin Crises of Climate Change and Air Pollution: Characterizing the Acute Cardiovascular Effects of Temperature and Uncertainties of Fine Particulate Matter Concentrations," examines the health effects of short-term temperature exposure and models fine particulate matter concentrations. His studies demonstrate that increases in hourly temperature and daily temperature variability increase the risk of heart attacks and ischemic strokes. He also constructed a nationwide, uncertainty-aware model of annual fine particulate concentrations that leveraged the unique strengths of already-developed models and examined the distribution of predictive uncertainty to inform future monitoring efforts. Sebastian is now a Scientist at PSE Healthy Energy, where he examines the health impacts of air pollution and energy systems, particularly within frontline communities.

Successful thesis defense by PhD candidate, Stephen Lewandowski

Stephen Lewandowski completed his PhD in July 2022. His thesis, titled 'Observed Impacts of Environmental Conditions on Heat Illness Morbidity in the Military', examined the impact of environmental parameters on heat illness outcomes over different timescales and assessed heat stress risk factors in a military population. He serves as a US Army Medical Service Corps officer and teaches in the Department of Preventive Medicine and Biostatistics at the Uniformed Services University of the Health Sciences with a focus on exposure science and environmental health risk assessment.

Successful thesis defense by PhD candidate, Victoria Lynch

Tory Lynch completed her PhD in August 2022. Her thesis, "Quantifying the effect of extreme and seasonal floods on waterborne disease in the US," examined the association between flooding and 10 waterborne pathogens with a particular focus on Legionnaires' disease. A primary component of this work was to characterize the different flood types that occur throughout the US (e.g. floods related to cyclonic storms, river floods, flash floods, etc.) using a range of meteorological variables to define flooding. Her work found that hospitalizations for specific pathogens were positively associated with distinct flood-indicator variables. She also studied the effect of tropical cyclonic storms on cases of waterborne diseases in the Eastern US. Tory will continue her training under Dr. Jeffrey Shaman as a Postdoctoral Research Scientist.

New PhD student

Raenita Spriggs received her BA from UC Berkeley in 2016 and MPH from UCLA in 2019. Before joining Mailman, she served as the Manager of Climate Action Research at the UCLA Luskin Center for Innovation. There she facilitated the center's climate action and extreme heat research through strategic partnerships and engagement with policymakers, advocates, and impacted communities. As a PhD student, Rae plans to explore the intersection of extreme heat and other climate-related exposures, neighborhood conditions including historical environmental injustice, and mental health outcomes.

New staff

Roselyn Kaondera-Shava received her PhD in Mathematics from Botswana International University of Science & Technology. Her area of expertise is applied mathematics, with specific focus on Mathematical Epidemiology. Her doctorate was dedicated to the development and analysis of mathematical models for viral infectious diseases (such as Ebola virus disease and AIDS-associated Kaposi's sarcoma) with a particular interest in gaining more insight into disease dynamics and outbreaks, improving the control of disease spread. At Columbia, Roselyn is investigating nonlinear error growth in infectious disease systems and developing model-inference frameworks for simulation of infectious agents, inference of critical epidemiological characteristics, counterfactual simulations, and projections and forecasting.

Matteo Perini earned his PhD from the Department of Biomedical and Clinical Sciences at University of Milan (Italy) and his MS in Biosciences from University of Camerino (Italy). His doctoral studies focused on the development of bioinformatic tools and protocols for the application of new approaches for fast and inexpensive subspecies typing of pathogens, particularly in nosocomial settings. At Columbia, Matteo is working on metapopulation mathematical models with data assimilation methods to study and forecast the dynamics of infectious diseases. He is also working on human genomic data to perform Genome-Wide Association Studies in the context of acute respiratory infections.

Jiyeon Suh completed her PhD in the School of Mathematics and Computing at Yonsei University. Her research focused on the mathematical modeling of infectious diseases to evaluate the impact and cost-effectiveness of disease control interventions and ultimately provide guidelines to public health policymakers. At Columbia, Jiyeon is developing meta-population models with data assimilation to assess and forecast infectious diseases dynamics. She will also work on mathematical modeling to estimate the impact of climate change and extreme climate on infectious diseases and human health.

Rami Yaari received his PhD from the School of Environmental Studies in Tel-Aviv University. His previous research focused on the application of mathematical modeling and statistical inference procedures in the study of the spread of various infectious diseases including influenza, polio, shigella, measles and Covid-19. In addition, he worked on developing statistical tools for data science applications. At Columbia, he will be working with data assimilation methods to study and forecast the dynamics of infectious diseases.

Faculty and staff in the news

Professor Frederica Perera authored a review paper on Climate Change, Fossil-Fuel Pollution, and Children's Health in NEJM. Speaking with TIME, she said 'There is direct harm, now, to children's health—and certainly their future is being jeopardized in a major way. We know how to do it; we know alternatives, and they're working in different countries…We just have to speed the process up…and put into effect the solutions we know work.' She was also featured in CNN, The Hill, Kaiser Health News, and Inside Climate News.

Professor Cecilia Sorensen joined host Bobby Bascomb of Living on Earth to discuss research on how extreme heat is linked to complications of pregnancy including eclampsia, preterm birth and stillbirth. She also spoke with WNYC host Michael Hill on what the Supreme Court's ruling on EPA authority means for air quality and for local and global health.

Professor Joan Casey published a study in the Journal of Exposure Science & Environmental Epidemiology on historic redlining and the siting of oil and gas wells in the United States. The study adds to the evidence that structural racism in federal policy is associated with the disproportionate siting of oil and gas wells in marginalized neighborhoods. Speaking with the Washington Post, she said 'I think this is more evidence that this legacy of structural racism created through redlining boundaries has implications for health today.'

A paper authored by **Dr. Robbie Parks**, postdoctoral research scientist, was selected for NIEHS paper of the month in May 2022. The paper, titled 'Association of tropical cyclones with county-level mortality in the US,' was published in JAMA. In an interview with USA Today, Robbie discussed how the 'results show that tropical cyclones in the U.S. were associated with increases in deaths for several major causes of death, speaking to the 'hidden burden' of climate-related exposures and climate change.' He was also featured in The Hill.

Professor Jeffrey Shaman spoke with CNN on what could potentially be in store for Covid-19 and influenza in the US this winter, based on Australia's tough flu season. He said, "I think we've got to keep an eye – if we're going to have something analogous to Australia – to what goes on in November…Do we start to see flu a little earlier than we typically do? And it may take off. And of course, on top of that, we've got to worry about how that compiles with the Covid circulating."

Staff transition

Yanelli Nunez was a Postdoctoral Research Scientist mentored by Professor Marianthi-Anna Kioumourtzoglou. She worked on identifying sources of air pollution mixtures and the association of such sources with adverse neurological outcomes using novel pattern recognition methods. This past July, she joined PSE Healthy Energy as an Environmental Health Scientist and is now an adjunct scientist at Columbia.

Second years' summer practicum experiences

Jaemie Bennett interned with Arch Street Communications (ASC). ASC specializes in public engagement for public sector projects with an environmental aspect. Jaemie worked within the Transportation Vertical, which focused on projects that included a transportation angle such as trains, cars, or biking. While Jaemie assisted with many internal and client projects, she mostly focused on a climate resilience project at Battery Park, a greenspace on the southern tip of Manhattan. This included facilitating public engagement meetings to get feedback on project plans and compiling public feedback so it would be incorporated in the next phase of the project.

Emilia Bulfone worked as a Research Associate at Environmental Volunteers. She supported a specific initiative called Sprout Up - an environmental science education program for 1st and 2nd-grade students in low-income communities. Here, she investigated areas of potential chapter growth across the nation, provided editing support to chapter materials, such as leadership guides and curriculum, as well as managed all research, community engagement, and communications related to the project.

Hannah Davin worked for the Harvard T.H. Chan School of Public Health as a Research Assistant in the Nutrition Department this past summer. She was responsible for data entry, utilizing R to find errors in a large database, and literature reviews on the nutrition content of aquatic species and how the nutrition content of aquatic species impacts human health. Hannah worked with a very supportive team and enjoyed learning about aquatic species and how their nutrition content can impact human health in the long-term.

Nico Hamacher worked as the Public Health Fellow at Columbia's Global Consortium for Climate and Health Education (GCCHE). He assisted the GCCHE and collaborating organizations in running Climate and Health Responder courses in the Caribbean and Latin America. The courses engaged ≈5,000 health professionals in climate health education over multiple weeks. Data collected from course enrollment and pre- and post-course surveys on program effectiveness was used to write an article focused on climate health education for health professionals. Nico also helped manage other aspects of GCCHE programming and design public outreach initiatives.

Mary Lundin worked as a graduate research assistant for the National Center for Disaster Preparedness (NCDP) at the Columbia Climate School. She worked on the Curriculum Development team and mostly helped with the design of FEMA-sponsored courses that focused on Pandemic Planning and Mass Care. She also created a variety of course deliverables and assisted with the compliance of documents between FEMA and NCDP. Mary also wrote for The Climate Club and published a variety of articles on pertinent environmental and climate issues.

Teng Zhao completed his practicum under Dr. Huichen Wu as a Research Assistant working on a project to identify differential DNA methylation related to aflatoxins exposure using 450k epigenome-wide scan. He collected and cleaned patient data and analyzed and summarized differences in DNA methylation between different aflatoxin exposures.

Awards

Professors Darby Jack and Kiros Berhane were awarded a renewal for their five-year U2R training grant, Eastern Africa GEOHealth Hub, through the NIH Fogarty International Center.

Dr. Robbie Parks, postdoctoral research scientist, was awarded an K99/R00 award from NIEHS for his proposal, titled 'Novel Assessments of the Health Impacts of Tropical Cyclones.'

Professor Sen Pei received an award from NSF for his proposal, titled 'Human Behavior Driven Mathematical Modeling and Forecasting of Respiratory Disease Transmission in Urban Settings.' The aim is to use behavior theories and detailed data to develop behavior-driven epidemic models, study the transmission dynamics of COVID-19, and generate improved forecasting systems in New York City.

Recent findings

Long-Term Fine Particulate Matter Concentrations and SARS-CoV-2 Prevalence: Differential Relationships by Socioeconomic Status Among Pregnant Individuals in New York City

Affiliated investigators: Joan Casey, Marianthi-Anna Kioumourtzoglou, Jeffrey Shaman, Sasikiran Kandula
Journal: American Journal of Epidemiology

We aimed to determine if long-term fine particulate matter ($PM_{2.5}$) concentrations are associated with increased risk of testing positive for COVID-19 among pregnant individuals who were universally screened at delivery and if socioeconomic status (SES) modifies this relationship. We used obstetric data from CUIMC in NYC from March–December 2020, which included Medicaid use (low-SES surrogate) and COVID-19 test results. We linked 300m resolution estimated 2018-2019 $PM_{2.5}$ concentrations and census tract-level population density, household size and income, and mobility estimates. Analyses included 3318 individuals; 5% tested positive for COVID-19 at delivery, 8% tested positive during pregnancy, 48% used Medicaid, and average long-term $PM_{2.5}$ concentrations were 7.4 µg/m^3 (SD = 0.8). In adjusted multilevel logistic regression models, we saw no association between $PM_{2.5}$ and ever-testing positive for COVID-19; however, odds were elevated among those using Medicaid (odds ratio = 1.6, 95% CI 1.0, 2.5 per 1-µg/m^3 increase). Further, while only 22% of those testing positive showed symptoms, 69% of symptomatic individuals used Medicaid. SES, including unmeasured occupational exposures or increased susceptibility to the virus due to co-social and environmental exposures, may explain the increased odds of testing positive for COVID-19 confined to vulnerable pregnant individuals using Medicaid.

Recent findings

Climate Change and COVID-19: Assessing the Vulnerability and Resilience of U.S. Indigenous Communities to Syndemic Crises

Affiliated investigator: Cecilia Sorensen
Journal: The Journal of Climate Change and Health

The rapid emergence of the COVID-19 pandemic and the insidiously evolving climate crisis represent two of the most pressing public health threats to Indigenous Peoples in the United States. Understanding the ways in which these syndemics uniquely impact Indigenous Peoples, given the existing health disparities for such communities, is essential if we are to address modifiable root causes of health vulnerability and devise effective and equitable strategies to protect and improve health in the evolving climate landscape. We explore the compounding burden of the COVID-19 pandemic and climate change on Indigenous Peoples' health and present several case studies which outline novel Indigenous approaches and perspectives that address climate change, COVID-19 and future health threats.

Long-Term Air Pollution Exposure and COVID-19 Mortality A Patient-Level Analysis from New York City

Affiliated investigator: Darby Jack
Journal: American Journal of Respiratory and Critical Care Medicine and Health

Rationale: Risk factors for coronavirus disease (COVID-19) mortality may include environmental exposures such as air pollution. Objectives: To determine whether, among adults hospitalized with PCR-confirmed severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), long-term air pollution exposure is associated with the risk of mortality, ICU admission, or intubation. Methods: We performed a retrospective analysis of SARS-CoV2 PCR–positive patients admitted to seven New York City hospitals from March 8, 2020, to August 30, 2020. The primary outcome was mortality; secondary outcomes were ICU admission and intubation. We estimated the annual average fine particulate matter ($PM_{2.5}$), nitrogen dioxide (NO_2), and black carbon (BC) concentrations at patients' residential address. We employed double robust Poisson regression to analyze associations between the annual average $PM_{2.5}$, NO_2, and BC exposure level and COVID-19 outcomes, adjusting for age, sex, race or ethnicity, hospital, insurance, and the time from the onset of the pandemic. Results: Among the 6,542 patients, 41% were female and the median age was 65 years. Over 50% self-identified as a person of color. Air pollution exposure levels were generally low. Overall, 31% of the cohort died, 19% were admitted to the ICU, and 16% were intubated. In multivariable models, a higher level of long-term exposure to PM2.5 was associated with an increased risk of mortality (risk ratio, 1.11 [95% confidence interval, 1.02–1.21] per 1-µg/m^3 increase in $PM_{2.5}$) and ICU admission (risk ratio, 1.13 [95% confidence interval, 1.00–1.28] per 1-µg/m^3 increase in $PM_{2.5}$). In multivariable models, neither NO_2 nor BC exposure was associated with COVID-19 mortality, ICU admission, or intubation. Conclusions: Among patients hospitalized with COVID-19, a higher long-term $PM_{2.5}$ exposure level was associated with an increased risk of mortality and ICU admission.

Select publications

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FEEDBACK

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