Yale Center on Climate Change and Health Annual Report

July 1, 2020 to June 30, 2021

Executive Summary

During Year 6 (July 1, 2020 to June 30, 2021) of the High Tide Foundation grant to support the Yale Center on Climate Change and Health (YCCCH) at Yale School of Public Health (YSPH), we successfully implemented all major Year 6 planned activities and have planned a full set of activities for Year 7. In summary, our Year 6 accomplishments included:

- Launch of the Climate Change and Health Concentration for MPH Students
- Publishing and dissemination of *Climate change and health in Connecticut: 2020 report*
- Launch of the Policy Impact Unit to maximize the policy outcomes of YCCCH activities, with initial focus on publishing issue briefs about Connecticut climate adaptation and mitigation policy
- Research publications in high-impact journals, including The Lancet, Nature Communications, Lancet Planetary Health, and Health Affairs
- Approval to hire a new faculty member to serve as the YCCCH Director of Education
- Organizing of a four-day virtual conference, *Climate Change and Health in Small Island Developing States: Focus on the Caribbean*, scheduled for October 5-8, 2021
- A new course taught by Dr. Kai Chen: *Methods in Climate Change and Health Research*
- Expansion of our speaker series into a not-for-credit course, *Seminar in Climate Change and Health*
- Expansion of our Climate Change and Health Internship Program, matching 12 MPH students, Student Associates, and undergraduates with non-profit or governmental organizations
- Expansion of our two-semester *Clinic in Climate Justice, Climate Policy, Law, and Public Health* into a joint course between Yale School of Public Health, Yale School of the Environment, and Vermont Law School
- Continued membership in *The Lancet Countdown on Health and Climate Change*, with authorship of two indicators in the 2020 Report
- Continued offering of the YCCCH Student Associates Program, with 26 students across the University, successfully shifting to a virtual format due to COVID-19 restrictions, and continuing to offer our Mentorship Program to match 17 Student Associates with mentors
- Two offerings of our 18-week online Climate Change and Health Certificate program
- Funding from Yale School of Public Health for two pre-doctoral fellows
- Launch of a monthly YCCCH newsletter
- Launch of the Inaugural Yale University Sustainability in Health Care Symposium
- Successful fundraising to support YCCCH research, education, and public health practice

YCCCH continues to receive strong support from the administration as evidenced by:

- An ongoing financial commitment to our pre-doctoral fellowship program
- Use of all net revenue from the online Climate Change and Health Certificate program to support YCCCH activities
- Full funding and a generous start-up package for Dr. Chen as a core faculty member of YCCCH
- Approval to recruit a new Assistant or Associate Professor to serve as YCCCH Director of Education

YCCCH Structure and Administration

Since January 2020 we have operated as a University Center, as reflected in our updated name: the Yale Center on Climate Change and Health. To support our expanded mandate, we developed a four-year strategic plan (2020-2024), expanded our staff, and created an Advisory Board. In 2020-2021, we continued to build out our work as a University Center by securing additional funds, receiving approval for another faculty hire, and expanding our educational offerings, among other activities.

YCCCH Core Team

- **Dr. Robert Dubrow**, Faculty Director; Professor of Epidemiology (Environmental Health Sciences)
- **Dr. Martin Klein**, Executive Director; Senior Advisor, YSPH Dean's Office, Lecturer (Health Policy and Management)
- **Dr. Kai Chen**, Director of Research; Assistant Professor of Epidemiology (Environmental Health Sciences)
- **Dr. Laura Bozzi**, Director of Programs; Lecturer (Environmental Health Sciences)
- **Dr. Jodi Sherman**, Director of Program on Healthcare Environmental Sustainability; Associate Professor of Anesthesiology
- **Mr. Mauro Diaz-Hernandez**, Program Administrator

Assistant or Associate Professor in Climate Change and Health in the Clinician-Educator Track

In June 2021, we received approval to recruit through an international search an Assistant or Associate Professor in Climate Change and Health in the Clinician-Educator Track. The successful candidate will serve as the YCCCH Director of Education and a core YCCCH faculty member. The Director of Education will direct the Climate Change and Health Concentration for MPH students, will serve as faculty in the Clinic in Climate Justice, Climate Policy, Law, and Public Health, will teach one additional course, and will direct the online Climate Change and Health Certificate Program for working professionals, which will be expanded into a global program. The successful candidate also will be expected to develop an independent research and/or public health practice program and to mentor MPH and PhD students. We anticipate that the new hire will begin in January 2022.

Advisory Board

The YCCCH Advisory Board includes students, faculty from other universities, and representatives from government and non-profit organizations. The following constitutes the Advisory Board membership:

- **John Balbus, MD, MPH,** Interim Director, Office of Climate Change and Health Equity, U.S. Department of Health & Human Services
- **Michelle Bell, PhD,** Mary E. Pinchot Professor of Environmental Health, Yale School of the Environment
- **Holly Burrows, BSc,** Master's student, Yale School of Public Health
- **Jazmín Diaz Rivera, MPH**, PhD student, Yale School of Public Health

- **Tekisha Dwan Everette, PhD, MPA**, Executive Director, Health Equity Solutions; Assistant Clinical Professor in Social and Behavioral Sciences, Yale School of Public Health
- **Rebecca French, PhD**, Director, Office of Climate Planning, Connecticut Department of Energy and Environmental Protection
- **Howard Frumkin, MD, DrPH**, Senior Vice President, The Trust for Public Land; Professor Emeritus, Environmental and Occupational Health Sciences, University of Washington School of Public Health
- **Shelley Geballe, JD, MPH**, Assistant Professor of Public Health Practice, Yale School of Public Health; Clinical Lecturer, Yale Law School; Distinguished Senior Fellow, Connecticut Voices for Children
- **Mark Mitchell, MD, MPH, FACPM**, Associate Professor of Climate Change, Energy, & Environmental Health Equity, George Mason University; Co-chair, Commission on Environmental Health, National Medical Association
- **Michael Pascucilla, MPH, REHS,** Chief Executive Officer/Director of Health**,** East Shore District Health Department
- **Surili Patel, MS,** Vice President, The Metropolitan Group
- **Virginia Pitzer, ScD,** Associate Professor of Epidemiology (Microbial Diseases)**,** Yale School of Public Health
- **Peggy Shepard,** Co-founder and Executive Director, WE ACT for Environmental Justice
- **Vasilis Vasiliou, PhD,** Department Chair and Susan Dwight Bliss Professor of Epidemiology (Environmental Health Sciences), Yale School of Public Health
- **Nick Watts, MD,** Chief Sustainability Officer, National Health Service, United Kingdom
- **Sacoby Wilson, PhD,** Associate Professor, the Maryland Institute for Applied Environmental Health and Department of Epidemiology and Biostatistics, School of Public Health, University of Maryland-College Park
- **Yawei Zhang, MD, PhD, MPH,** Associate Professor, Department of Surgery, Yale School of Medicine; Department of Environmental Health Sciences, Yale School of Public Health

Affiliated Faculty

On June 30, 2021, we had 35 Affiliated Faculty, 25 with primary appointments at YSPH and 10 with primary appointments in other schools or departments.

Student Assistants

- Melia Bernal, a second-year MPH student in the Department of Health Policy and Management, served as a Research Assistant for the YCCCH Program on Healthcare Environmental Sustainability.
- Holly Burrows, a second-year MPH student, served as the YCCCH Student Associate Program Student Coordinator.
- Yara El-Khatib, a senior in Yale College, served as a Research Assistant for the YCCCH Policy Impact Unit.
- Nick Elton, a second-year MPH student, served as the Sustainability Committee Student Coordinator.
- Martin Tipton, a senior in Yale College, served as a Research Assistant for the YCCCH Policy Impact Unit.

Affiliations

YCCCH has affiliated with the following organizations:

- Global Consortium on Climate and Health Education
- Planetary Health Alliance
- US Climate and Health Alliance
- Lancet Countdown: Tracking Progress on Health and Climate Change
- Connecticut Governor's Council on Climate Change

Communications

We maintain a YCCCH website within the YSPH website, and we continue to expand the website to reflect the Center's extensive work. For instance, the Yale Program on Healthcare Environmental Sustainability's section was revised to include more detail on the Program's internationally recognized research, education, and public health practice. We also have an active Twitter account (@cchyale). We have worked closely with the YSPH Communications Office to produce news articles highlighting YCCCH efforts, including articles on the Center's contributions to the 2020 report of the Lancet Countdown on Climate Change and Health and the Center's report on climate change and health in Connecticut. In July 2020, we launched the publication of a monthly newsletter that reaches approximately 1,300 recipients. We continue to receive positive feedback about the newsletter's usefulness and professionalism.

Program Accomplishments

Research

Core Research Program

The core research program is led by Dr. Kai Chen, the YCCCH Director of Research. Through this program, we are building a vibrant community of doctoral students, postdoctoral researchers, and collaborating faculty who apply multidisciplinary approaches – including climate and air pollution sciences, exposure assessment, mathematical and statistical modeling, and environmental epidemiology – to investigate a) interactive effects on human health of ambient temperature, air pollution, extreme weather events, demographic factors, and social determinants; b) future climate change impacts as determined by modeling of alternative scenarios; c) health co-benefits of climate change mitigation and adaption measures and related policies; d) effects of mitigation and adaptation policies on reducing disparities in environmental exposures and their adverse health effects; and e) adaptation strategies, especially to extreme heat. The program aims to produce policy-relevant knowledge that can be used to advance climate change mitigation and adaptation in a manner that promotes health and protects vulnerable populations.

During the 2020-21 academic year, the core research program included Dr. Chen, Dr. Dubrow, Dr. Pin Wang (postdoctoral researcher), five doctoral students, one visiting doctoral student, one master's student, and one undergraduate student.

Donations and grants to support research

- **Yuet Mei Chin Innovation Fund for Junior Faculty**. The donor has committed $1,000,000 for this endowed fund over a five-year period, with the first payment made in 2021.The expendable income from the fund will be used to provide pilot grants to junior faculty in YSPH for projects involving climate change and health. Preference will be given to faculty who propose to involve MPH, MS, and Ph.D. students in their projects.
- **Effect of air pollution reductions on mortality during the COVID-19 lockdown: a natural experiment study**. This study aims to evaluate whether changes in mortality are associated with changes in ambient NO_2 and $PM_{2.5}$ levels before, during, and after COVID-19 lockdowns and to disentangle the short-term effects of NO_2 versus $PM_{2.5}$ on mortality. The analysis will be conducted in four countries: China, Germany, Italy, and the United States.
    - Principal Investigator: Kai Chen
    - Funder: Health Effects Institute
    - Project period: 06-01-2021 to 05-31-2023
    - Total costs for project period: $499,101
- **Associations between extreme precipitation, floods, or drought and childhood diarrhea in low- and middle-income countries.** This study aims to quantify the relationship between extreme precipitation, floods, or drought, and risk of childhood diarrhea in children under age five years in low- and middle-income countries and to evaluate whether the effects of extreme precipitation, floods, and drought are modified by water, sanitation, and hygiene practices.
    - Principal Investigator: Kai Chen
    - Funder: Reckitt Global Hygiene Institute
    - Project period: 06-24-2021 to 05-31-2023
    - Total costs for project period: $300,000
- **Ethane cracker plants in the United States: emissions and community vulnerability**. This study aims to characterize emissions profiles of all ethane cracker plants in the United States and the spatial patterning of sociodemographic and environmental characteristics and health-related vulnerability factors of areas with ethane cracker plants compared to those without.
    - Principal Investigator: Dr. Nicole Deziel.
    - Funder: High Tide Foundation
    - Project period: 1/1/2021 – 12/31/2021
    - Total costs for project period: $100,000
- **Support for a postdoctoral associate**. We received a $63,851 private donation to support a postdoctoral associate to work with Drs. Chen and Dubrow.

The following relevant articles were published by core program faculty during the period of this annual report:

- Robertson LS, Zhou L, **Chen K**. Temperature, precipitation, ozone pollution, and daily fatal unintentional injuries in Jiangsu Province, China during 2015-2017. Inj Epidemiol. 2020 July 27;7(1):42.

- Hemez C, Chiu J, Ryan EC, Sun J, **Dubrow R**, Pascucilla M. Environmental and health impacts of electric service vessels in the recreational boating industry. Water Pract Technol. 2020; July;15(3):781-796.
- **Chen K**, Vicedo-Cabrera AM, **Dubrow R**. Projections of ambient temperature- and air pollution-related mortality burden under combined climate change and population aging scenarios: a review. Curr Environ Health Rep. 2020 Sept;7(3):243-255.
- Ma Y, Zhou L, **Chen K**. Burden of cause-specific mortality attributable to heat and cold: A multicity time-series study in Jiangsu Province, China. Environ Int. 2020 Nov;144:105994.
- Gilbert SZ, Walsh DE, Levy SN, Maksagak B, Milton MI, Ford JD, Hawley NL, **Dubrow R**. Determinants, effects, and coping strategies for low-yield periods of harvest: a qualitative study in two communities in Nunavut, Canada. Food Secur. 2021 Nov;13:157–179.
- Watts N, Amann M, Arnell N, Ayeb-Karlsson S, Beagley J, Belesova K, Boykoff M, Byass P, Cai W, Campbell-Lendrum D, Capstick S, Chambers J, Coleman S, Dalin C, Daly M, Dasandi N, Dasgupta S, Davies M, Di Napoli C, Dominguez-Salas P, Drummond P, **Dubrow R**, Ebi KL, Eckelman M, Ekins P, Escobar LE, Georgeson L, Golder S, Grace D, Graham H, Haggar P, Hamilton I, Hartinger S, Hess J, Hsu SC, Hughes N, Jankin Mikhaylov S, Jimenez MP, Kelman I, Kennard H, Kiesewetter G, Kinney PL, Kjellstrom T, Kniveton D, Lampard P, Lemke B, Liu Y, Liu Z, Lott M, Lowe R, Martinez-Urtaza J, Maslin M, McAllister L, McGushin A, McMichael C, Milner J, Moradi-Lakeh M, Morrissey K, Munzert S, Murray KA, Neville T, Nilsson M, Sewe MO, Oreszczyn T, Otto M, Owfi F, Pearman O, Pencheon D, Quinn R, Rabbaniha M, Robinson E, Rocklöv J, Romanello M, Semenza JC, **Sherman J**, Shi L, Springmann M, Tabatabaei M, Taylor J, Triñanes J, Shumake-Guillemot J, Vu B, Wilkinson P, Winning M, Gong P, Montgomery H, Costello A. The 2020 report of The Lancet Countdown on Health and Climate Change: responding to converging crises. Lancet. 2021 Jan;397(10269):129-170.
- Lowe SR, Wang C, Ma Y, **Chen K**. Particulate matter pollution and risk of outpatient visits for psychological diseases in Nanjing, China. Environ Res. 2021 Feb;193:110601.
- **Chen K**, Breitner S, Wolf K, Stafoggia M, Sera F, Vicedo-Cabrera AM, Guo Y, Tong S, Lavigne E, Matus P, Valdés N, Kan H, Jaakkola JJK, Ryti NRI, Huber V, Scortichini M, Hashizume M, Honda Y, Nunes B, Madureira J, Holobâcă IH, Fratianni S, Kim H, Lee W, Tobias A, Íñiguez C, Forsberg B, Åström C, Ragettli MS, Guo YL, Chen BY, Li S, Milojevic A, Zanobetti A, Schwartz J, Bell ML, Gasparrini A, Schneider A. Ambient carbon monoxide and daily mortality: a global time-series study in 337 cities. Lancet Planet Health. 2021 April;5(4):e191-e199.
- Yin H, Brauer M, Zhang JJ, Cai W, Navrud S, Burnett R, Howard C, Deng Z, Kammen DM, Schellnhuber HJ, **Chen K**, Kan H, Chen ZM, Chen B, Zhang N, Mi Z, Coffman D, Cohen AJ, Guan D, Zhang Q, Gong P, Liu Z. Population ageing and deaths attributable to ambient $PM_{2·5}$ pollution: a global analysis of economic cost. Lancet Planet Health. 2021 June;5(6):e356-e367.
- Ma Y, Pei S, Shaman J, **Dubrow R, Chen K.** Role of meteorological factors in the transmission of SARS-CoV-2 in the United States. Nat Commun. 2021 June;12(1):3602.
- Yu H, Luo J, **Chen K**, Pollitt KJG, Liew Z. Solid fuels use for cooking and sleep health in adults aged 45 years and older in China. Sci Rep. 2021 June;11(1):13304.

Other Research Highlights

- *Lancet Countdown: Tracking Progress on Health and Climate Change*

The Lancet Countdown is an international collaboration that produces an annual report, published in *The Lancet*, that tracks indicators of global progress (or lack of progress) on climate change and health. Since 2018, Yale, represented by YCCCH, has been a member of the collaboration. Drs. Dubrow and Sherman were among the co-authors of the 2020 report, contributing indicators on (1) mitigation in the healthcare sector and (2) air conditioning: benefits and harms. The 2021 report is scheduled to be published in October 2021. Drs. Sherman and Bozzi served as reviewers for the ancillary 2020 Lancet Countdown on Health and Climate Change Policy Brief for the United States of America. YCCCH also served as a financial sponsor for the *2020 Lancet Countdown U.S. Virtual Launch* on December 12, 2020.

With the Lancet Countdown, YCCCH co-hosted a *webinar on Mitigation in the Healthcare Sector* on December 16, 2020. The webinar, which was aimed at physicians and other health professionals from the UK, the USA, and around the world, underscored findings in the 2020 Lancet Countdown report. It explored in detail the sources of emissions within the health sector, presented England's National Health Service as a case study, and provided practical advice and information on the role of health professionals in addressing the healthcare sector's carbon footprint. Participants were eligible to receive continuing medical education credits.

- *C40 Cities' Heat Resilient Cities Tool*

Dr. Chen and YCCCH post-doctoral associate, Dr. Pin Wang, reviewed and validated the C40 Cities' Heat Resilient Cities tool, which helps city planners and decision-makers quantify the health, economic, and environmental benefits of urban heat adaptation actions. The tool models the impact of heat adaptation actions on surface temperatures, and in turn, the lower heat-related hospital admissions and economic cost savings that lower temperatures generate. Cities can then use this information to make the case for urban heat adaptation investments, and to prioritize the actions that are likely to have the most positive impact locally.

- *International Society for Environmental Epidemiology (ISEE) Young Conference*

YCCCH predoctoral fellows, Lingzhi Chu and Yiqun Ma, gave speed talks at the 2021 International Society for Environmental Epidemiology (ISEE) Young Conference. At this same conference, Dr. Kai Chen chaired a Speed Talk session on "Air pollution: cardiometabolic health & Covid-19."

- *Members of YCCCH research team present at ISEE Annual Conference in 2020*

Lingzhi Chu, Yiqun Ma, and Pin Wang presented work at the ISEE 32nd Annual Conference, August 24 – 27, 2020. Lingzhi's presentation was entitled *The relationship between ambient temperature and renal disease morbidity in Vietnam: a case-crossover study*; Yiqun's was entitled *Burden of cause-specific mortality attributable to heat and cold: a multicity time-series study in Jiangsu Province, China*; and Pin's was entitled *A systematic review on lagged associations in climate-health studies*. Both Yiqun and Pin were awarded ISEE Awards to cover their registration costs.

- *Yale News article: Even "safe" ambient CO levels may harm health*

Dr. Chen, with Dr. Michelle Bell and 36 other researchers from the Multi-Country, Multi-City Collaborative Research Network, found "that even slight increases in ambient carbon monoxide levels from automobiles and other sources are associated with increased mortality." Dr. Chen notes that "these findings have significant public health implications [since] millions and millions

of people live in environments with elevated CO levels and in environments where the CO levels are within the current guidelines considered 'safe range.'"

- *Yale Medicine article: Pollution linked to increased mental health outpatient visits*

Dr. Sarah Lowe, YSPH Assistant Professor, Dr. Chen, and Yiqun Ma, Climate Change and Health Pre-doctoral fellow, published an article analyzing the increase in usage of mental health services on days with poor air quality in Nanjing, China. "These tiny particles not only have effects on the lungs, the heart and the brain, but they also have effects on other organs of your body," said Dr. Chen

- *Yale News article: Heat, humidity and UV rays linked to COVID-19 spread*

Led by Dr. Chen, the study - published in Nature Communications – "found that warmer temperatures (above 20 °C), increased humidity, and higher levels of UV radiation were moderately associated with...decreased person-to-person transmission. Of the three factors, absolute humidity played the greatest role." Dr. Dubrow, a co-author of this study, said the findings suggest that the role of meteorological factors in COVID-19 dynamics is meaningful but not dominant. "Public health measures, including vaccination, mask wearing, and social distancing, represent the primary strategies for mitigating transmission of SARS-CoV-2," he said. Yiqun Ma, a doctoral student in the Department of Environmental Health Sciences, is the first author of this study.

- *Lingzhi Chu awarded a 2021 Dan David Prize Scholarship*

Climate Change and Health Pre-doctoral Fellow Lingzhi Chu was awarded a Dan David Prize Scholarship to support her dissertation research on ambient temperature, humidity, air pollution and renal disease morbidity. More information about the Dan David Prize Scholarship can be found on their website.

- *Planned virtual "Conference on Climate Change and Health in Small Island Developing States: Focus on the Caribbean," to be held October 5-8, 2021*

Although the Caribbean islands have made negligible contributions to the world's greenhouse gas emissions, due to their propensity to be hit by hurricanes, which are becoming more intense due to climate change, and accelerating sea level rise, also caused by climate change, these mostly underdeveloped islands, with very limited resources, are among the most vulnerable countries/territories in the world to the adverse effects of climate change, posing monumental public health challenges. Consequently, and because the Caribbean is in our "backyard," YCCCH has made the Caribbean our top global priority, with this conference being our first significant activity. YCCCH has served as a lead organizer for the conference, which is being organized in partnership with more than 25 international, U.S., and Caribbean organizations. A primary expected output from the conference is an action-oriented research agenda for climate change and health in the Caribbean.

Yale Program on Healthcare Environmental Sustainability

The Yale Program on Healthcare Environmental Sustainability (Y-PHES), led by Dr. Jodi Sherman, is housed within YCCCH. The health sector is a leading emitter of greenhouse gas and non-greenhouse gas pollution. Y-PHES seeks to improve the environmental performance of the healthcare sector by a) quantifying its environmental impacts to aid decision-making and b) designing and testing interventions to reduce unnecessary resource consumption, waste, and greenhouse gas emissions. The program is a partnership among the Schools of Public Health, Nursing, and Medicine, working in close collaboration with Yale-New Haven Health System.

The following articles were published by program faculty during the period of this annual report:

- Eckelman M, Romello M, **Sherman J**, Watts N. The health-care sector's role in climate stabilization—Author's reply. The Lancet. 2020 Jul;396(10244):92-93.
- **Sherman J**, Thiel C, MacNeill A, Eckelman MJ, **Dubrow R**, Hopf H, Lagasse R, Bialowitz J, Costello A, McGain F, Stancliffe R, Anastas P, Anderko L, Baratz M, Barna S, Bhatnagar U, Burnham J, Cai Y, Cassels-Brown A, Cimprich AFP, Cole H, Coronado-Garcia L, Duane B, Grisotti G, Hartwell A, Kumar V, Kurth A, Leapman M, Morris D, Overcash M, Parvatker A, Pencheon D, Pollard A, Robaire B, Rockne K, Sadler BL, Schenk B, Sethi T, Sussman S, Thompson J, Twomey JM, Vermund SH, Vukelich D, Wasim N, Wilson D, Young SB, Zimmerman J, Bilec MM.. The Green Print: advancement of environmental sustainability in healthcare. Resources, Conserv and Recycl. 2020 Oct;161:104882.
- McGain F, Muret J, Lawson C, **Sherman JD**. Environmental sustainability in anaesthesia and critical care. Br J Anaesth. 2020 Nov;125(5):680-692.
- MacNeill A, Hopf H, Khanuja A, Alizamir S, Bilec M, Eckelman MJ, Hernandez L, McGain F, Simonsen K, Thiel C, Young S, Lagasse R, **Sherman JD**. A call for medical device industry transformation: toward a circular economy. Health Affairs .2020 Dec;39(12):2071-2079.
- Eckelman MJ, Huang K, Lagasse R, Senay E, **Dubrow R**, **Sherman JD**. United States health care pollution and public health damages: an update. Health Affairs. 2020 Dec;39(12):2071-2079.
- Tennison I, Roschnik S, Ashby B, Boyd R, Hamilton I, Oreszczy T, Owen A Romanello M, Ruyssevelt P, **Sherman JD**, Smith AZP, Steele K, Watts N, Eckelman, MJ. Healthcare's response to climate change: the carbon footprint of the NHS in England. Lancet Planetary Health. 2021 Feb; 5(2):e84-e92.
- McGain F, Muret J, Lawson C, **Sherman JD**. Effects of the COVID-19 pandemic on environmental sustainability in anaesthesia. Response to Br J Anaesth. 2021 March;126:e118-e119. Br J Anaesth March. 2021;126(3):e119-e122.
- Gordon I, **Sherman JD**, Leapman M, Nolte A, Overcash M, Thiel C. Life cycle greenhouse gas emissions of gastrointestinal biopsies in a surgical pathology laboratory. Am J Clin Pathol .2021 Oct;156(4):540-549.
- Senay E, Gore K, **Sherman J**, Patel S, Ziska L, Lucchini R, DeFelice N, Just A, Nabeel I, Thanik E, Sheffield P, Rizzo A, Wright R. Coming together for climate and health: Proceedings of the Second Annual Clinical Climate Change Meeting, January 24, 2020. J Occup Environ Med. 2021 May;63(5):e308-e313.
- **Sherman JD**, Sulbaek Andersen MP, Renwick J, McGain F. Environmental sustainability in anaesthesia and critical care. Response to Br J Anaesth 2021; 126: e195-e197. Br J Anaesth. June 2021;126(6):e193-e195.

Y-PHES Events

- *Clinical Sustainability: Environmental Stewardship at the Bedside* (part of the CleanMed Virtual Series). Dr. Jodi Sherman, Dr. Cassandra Thiel (NYU Grossman School of Medicine), and Dr. Jonathan E. Slutzman (Harvard Medical School) discussed clinical sustainability as an important strategy in advancing climate-smart health care.
- *Covid 19, Climate Change and Supply Chain Resiliency***.** In collaboration with the Nordic Center for Sustainable Healthcare, Dr. Jodi Sherman moderated a discussion on how the Covid-19 pandemic has exposed vulnerabilities in the global healthcare supply chain, and the opportunities for establishing a more robust and resilient supply chain.
- *Care Without Carbon: The Road to Sustainability in US Health Care*. The Inaugural Yale University Sustainability in Health Care Symposium. There were 461 registrants.
    - *Part 1: Sustainability frameworks for the US healthcare sector*. Presented with the Yale Center for Business and the Environment.
    - *Part 2: Lessons from the Greener NHS Initiative: challenges and opportunities on the road to net zero health care*. Presented with the University College London Energy Institute, the Lancet Countdown on Health and Climate Change, and the Northeastern University College of Engineering.
    - *Part 3: Lessons from the Nordic sustainable health care experience*. Presented with the Nordic Center for Sustainable Healthcare.

Climate Change and Health Pilot Research Grant

We did not award a pilot project research grant in 2020-21.

Education

In 2020-21, YCCCH expanded its climate change and health educational offerings at Yale with the successful launching of the new Climate Change and Health Concentration and two new climate change and health courses. We also continued to offer the two-semester clinic course, which is now a joint course with Vermont Law School, as well as two online programs for working professionals. Due to COVID-19 restrictions, Yale courses were taught remotely.

Climate Change and Health Concentration for MPH Students

2020-21 was the inaugural year of YCCCH's Climate Change and Health Concentration for MPH students. Concentrations are cross-departmental programs, with specific requirements, that are open to all MPH students, regardless of department.

The Concentration course requirements are as follows:

- EHS 547, Climate Change and Public Health
- EHS 560, Methods in Climate Change and Health Research
- EPH 555, Clinic in Climate Justice, Climate Policy, Law, and Public Health
- EPH 570 and 571, Seminar in Climate Change and Health
- Two courses from an approved list of electives

It is also recommended that students complete a thesis with a substantive focus on climate change and health and a summer internship related to climate change and health.

In December 2020, three MPH students from the Class of 2022 were accepted to join the concentration. YCCCH also has engaged closely with the YSPH Admissions Office to recruit new students to the MPH program who have an interest in pursuing climate change and health. Our goal is to matriculate 10 new MPH students to the concentration from the Class of 2023.

EHS 547: Climate Change and Public Health

This course is the foundational climate change and public health course offered at YSPH. Developed and taught by Dr. Dubrow, it is a required course for concentration students, as well as a course that is open to other students at YSPH and to students across the university. The following is the course description:

> This course takes an interdisciplinary approach to examining relationships between climate change and public health. After placing climate change in the context of the Anthropocene, planetary boundaries, and planetary health, and exploring the fundamentals of climate change science, the course covers impacts of climate change on public health, including extreme heat, wildfires, hurricanes and flooding, vector-borne diseases, population displacement, and mental health effects. The course covers the public health strategies of adaptation (secondary prevention) and mitigation (primary prevention) to reduce adverse health impacts of climate change and discusses the substantial non-climate immediate health benefits of these strategies. Policy, vulnerability, and climate justice considerations are integrated into the course throughout. The course is reading-intensive and makes ample use of case studies. This course should be of interest to students across Yale School of Public Health and the University.

See the course syllabus here.

EHS 560: Methods in Climate Change and Health Research

Dr. Chen offered this course for the first time in Fall 2020. The course is an important component of both the Climate Change and Health MPH Concentration and the doctoral course sequence for students working with Drs. Chen and Dubrow. See the course syllabus here. The following is the course description:

> Climate change is recognized as one of the greatest public health challenges of the twenty-first century. This course takes multidisciplinary approaches to identify, assess, quantify, and project public health impacts of climate change and of measures to address climate change. It first introduces the fundamental principles of health impact assessment and gives a brief overview of the public health approaches to address climate change. Then it applies advanced data analysis methodologies in environmental epidemiology, including time-series analysis, spatial epidemiology, and vulnerability assessment, to characterize the present climate-health (exposure-response) relationships and to identify vulnerable populations. This course discusses key concepts of scenario-based climate projections and their applications in projecting future health impacts, evaluating health co-benefits of climate mitigation polices, and assessing climate change adaptation measures. Emphasis is placed on hands-on computer lab exercises with real-data examples and R scripts.

Clinic in Climate Justice, Climate Policy, Law, and Public Health

This course is an expanded version of EPH 555, *Practicum in Climate Change, Sustainability, and Public Health*, which Dr. Dubrow has taught since 2017. As in 2019-20, the 2020-21 course was co-taught with an initial faculty team of Dr. Dubrow, Dr. Bozzi, and Ms. Marianne Engelman-Lado. We also expanded the course into a joint course with Vermont Law School (VLS), since Ms. Engelman-Lado took a position at VLS (while maintaining a Yale lecturer

affiliation). Ms. Ruthie Lazenby, the Clinical Legal Fellow for the Environmental Justice Clinic at Vermont Law School, joined the faculty team teaching the clinic. In February 2021, Ms. Engelman-Lado left her Yale and VLS positions to take a position in the Biden Administration as Deputy General Counsel for the Environmental Protection Agency. VLS hired Amy Laura Cahn as visiting professor, and she joined the clinic faculty team. Ms. Cahn brought both strong community lawyering and environmental justice experience; she had most recently served as Senior Attorney and Interim Director of the Healthy Communities & Environmental Justice Program at Conservation Law Foundation.

The following is the 2020-21 course description:

> This course, an innovative collaboration between Yale School of Public Health, Yale School of the Environment, and Vermont Law School, includes students from both Yale and Vermont Law School. In the course, interdisciplinary student teams carry out applied projects that incorporate elements of climate justice, climate policy, and/or law with public health. Each team works with a partner organization (e.g., state agency, community organization, other nongovernmental organization) or on an ongoing project of the Yale Center on Climate Change and Health and/or the Vermont Law School Environmental Justice Clinic. A given team may include students from one institution or from both institutions, in which case team members work together remotely. The course affords the opportunity to have a real-world impact by applying concepts and competencies learned in the classroom. This course should be of interest to graduate and professional students across the University and is open to Yale College juniors and seniors. In addition, this course is one of the options available to students to fulfill the practice requirement for the MPH degree at YSPH and the capstone requirement for the MEM degree at the Yale School of the Environment. Enrollment is by application only; check the Yale Center on Climate Change and Health website or the course's Canvas site for more information.

Enrollment in the course is by application only. Twenty-two students (16 Yale students) took the course in the fall term and eighteen students (10 Yale students) took the course in the spring term. Each student who enrolled became a member of a student team working on one of the following projects:

Project Title	Organizational Partner
Climate Change and Non-Communicable Diseases in Small Island Developing States (project description: fall term)	Eastern Caribbean Health Outcomes Research Organization and Healthy Caribbean Coalition
Climate Justice for Persons Vulnerable to Heat Stress: Auditing Cooling Centers in Northern Manhattan (project description: fall term, spring term)	WE ACT for Environmental Justice
Connecticut Governor's Council on Climate Change (GC3): Environmental Justice and Public Health (project description: fall term, spring term)	GC3 Working Groups: Equity and Environmental Justice; Public Health and Safety
Northern New England Rural Transportation & Climate Justice (project description: fall term, spring term)	Conservation Law Foundation
Climate Justice Petition on Application of Low Carbon Fuel Standards to Biogas from the Dairy Industry in California (Biogas Petition) (project description: fall term, spring term)	Public Justice, Leadership Counsel for Justice and Accountability, Association of Irritated Residents

See the fall semester syllabus here and the spring semester syllabus here. The Northern New England Rural Transportation and Climate Justice team produced a project brief, which was shared with regional stakeholders and is available here.

The clinic will again be offered as a joint course with Vermont Law School in the 2021-22 academic year, using a hybrid format. YCCCH received a three-year grant for $189,700 from the *SNF Fund for the Integration of Theory and Practice* to support the clinic. The SNF Fund, based at Yale Law School, has awarded inaugural grants to faculty across the University to support collaborative efforts to integrate theory and practice through innovative, experiential learning models.

EPH 570 and 571: Seminar in Climate Change and Health

During the 2020-21 academic year, we expanded our speaker series into a not-for-credit seminar course meeting four times each semester. The seminar is a required course for students in the Climate Change and Health Concentration, as well as open to the public. Students are required to attend the seminar, read articles by the seminar speaker in advance, and submit questions in advance. Because we held the seminar series via Zoom (due to COVID-19), we were able to reach an audience far beyond the Yale and New Haven communities, as well as to include speakers from around the country. These were the speakers:

- Dr. Virginia Pitzer, Associate Professor of Epidemiology (Microbial Diseases), Yale School of Public Health. *Microbial forecasting: How do we predict the impact of climate change on infectious diseases?* (51 registrants)
- Dr. Xuhui Lee, Sara Shallenberger Brown Professor of Meteorology, Yale School of the Environment. *Urban heat islands: Theory, measurement and mitigation.* (52 registrants)
- Dr. Gregory Wellenius, Professor of Environmental Health, Boston University School of Public Health. *Heat health effects: Research to inform policy.* (45 registrants)

- Dr. Michael Méndez, Assistant Professor, School of Social Ecology, University of California Irvine. *Vulnerability of Latino/a & indigenous immigrants to climate disasters: Case study of the Thomas Fire in California.* (80 registrants)
- Dr. Sarah Lowe, Assistant Professor of Public Health (Social and Behavioral Sciences), Yale School of Public Health. *Mental health after weather-related disasters: State of the research and future directions.* (86 registrants)
- Ruth Santiago, JD, LLM; Comité Diálogo Ambiental, Inc., *Energy system transformation in Puerto Rico: Enviro/racial justice and public health implications.* (52 registrants)
- Lingzhi Chu, Yiqun Ma, and Phoebe Tran, doctoral students, Yale School of Public Health. *Showcase of YCCCH-sponsored doctoral student research.* (49 registrants)
- Dr. Michelle Bell, Mary E. Pinchot Professor of Environmental Health, Yale University School of the Environment. *Links between wildfires, air pollution, and health under a changing climate.* (186 registrants)

YCCCH Student Associates

Student Associates serve one-year terms as ambassadors for YCCCH while engaging with a diverse community of like-minded students. Associates gain broad exposure to issues of climate change and health through small, seminar-style discussions with field experts whom they help to select. Associates also participate in additional programming such as workshops and skill-based training, film screenings, and student-led presentations/discussions. For the 2020-21 academic year, we received 40 applications for 26 openings. These 26 students represented the Schools of Public Health, the Environment, Medicine, Divinity, and Engineering; the Jackson Institute for Global Affairs; and Yale College.

The COVID-19 pandemic necessitated the move to online Student Associate activities. As such, the Students Associates participated in online seminars with:

- Mr. Lee Cruz, Director of Community Outreach with the Community Foundation of Greater New Haven, on *Environmental and social justice in Fair Haven, CT*
- Dr. Soumyadeep ”Deep” Mukherjee, Assistant Professor in the Department of Health and Physical Education at Rhode Island College, on *Health communications and data exploration for the global climate crisis: a health equity approach*
- Student group “Plant-Based For Public Health,” itself co-led by two Student Associates alumni and two 2020-21 Student Associates, on *From plate to planet: food system solutions in a time of compounding crises*. Featuring: Dawn Moncrief, founder and president of A Well-Fed World; Dr. Jeff Sebo, Clinical Associate Professor of Environmental Studies, Affiliated Professor of Bioethics, Medical Ethics, and Philosophy, and Director of the Animal Studies MA Program at New York University; and Latha Swamy, the City of New Haven’s Director of Food System Policy
- Ms. Anne Hulick, State Director of Connecticut Clean Water Action, on *Healthcare, law, and advocacy*

Additionally, students participated in sessions for “Advocacy Month” (described below in the Public Health Practice section) and participated in student-led working groups: Film Discussions, Advocacy Workshop, and Alumni Events. The Student Associate student coordinator, Holly Burrows, and the Alumni Working Group held four virtual coffee hours throughout the year to connect Student Associate alumni with the current cohort.

To further support the Student Associates' academic and professional development in the field of climate change and health, our Mentorship Program paired 17 students with experts in the field. This was an increase from the 12 pairings created in the 2019-2020 academic year. We also expanded the Summer Internship Program eligibility to include Student Associates outside of YSPH (see below).

Summer Internships in Climate Change and Health

YCCCH further expanded its summer internship program to meet the significant interest in the field of climate change and health. The 2021 program was open to MPH students, YCCCH Student Associates, and for the first time, undergraduate students in the Environmental Studies major. We solicited 12 summer internship projects from partner organizations – eight more than in 2020. Through the two-step process we developed, eligible students applied to be matched with one of the summer internship projects, and then the selected students applied for funding from sources including – but not limited to – YCCCH. YCCCH provided a stipend to four students, while all other students secured funding from other Yale sources. This revised process allowed us to continue building connections with key partner organizations and to expand our reach by leveraging other Yale funds to support the students.

To create a sense of community (particularly given that most of the internships were conducted remotely due to COVID-19), we organized optional bi-weekly lunchtime get-togethers on Zoom for the cohort. As part of the program, all students also were expected to participate in an internship colloquium in Fall 2021 to report back and reflect on their internship experiences. The students, their host organizations, and internship projects are listed below:

Student	Affiliation	Host organization	Project title
Adriana Ballinger	Environmental Studies, Yale College	CT Institute for Resilience and Climate Adaptation & YCCCH (Groton & New Haven, CT)	Municipal Tools for Extreme Heat
Caroline Erickson	Environmental Studies, Yale College, 5-year BA/BS + MPH program	East Shore District Health Department (Branford, CT)	Climate Change in Connecticut: A Research & Photojournalism Road Map to Awareness
Rebecca Gillman	YSPH, Climate Change & Health Concentration	EarthMedic & EarthNurse (Trinidad and Tobago)	Climate and Health Initiatives in Small Islands Developing States – Overview and Potential of NGO-Participation in UN Processes
Natalie Henning	YSPH	Montana Health Professionals for a Healthy Climate	Montana Voices on Climate Impacts
Trinidad Kechkian	Yale College, 5-year BA/BS + MEM program	WE ACT for Environmental Justice (New York, NY)	Northern Manhattan Cooling Center Audit
Erika-ann Kim	YSPH, Climate Change and Health Concentration	Eastern Caribbean Health Outcome Research Network (New Haven/ Atlanta)	Feasibility and Acceptability of Emergency Non-communicable Disease (NCD) Kits to Address Needs of people Living with NCDs After Natural Disasters
Nora Massie	Environmental Studies, Yale College	Save the Sound (New Haven, CT)	Climate Justice and Health Training Initiative
Gwen Oliver	YSPH	California Department of Public Health, Climate Change and Health Equity Unit	California Climate Change and Health Data and Research
Ian Reilly	YSPH, Climate Change & Health Concentration	Equity & Environmental Justice-Adaptation Subcommittee of the Governor's Council on Climate Change (Hartford, CT)	Connecticut Climate Justice & Climate Adaptation
Katie Schlick	Environmental Studies, Yale College	New Haven City Plan Department	Planning for Climate and for Health
Max Teirstein	YCCCH Student Associate, Environmental Studies, Yale College	Community Engagement, Environmental Justice, and Health (CEEJH) Laboratory, University of Maryland School of Public Health	Climate and Health Equity Mapping
Weixi Wu	YSPH, YCCCH Student Associate	Dejusticia (Bogota, Colombia)	Health, Air Quality and Climate Change Interlinkages with a Human Rights Perspective

Climate Change and Health Pre-Doctoral Fellowships

Our first pre-doctoral fellow, Alyssa Parpia, completed her fifth year in the YSPH doctoral program in the Department of Epidemiology of Microbial Diseases. She entered the program with an interest in the mathematical modeling of infectious disease risks in relation to climate change. However, over the past three years her interests have broadened to infectious disease modeling in general. She has completed her three years of funding by YCCCH and was funded by other sources in 2020-21. Her dissertation advisor is Dr. Alison Galvani.

Sappho Gilbert, our second pre-doctoral fellow, completed her fourth year. She is interested in the effects of climate change on food security in indigenous Arctic communities. In May 2021, the National Institute of Environmental Health Sciences awarded her a two-year pre-doctoral fellowship to support her stipend and tuition. The award is entitled "Socio-environmental determinants of grocery sales and community nutrition in transition in Nunavut, Canada." Sappho's dissertation advisor is Dr. Dubrow.

Lingzhi Chu (funded by the China Scholarship Council) completed her third year. Her dissertation prospectus, "Ambient temperature, humidity, air pollution and renal disease risk," was approved with distinction. In April 2021, she was awarded a Dan David Prize Scholarship to support her dissertation research during her fourth year. Dr. Dubrow is her dissertation advisor.

Yiqun Ma (funded by the China Scholarship Council) completed her second year. In June 2021, she started serving as a graduate research assistant on Dr. Chen's grant from the Health Effects Institute entitled *Effect of air pollution reductions on mortality during the COVID-19 lockdown: A natural experiment study*. Dr. Chen is her advisor.

Chengyi Lin (funded by YSPH) completed her first year. Dr. Chen is her advisor.

One doctoral student (funded by YSPH) dropped out of the program at the end of her first year.

Online Certificate Program in Climate Change and Health

YCCCH has continued to offer the well-regarded online Climate Change and Health Certificate program for working professionals. The program prepares public health professionals and those in related fields to address the health impacts of climate change and is open to any qualified person in the world. This 18-week program consists of three consecutive six-week courses: *Introduction to Climate Change and Health* (instructor: Robert Dubrow), *Climate Adaptation for Human Health* (instructor: Kathryn Conlon, Assistant Professor, Department of Public Health Sciences, School of Medicine, University of California, at Davis), and *Communicating Climate Change and Health* (instructor: Connie Roser-Renouf, Associate Research Professor, Center for Climate Change Communication, George Mason University). While focusing on distinct topics, all three courses interweave common themes of climate change health impacts, vulnerability and health equity, and the health co-benefits of mitigation and adaptation.

The curriculum includes video-recorded lectures that students can view at their convenience, readings, quizzes and short assignments, weekly live discussion sessions conducted via Zoom, each with 15 or fewer students, led by a discussion leader (typically a doctoral student), and a concluding assignment. We offered the program in September 2020 (Cohort 5) and in February 2021 (Cohort 6). Cohort 5 included 84 students representing 16 countries; Cohort 6 included 77 students representing 10 countries. In student evaluations, 99% would recommend the certificate program to others and 92% rated the program as excellent or very good.

The alumni network has continued with active participation. Interested alumni meet via Zoom, have a dedicated website, and share resources via an online platform. We also have continued to integrate the Certificate alumni into YCCCH programming, including by inviting select alumni to serve as mentors for Student Associates.

We charged $2,000 for matriculation into the certificate program. Full scholarships, discounts for members of professional organizations, and financial aid were offered. In 2020-21, YCCCH received a net income of $234,007 from the certificate program to support YCCCH activities.

Coursera Specialization

We continue to offer the three-course Coursera Specialization, *Climate Change and Health: From Science to Action*, first launched in September 2019. Coursera is an online course platform with a large, global reach. The Specialization is an abridged version of the online certificate program that better fits the needs of learners who want an introductory learning experience with a smaller time commitment or who are looking to complete the courses at their own pace. The cost is substantially lower: a three-month Coursera subscription costs $147, and the courses also are free to audit (in this case, the learner does not receive a certificate of completion). Nevertheless, in 2020-21 YCCCH's share of the revenue from the Coursera Specialization was $21,350.

Select statistics and testimonials for each of the three courses, July 2020- June 2021, are as follows:

Course (Instructor)	**Enrollment Statistics**			**Average rating**
	Visitors	**Started course**	**Completed course**	
Introduction to Climate Change and Health (R. Dubrow)	28,798	6,007	3,687	4.8/5 (based on 354 reviews)
Climate Adaptation for Human Health (K. Conlon)	7,889	908	443	4.5/5 (based on 63 reviews)
Communicating Climate Change and Health (C. Roser-Renouf)	8,664	840	441	4.8/5 (based on 56 reviews)

Example testimonials:

- *Introduction to Climate Change and Health*: I'm George from Ghana-Africa. I joined this course to better appreciate climate change and its effects on our health. I am glad to say that this course delivered on its objectives as I have been enlightened and I clearly understand the link between climate and our health.
- *Climate Adaptation for Human Health:* I'm a high school student looking to pursue a career in the field of public health & epidemiology. Since climate change and public health are inextricably related, I thought that this would be an interesting direction to go in. Thank you so much for your instruction! Your clarity and knowledge on the subject are impeccable! You have really gotten me more into the field.
- *Communicating Climate Change and Health:* I am a university student reading Environmental Science in The African Methodist Episcopal University, Liberia, West Africa. Your instruction was compelling and understanding. I have leaned ahead of my colleagues. I can robustly communicate health-related risks of climate change effectively to the public &

policymakers & motivate positive changes in climate-related behaviors. It was a nice and memorable time with you!

Public Health Practice

Policy Impact Unit: Focus on Connecticut

In Fall 2020, YCCCH launched its Policy Impact Unit, which leverages YCCCH research and public health practice projects to inform climate policy. The initial focus of the unit, which is led by Dr. Laura Bozzi, YCCCH Director of Programs, is on Connecticut climate mitigation and adaptation policies. In September 2020, we issued *Climate change and health in Connecticut: 2020 report* (*2020 Report*), a first-of-its-kind comprehensive report on climate change and health in Connecticut. The report tracks 19 indicators across four domains: temperature, extreme events, infectious diseases, and air quality. The indicators were developed using publicly available data from state and federal agencies, peer-reviewed literature, and medical associations. Where possible, we directly tracked trends in health impacts (e.g., West Nile virus infections; emergency department visits and hospitalizations for heat stress). However, because of the relative paucity of Connecticut-specific data on health impacts associated with climate change, we also tracked environmental and climate conditions (e.g., drought; outdoor allergens) that can lead to adverse health outcomes. Finally, we tracked indicators related to the impacts caused by the drivers of climate change (specifically, air quality impacts largely driven by fossil fuel combustion).

The *2020 Report* was distributed as physical and digital copies to state legislators, local health officials, agency directors, advocates, and other decision-makers. The report received substantial television, print, and radio media attention, including:

- YSPH news release, *New YSPH report raises concerns about climate change and health in Connecticut*, Sept. 15, 2020
- Yale Daily News article, *Yale report shows alarming climate impacts in University's own backyard*, Sept. 23, 2020
- Connecticut Mirror Op-Ed, Laura Bozzi and Robert Dubrow, *One health threat affects all of Connecticut's 3.5 million residents: climate change*, Oct. 2, 2020
- Danbury News Times, *'Climate change is happening now': Yale report highlights how environmental changes affect CT residents*, Oct. 16, 2020
- WTNH (TV news) interview, *Yale climate change study raises health concerns for Connecticut residents*, Nov. 5, 2020
- WNPR (radio) interview, *What climate change could mean for our health*, Nov. 12, 2020

In addition, Dr. Bozzi gave a virtual seminar: *Climate change and health in Connecticut: 2020 report*. (142 registrants)

As a result of our active engagement in state climate policy activities, the report is cited in the Connecticut Governor's Council on Climate Change (GC3) Adaptation Plan. Dr. Bozzi also led development of the GC3's extreme heat adaptation recommendations, as a member of the GC3 Public Health and Safety Working Group.

Next, we authored a series of issue briefs that align with the *2020 Report*'s four domains, summarizing the key findings and extending them to include policy recommendations. Issue

briefs on *Extreme heat in Connecticut* and *The air quality health benefits of climate action in Connecticut* were published in February and April 2021, respectively. In June 2021, we issued *Natural gas policy and health in Connecticut*; this brief came about through a MPH student's master's thesis (mentored by Drs. Bozzi and Dubrow), which she adapted into an issue brief in partnership with YCCCH. Two more issue briefs – on extreme events and vector-borne diseases – are planned for the latter half of 2021 and the first half of 2022.

Each issue brief is distributed widely to state legislators and other local and state decision-makers. The briefs also form the basis of our policy advocacy with the Connecticut General Assembly and other state decision-making bodies, such as the Low-Income Energy Advisory Board. Our advocacy efforts have supported proposed legislation, including *An Act Concerning Emissions Standards for Medium and Heavy Duty Vehicles* and *An Act Concerning Education and Training in Exertional Heat Illness For Coaches, Parents, Guardians, and Students.*

We received a $10,560 gift from The Patrick and Catherine Weldon Donaghue Medical Research Foundation to support the design, printing, and distribution of the *2020 Report* and the policy briefs.

Outreach

YCCCH faculty and staff are frequently asked to speak on climate change and health topics. Below is a selected list of public speaking events and media appearances we have engaged in to educate about climate change and health and propel policy action.

- Dr. Bozzi delivered the keynote address at the Connecticut Commission on Women, Children, Seniors, Equity & Opportunity-sponsored *Climate Change Summit*, June 4, 2021.
- Dr. Chen gave a lecture, "Climate change and health: connecting the dots" during *Yale Climate Day*, May 11, 2021.
- Dr. Bozzi spoke with March for Science's Dr. Lucky Tran about climate, health, and justice during the Earth Day Initiative & March for Science NYC's *Earth Day 2021* virtual event, April 18. 2021.
- Dr. Bozzi gave a lecture for the *One Air, Water and Land Webinar Series*, hosted by the Cos Cob (Greenwich, CT) Library, March 31, 2021.
- Dr. Dubrow spoke with Yale Climate Connections in a piece entitled, *COVID recovery packages should include climate solutions*, which explored the opportunities we now have to tackle two major crises: COVID-19 and climate change.
- Dr. Dubrow gave the inaugural presentation in the Yale Alumni Academy's Climate Change Conversations series. His presentation was entitled *Climate change mitigation: Protecting the health of Current and future generations*.

Advocacy Training for Climate Action

Responding to student feedback about offering varied times for engagement opportunities, YCCCH organized and hosted the *Advocacy Training for Climate Action* workshop (informally: "Advocacy Month") throughout the month of February 2021. Five sessions occurred on Tuesdays and Thursdays, with a concluding online social on Friday, February 26, 2021. There were 61 total registrants, and nearly all participated in multiple sessions.

Sessions addressed: (1) the role of citizen science and incorporating voices and knowledge from community members' lived experiences into science and advocacy; (2) stakeholder

analysis and leveraging connections to create curriculum changes, using the Yale School of Medicine as an example; (3) crafting and communicating a message in ways that motivate action; (4) fact finding and using data to support messaging; and (5) writing effective op-ed pieces in local and national media outlets. The sessions were led by issue experts and Student Associates (both past and present) from the following organizations: Nature Now International, Physicians for Social Responsibility, the Yale Program on Climate Communication, and the Yale School of Management.

YSPH Commitment

Pre-doctoral Fellowships

YSPH paid half the tuition and the full health insurance for Sappho Gilbert, Lingzhi Chu, and Yiqun Ma. YSPH paid the entire cost for Chengyi Lin and for the student who dropped out of the program.

Sustainability Committee

In 2015, YSPH established a Sustainability Committee, co-chaired by Dr. Dubrow and Heidi Richard (Chief of Staff, Office of the Dean). This is the Committee's vision: "We envision a YSPH in which the integral relationship between sustainability and health is seamlessly incorporated into our teaching, research, practice, operations, and culture." This is the Committee's mission: "The YSPH Sustainability Committee guides the School's efforts to implement its ongoing Sustainability Action Plan, which includes the areas of energy and greenhouse gas emissions; natural and built environment; materials management; food and well-being; and sustainability leadership and capacity building; the Committee's efforts at greenhouse gas reduction will be guided by both the Sustainability Action Plan and the school-wide Climate Change and Health Initiative. The Committee collaborates with YSPH faculty, students and staff and the Yale Office of Sustainability to achieve its goals."

The membership of the Committee for the 2020-21 academic year was:

- Dr. Robert Dubrow, Professor of Epidemiology (Environmental Health Sciences), (co-chair)
- Heidi Richard, Administrative Director, Office of the Dean (co-chair)
- Elizabeth Eocaci-Tucker, Senior Administrative Assistant
- Dr. Peter Krause, Senior Research Scientist in Epidemiology (Microbial Diseases)
- Dr. Brian Weiss, Research Scientist in Epidemiology (Microbial Diseases)
- Dr. Paul Cleary, Professor of Public Health Policy
- Dr. Debbie Humphries, Clinical Instructor in Epidemiology (Chronic Diseases)
- Jennifer Farkas, Director of Financial Aid
- Cassie Clark, PhD student
- Nicholas Elton, MPH student
- Erika-Ann Kim, MPH student
- Natalie Henning, MPH student
- Giselle Bellia, MPH student
- Rachel Hennein, MD/PhD student

The committee is guided by a YSPH Sustainability Action Plan, developed in 2018 in coordination with the Yale Sustainability Plan 2025. During the 2020-21 academic year, all classes were taught virtually and all faculty and staff worked from home due to the COVID-19 pandemic. This virtual environment posed challenges for advancing sustainability within the YSPH physical space, but we were able to pivot and held successful virtual "coffee hours" on *Electric vehicles: taking charge of vehicle choices*, *Transitioning to plant-forward food*, *Priorities for climate change legislation in Connecticut*, and *Composting basics*. We also helped orchestrate the planting of a cedar tree in front of the school as a tribute to Paul Cleary, our former dean and member of this committee, who retired at the end of last academic year.

Other YSPH Support

- Use of all net revenue from the online Climate Change and Health Certificate program to support YCCCH activities
- Full funding and a generous start-up package for Dr. Chen as a core faculty member of YCCCH
- Approval to recruit a new Assistant or Associate Professor to serve as YCCCH Director of Education
- An ongoing financial commitment to our pre-doctoral fellowship program
- YCCCH is a top funding priority for the upcoming Yale capital campaign

Major Year 7 Goals

Year 7 will focus on implementing the second year of our four-year strategic plan. Highlights include:

- **Recruitment of a new core faculty member to serve as YCCCH Director of Education**. We aim to conduct an international search, with the aim of recruiting the Director of Education, with a start date of January 1, 2022.
- **Conference on Climate Change and Health in Small Island Developing States: Focus on the Caribbean, October 5-8, 2021**. YCCH has identified the Caribbean as its top global priority. This conference, for which YCCCH has served as a lead organizer, represents our first major activity. We are organizing the conference in partnership with more than 25 international, U.S., and Caribbean organizations. A primary expected output from the conference is an action-oriented research agenda for climate change and health in the Caribbean.
- **Climate Change and Health Concentration for MPH Students**. We aim to enroll at least 10 students from the Class of 2023 into the concentration.
- **Expansion of core research program** team. We aim to add a postdoctoral associate, a predoctoral fellow, and a visiting scientist to our research team.
- **Policy Impact Unit: Focus on Connecticut**. We aim to publish policy briefs on extreme events and vector-borne diseases.
- **Fundraising**. We aim to secure at least two major new grants or donations, and to actively support efforts associated with the university's capital campaign.