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NIH Wide Collaborative Initiative on Climate Change and Health

Rick Woychik, Ph.D.

Director, NIEHS & NTP

On behalf of the CCHI Executive Committee

NIH Advisory Committee to the Director (ACD)

June 9, 2023



Impacts of Climate Change on Human Health

CHANGES IN CLIMATE



Increased global temperature



Extreme weather and disasters



Precipitation extremes



Sea level rise



Changes in land use and growing seasons

EFFECTS OF CLIMATE CHANGE



Extreme heat



Air and water pollution



Reduced food and water quality



Changes in infectious diseases and vector transmissions



Increasing allergens

HEALTH IMPACTS



Heat related illness



Cardiovascular disease, stroke, and other chronic conditions



Injuries and death



Mental and neurological disorders



Zoonotic, vector- and water-borne diseases



Respiratory diseases and asthma



Climate Change Affects Us Unequally



Under-served populations with health disparities

(Some communities of color; Low-income populations; Low-educational attainment groups; Immigrant groups; Indigenous populations)



Exposed workers

(e.g., farmers, construction workers)



Persons with disabilities



Vulnerability by life stage

(Fetal/pre-natal, infants, young children, pregnant women, elderly)



Vulnerability associated with chronic medical conditions

(e.g., diabetes, asthma, cardiorespiratory diseases, psychiatric diseases)



Populations in LMICs

(Higher rates of existing diseases, malnutrition, and extreme poverty)

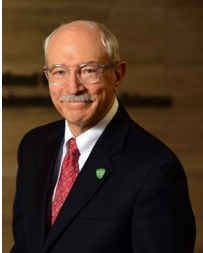
NIH Wide Climate Change and Health Initiative

- **Formally launched in 2021**
 - Builds on past NIH efforts and funding, with previous roots in 2009
- **Led by Collaboration of seven NIH Institute and Center Directors**
 - National Institute of Environmental Health Sciences (NIEHS)
 - Fogarty International Center (FIC)
 - National Institute on Minority Health and Health Disparities (NIMHD)
 - National Institute of Mental Health (NIMH)
 - National Institute of Nursing Research (NINR)
 - Eunice Kennedy Shriver National Institute of Child Health and Human Development (NICHD)
 - National Heart, Lung, and Blood Institute (NHLBI)
 - **Working Group of more than 140 members across 25 NIH Institutes and Centers**





NIH Climate Change and Health Initiative Executive Committee



Rick Woychik, Ph.D. (Chair)
[National Institute of Environmental Health Sciences \(NIEHS\)](#)



Gary H. Gibbons, M.D.
[National Heart, Lung, and Blood Institute \(NHLBI\)](#)



Eliseo J. Pérez-Stable, M.D.
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Peter Kilmarx, M.D.
[Fogarty International Center \(FIC\)](#)



Diana I. Bianchi, M.D.
[Eunice Kennedy Shriver National Institute of Child Health and Human Development \(NICHD\)](#)



Joshua A. Gordon, M.D., Ph.D.
[National Institute of Mental Health \(NIMH\)](#)

From 2011-2020 NIH funded 350 research grants on climate change and health topics. We conducted a portfolio analysis in development for our strategic framework.

- **Health Outcomes n=215**

- Respiratory
- Birth/Premature Birth
- Maternal Health
- Occupational Health
- Malaria & Dengue
- Heat Stress

- **Weather Related Concepts n=233**

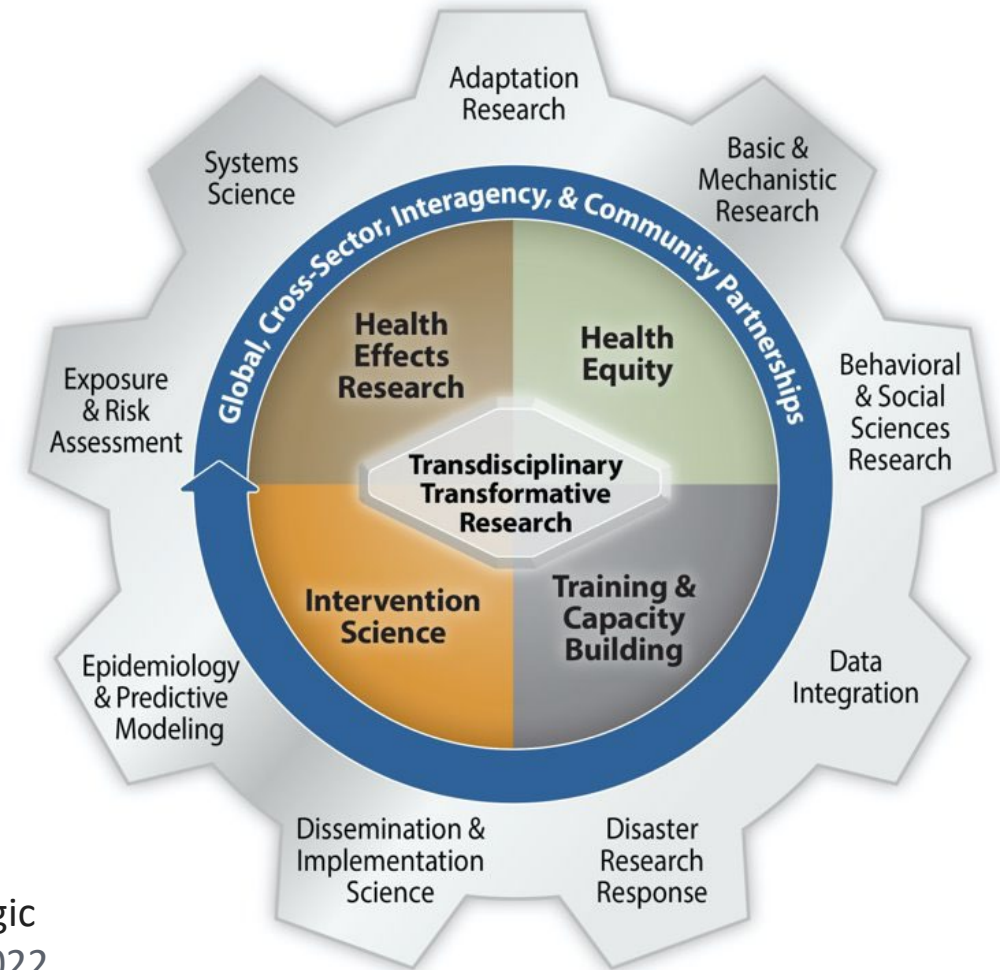
- Extreme heat/weather/temperature
- Drought/flood/rain/precipitation
- Hurricanes /Tropical Cyclones
- Climate variability/seasons
- Fire/wildfire
- Humidity

When analyzing the portfolio by research cog from our signature diagram, we found that most of the grants were in the epidemiology/predictive modeling, exposure and risk assessment cogs. Scientific gaps were noted for climate adaptation, interventions/implementation science, and systems science. We have a manuscript submitted with further details of our expanded portfolio analysis.



Initiative Goals and Framework

Goals: Reduce health threats across the lifespan and build health resilience in individuals, communities, and nations around the world, especially among those at highest risk.



Woychik, et. al. The NIH Climate Change and Health Initiative and Strategic Framework: addressing the threat of climate change to health, Lancet 2022 Nov 26, 1831-1833



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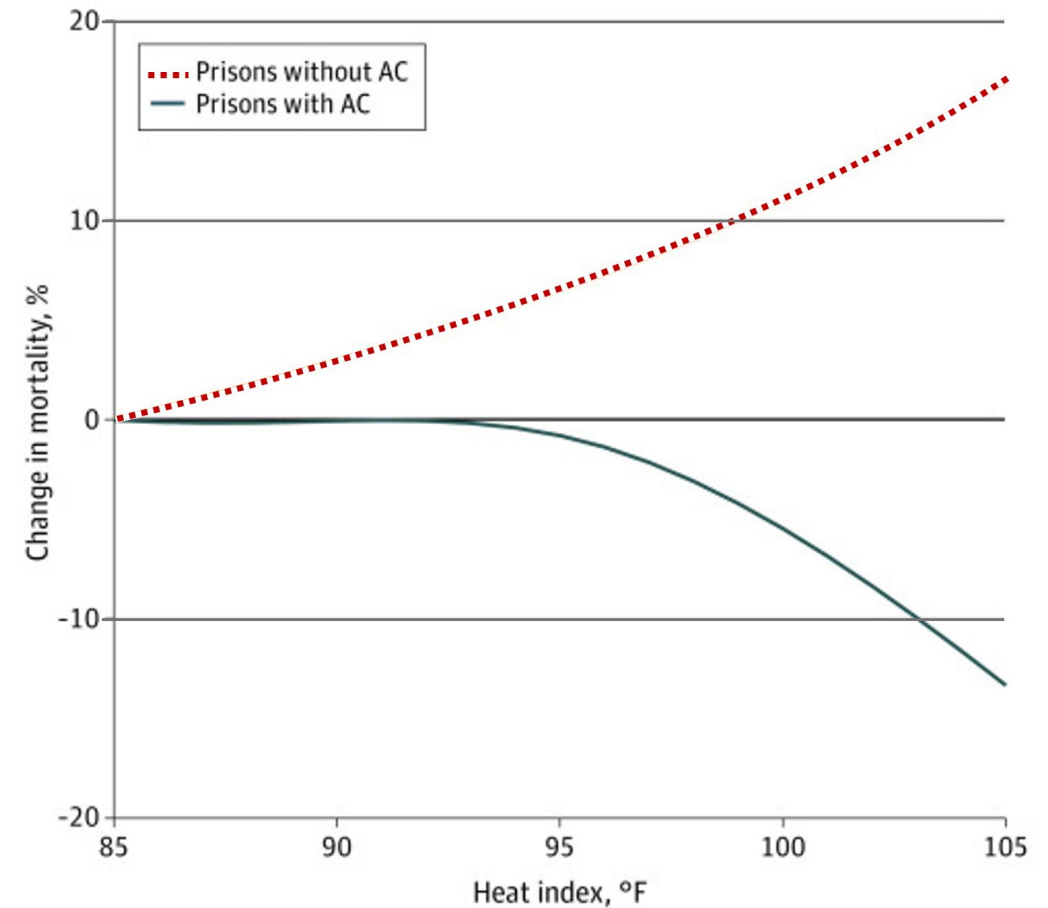
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NIH Funded Climate Change and Human Health Research



Adaptation Research: The Role of Air Conditioning in Prisons

- **Objective:** Investigate heat-related mortality risk in Texas prisons without AC with funding from NIMH and NIEHS
- **Method:** Case-crossover design 2001-2019
- **Results:**
 1. Prisons without AC had higher all-cause mortality rates
 2. 1-degree increase above 85-degree heat index linked to 0.7% mortality risk increase
 3. Each extreme heat day associated with 15.1% mortality risk increase
 4. AC provided protection, especially during extreme heat
- **Conclusion:** 14 deaths/year linked to heat in prisons without AC, no deaths in prisons with AC.

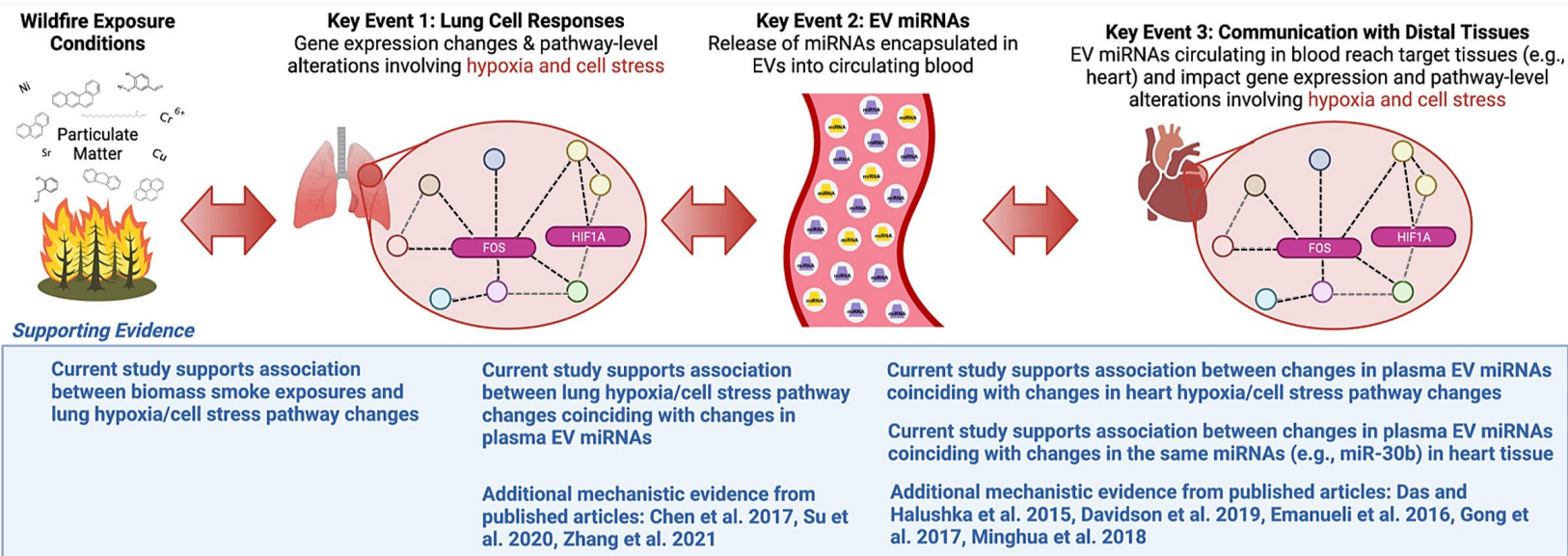


Association Between Same-Day Maximum Heat Index Relative to 85 °F and All-Cause Mortality in Texas Prisons by Air Conditioning (AC) Status From 2001 to 2019



Basic and Mechanistic Research: Cardiopulmonary Responses to Wildfire Smoke

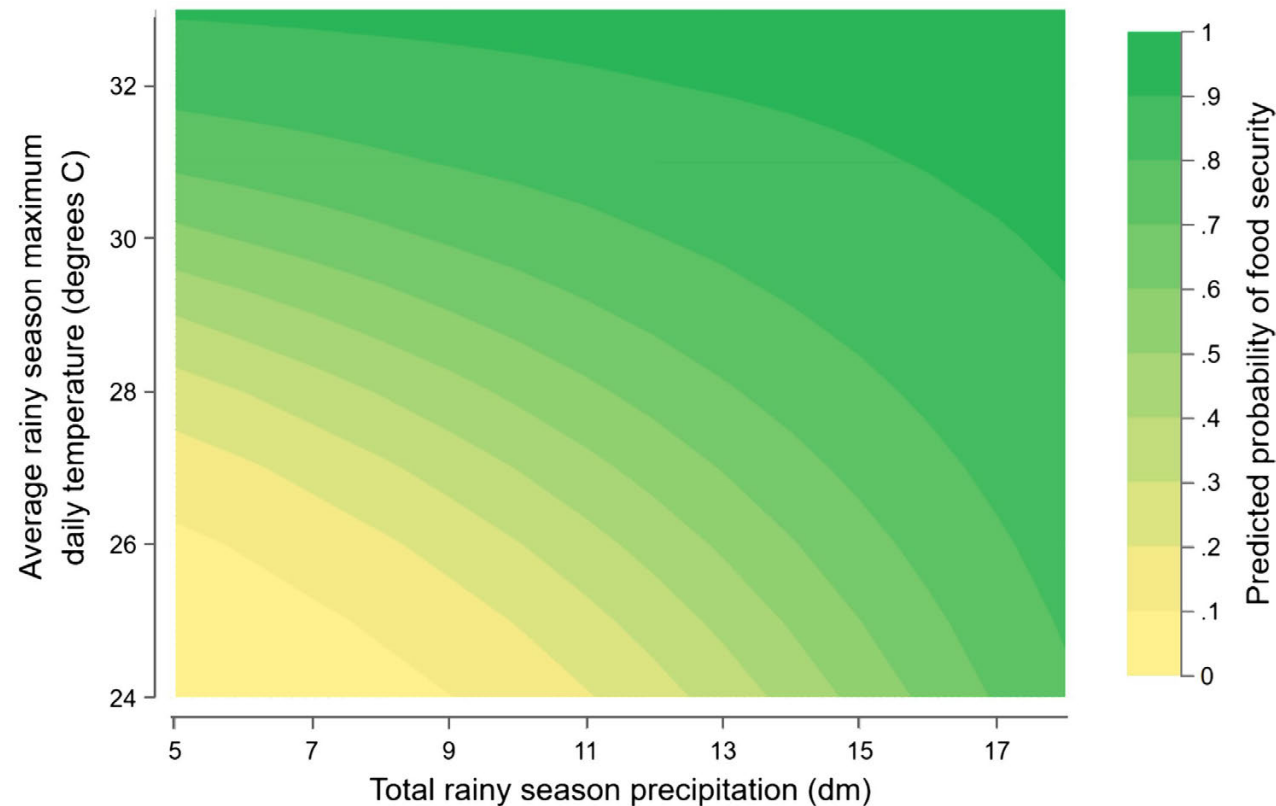
- **Hypothesis:** miRNAs in peripheral blood EVs respond to variable biomass smoke exposures, indicating lung and heart toxicity.
- **Methods:** Female mice exposed to different biomass smoke scenarios. Lung, blood, and heart tissues collected for RNA sequencing.
- **Results:** Lung and heart mRNAs showed differential expression enriched in hypoxia and cell stress-related pathways.
- **Conclusion:** NIEHS funded study reveals plasma EVs as a potential mechanism for cardiopulmonary responses to wildfire exposure, facilitating intercellular communication between tissues.





Behavioral and Social Science Research: The Resilience of Food Security to Climate Shocks

- **Hypothesis:** NICHD-funded study explores the link between rainfall, temperature, and food security in Tanzania.
- **Methods:** Integrating household survey data and climate data, fixed effects regression models examine the impact of the rainy season on food security indicators: Food Consumption Score (FCS) and reduced Coping Strategies Index (rCSI).
- **Results:** Optimal food security observed during warm and wet conditions. Food insecurity more likely during dry and cool rainy seasons, especially with rainfall below 11 dm and average maximum daily temperatures below approximately 27 degrees C.
- **Conclusions:** Insufficient rainfall hinders food access, leading to lower agricultural production, increased food prices, reduced dietary diversity, and food shortages.



Predicted probability of being food secure based on precipitation-temperature interactions.

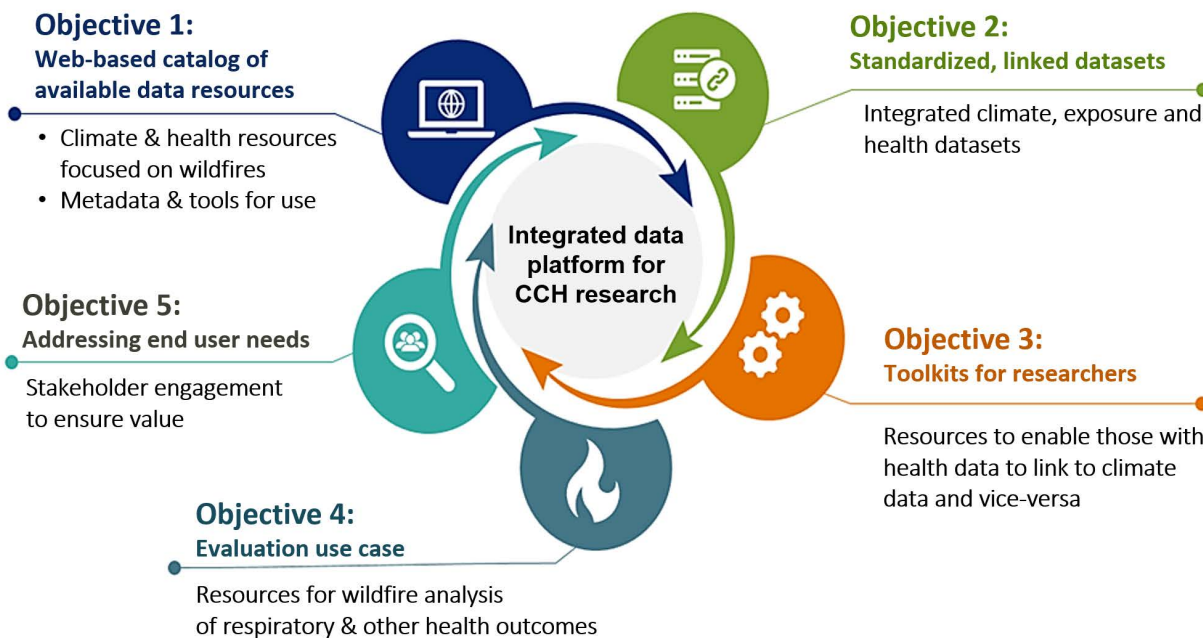


Data Integration: NIH Climate and Health Outcomes Research Data Systems (CHORDS)

Goal: This new project will create a resource that links **climate and environmental data with health outcomes data** so that researchers can identify, analyze, and reduce the health effects associated with climate-related events and improve patient and population health outcomes

Project: Effort to harmonize, standardize, and link diverse types of data, in order to produce publicly accessible data products and resources to improve patient and population health.

- **Examples of data types:**
 - GIS mapping data
 - Climate satellite data
 - Personal Exposure data
 - Electronic Health records



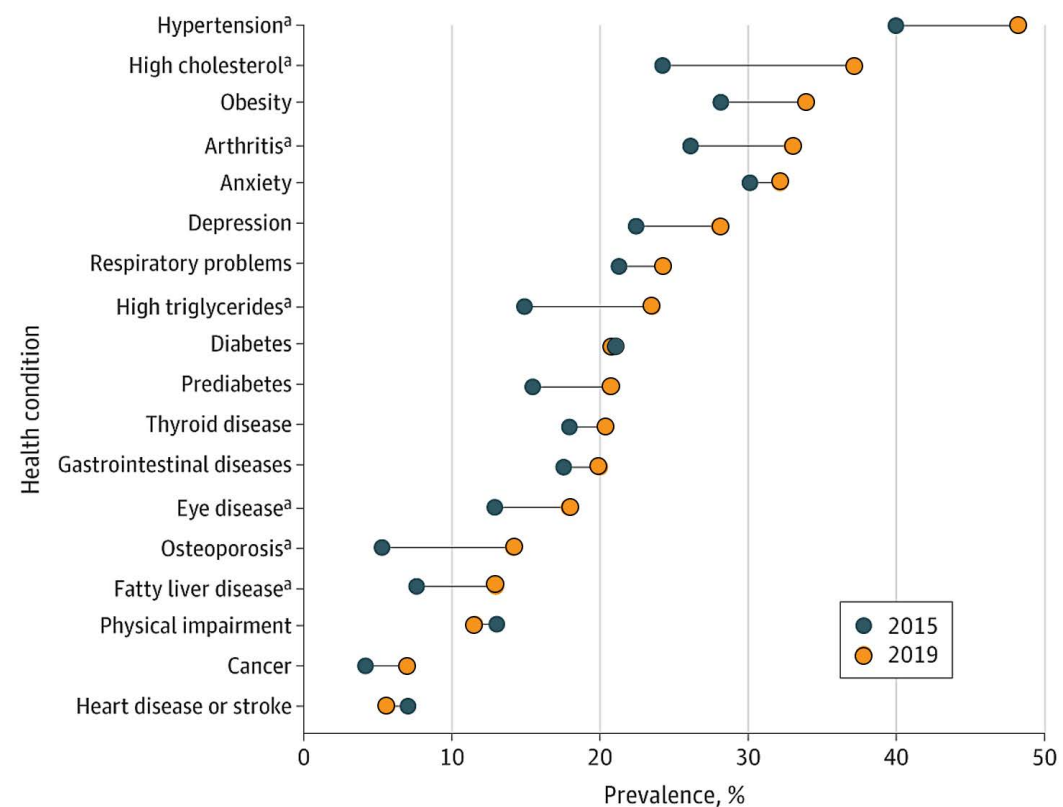
Collaboration partners: NIEHS, NHLBI, NIA, CDC, NASA, AHRQ, HHS-OS



Disaster Research Response: Hurricanes and Chronic Health Problems

- **Hypothesis:** NHLBI and NIMHD research examines the impact of hurricanes on the prevalence of chronic diseases and associated risk factors.
- **Methods:** Cross-sectional study comparing pre- and post-Hurricane Maria data (PRADLAD 2015 and PROSPECT 2019). Conducted χ^2 tests for categorical variables.
- **Results:** Significant increase in prevalence of hypertension, high cholesterol, arthritis, high triglycerides, eye disease, osteoporosis, and fatty liver disease after the hurricane in Puerto Rico.
- **Conclusions:** Study reveals higher prevalence of unhealthy behaviors and multiple chronic conditions following a hurricane.

Figure. Chronic Diseases Reported by Adults in 2015, Before Hurricane Maria, and 2019, After Hurricane Maria



^aSignificantly different from populations in 2015 and 2019 at P < .05. Differences assessed using χ^2 test.



Risk Assessment: Glucose Metabolism and Heat in Kidney Disease

- **Background:** Rising environmental temperatures increase concern for heat-related illnesses (HRI) and acute kidney injury (AKI) among vulnerable populations.
- **Methods:** Explore glucose metabolism, heat exposure, and AKI in farmworkers using high-resolution metabolomics and big data analytics.
- **Findings:** Identify new risk factors (e.g., impaired glucose metabolism) and early biomarkers (e.g., perturbed glucose, HRI, and inflammatory profiles) for AKI.
- **Implications:** Early detection of AKI and intervention opportunities for improved outcomes.



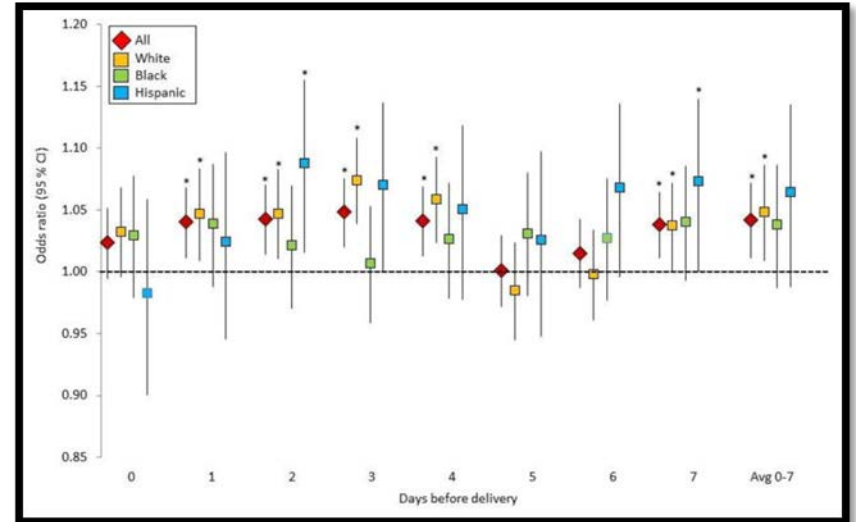
Contact PI/Project Leader: Cristina Roxana Chicas

Awardee Organization: Emory University

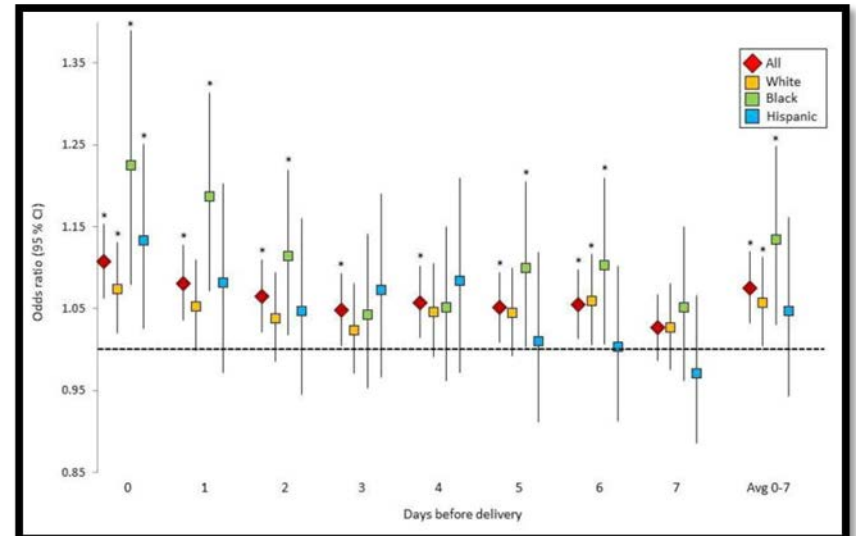


Epidemiology: Ambient Temperature Changes Contribute to Maternal Cardiovascular Complications

- **Background:** The impact of ambient temperature on cardiovascular events during labor/delivery in pregnant women is unclear.
- **Objective:** Examine the association between temperature and cardiovascular events, considering maternal race/ethnicity.
- **Methods:** Analyzed data from 680 women across 12 US sites using case-crossover analysis.
- **Results:** Lower temperatures before delivery in the cold season and higher temperatures in the warm season increased the risk of cardiovascular events. Risks were higher closer to delivery and Black women showed greater susceptibility in the warm season.
- **Conclusion:** Temperature changes affect cardiovascular events during labor/delivery, with potential racial disparities.



Cold Weather



Warm Weather



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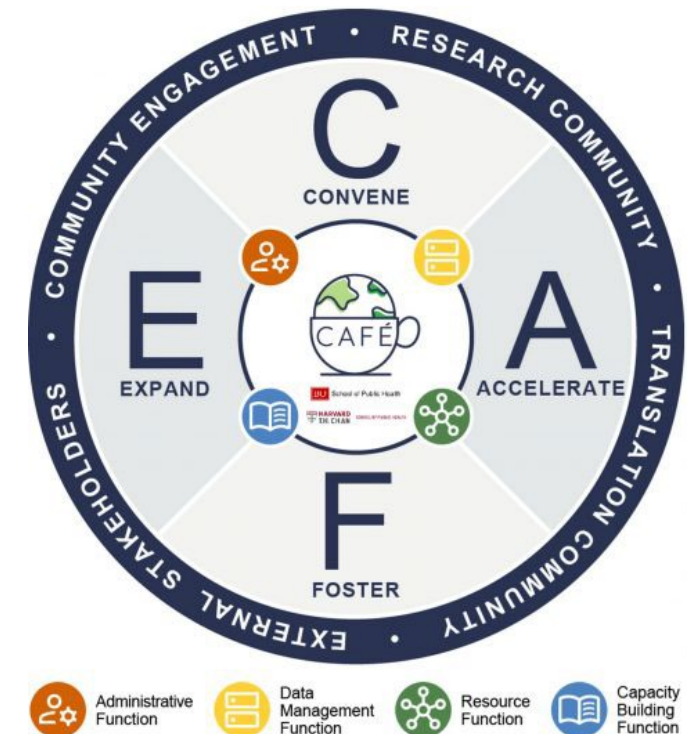
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NIH CCH Programmatic Accomplishments



Research Coordinating Center - Boston University SPH - Harvard T.H. Chan SPH

- Researchers from Boston University School of Public Health and Harvard T.H. Chan School of Public Health will coordinate and develop the NIEHS funded Research Coordinating Center (RCC) dedicated to accelerating research and translation on the health impacts of climate change.
- MPIs: Drs. Greg Wellenius, Amruta Nori-Sarma (BUSPH), Francesca Dominici (HSPH)
- Overview:
 - Launched May 9, 2023
 - RCC will have four core areas of focus:
 - The Administrative Function
 - The Data Management Function
 - The Resource Function
 - The Capacity Building Function



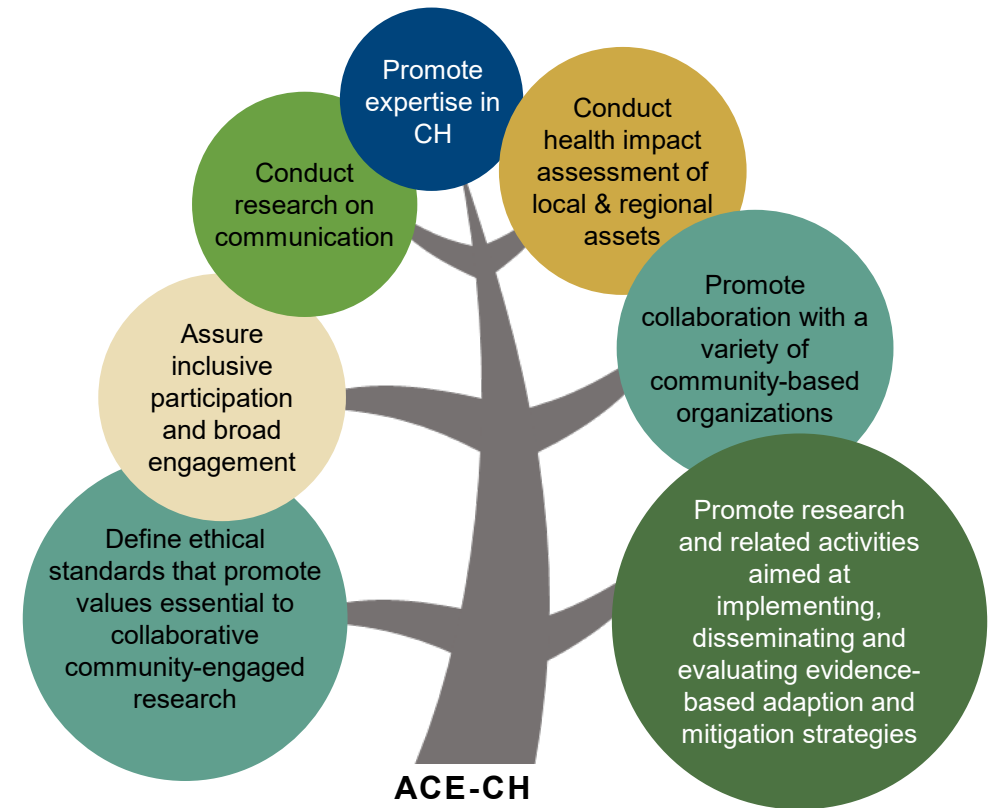
COMMITTED SUPPORTERS:

Harvard Data Science Institute, Harvard Climate Change Institute, BUSPH Center for Climate and Health, Microsoft, AWS, ESRI, Google, BU Events Planning, UMass Boston, Meharry Medical College, PHFI, C40 Cities, EHRA



Alliance for Community Engagement – Climate and Health (ACE-CH)

- Goal: The ACE-CH seeks to coordinate and build community engagement research opportunities to:
 - Support community-engaged research and outreach focused on climate change
 - Promote inclusion of underserved, racial/ethnic minority, and rural populations with the greatest disadvantage to the impacts of climate change
- Funding: FY22 with IC contributions
 - Continued funded in FY23-26 from the appropriation
 - Administered by NHLBI using OTA mechanism



ACE-CH will work in close collaboration with community partners, including health service providers, public health agencies, policymakers, community-based organizations, health advocacy groups, environmental justice and climate justice groups, and other stakeholders as appropriate.



Funded ACE-CH Hubs



Alaska Alliance for Community Engagement – Climate and Health (AK ACE-CH)

- **Communities:** Indigenous Alaska Natives in rural/remote AK
- **Climate impacts:** Food systems, infectious disease, mental health



Community-driven approaches to EJ and Health in the Face of the Climate Crisis in Southern CA

- **Communities:** Economically disadvantaged, immigrant groups, people of color, unhoused and elderly communities in LA and Carson
- **Climate impacts:** EJ, extreme heat, air pollution, wildfires



University of Colorado
Boulder

Mountain West ACE-CH Hub: Climate Change Engagement Platform to Support Resilient Rural and Urban Communities

- **Communities:** Economically disadvantaged, communities of color, immigrant groups, and vulnerable occupational groups near Denver
- **Climate impacts:** Air quality, drought, wildfires, extreme heat



Climate Health Adaptation and Resilience Mobilizing (CHARM) Lake County Project

- **Communities:** American Indian tribal, immigrant populations, rural and agricultural workers in Lake County, CA
- **Climate impacts:** Extreme heat, harmful algal blooms (HABs)



Training and Capacity Building: NIH Climate and Health Scholars Program

- New program to bring scientists actively working in CCH to share knowledge and help build CCH science capacity across the NIH
- **Overview:**
 - Launched CH Scholars Program in Summer of 2022
 - 8 Scholars selected from academia and industry, hosted by:
 - FIC, NCI, NHLBI, NIA, NIAID, NIEHS, NINR, NIMHD
 - Call for applications for round 2 of the program in June 2023





NIH Intramural Targeted Climate Change and Health (ITCCH) Awardees



**Lindsey Criswell, M.D.,
D.Sc., M.P.H.**

- Senior Investigator, NIAMS
- “Effects of wildfire smoke exposure on the epigenome and health in a multi-ethnic cohort.”



**Una Grewal, Ph.D.,
M.P.H.**

- Senior Investigator, NICHD
- “Climate change and its effects on reproductive health, pregnancy, and birth outcomes



Edward Lakatta, M.D.

- Senior Investigator, NIA
- “Effects of climate change on cardiovascular aging and diseases.”



**Qing Lan, M.D., Ph.D.,
M.P.H.**

- Senior Investigator, NCI
- “Combined effects of extreme climate and air pollution on multi-omics upper airway and plasma biomarkers related to risk of lung cancer.”



**Emily Ricotta, Ph.D.,
M.Sc.**

- Independent Research Scholar, NIAID
- “Analysis of data management capacity in regions with high infectious disease spillover risk.”



Dale Sandler, Ph.D.

- Senior Investigator, NIEHS
- “Characterizing the role of epigenetic adaptation in the relationship between extreme heat and metabolic dysfunction: A paired human and mouse study.”

Building the Foundation for Climate Change and Health Research

- Awarded **19 administrative supplements** to add a CCH focus to research grants from 5 small NIH ICs (\$1.9M) in FY22
- **Additional Administrative supplements** will be awarded in FY23
- Awarded **31 new grants** (~\$12.5M) by NIEHS, NIA, FIC, NICHD, NIDDK, NINR, NIAID, NIMHD, and NIMH in FY22, and expect to expand this in FY23
- Discussing **collaborative programs with partners** such as NSF, CDC, EPA and global philanthropic organizations

Current Funding Opportunities (2023)

Exploratory Grants for Climate Change and Health (P20) RFA-ES-23-007

- **Goal:** To support the development of a transdisciplinary research environment to examine the impacts of climate change on health and to develop action-oriented solutions to protect the health of individuals, communities, and nations from the hazards posed by climate change.
- **Due Dates:** May 01, 2023; November 07, 2023
<https://grants.nih.gov/grants/guide/rfa-files/RFA-ES-23-007.html>

Current Funding Opportunities (2022-2024)

NOT-ES-23-006 Notice of Special Interest (NOSI):

- **Goal:** Supports CCH research in the U.S. and globally. Encourages use of common data element and collection tools. Open for 3 years.

NOT-ES-22-009 & NOT-ES-22-010: Notices of Special Interest: Innovative Technologies for Research on Climate Change and Human Health (SBIR/STTR)

- **Goal:** Supports technologies for capturing the effects of climate change/extreme weather on human health and to reduce the health threats posed by climate change.



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Climate Change and Health Initiative

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Thank You

NIH Climate Change and Health Initiative

Information on the Initiative and Framework

- www.nih.gov/climateandhealth

Funding Announcements

Updated live as announcements are released

- www.nih.gov/climateandhealth

Public Seminar Series

Promoting transdisciplinary discussion and collaboration against this threat to health.

- <https://www.nih.gov/climateandhealth#seminar-series>

Climate Change and Health Literature Portal

Searchable database to provide access to the most relevant scientific literature

- <https://tools.niehs.nih.gov/cchhl/index.cfm>