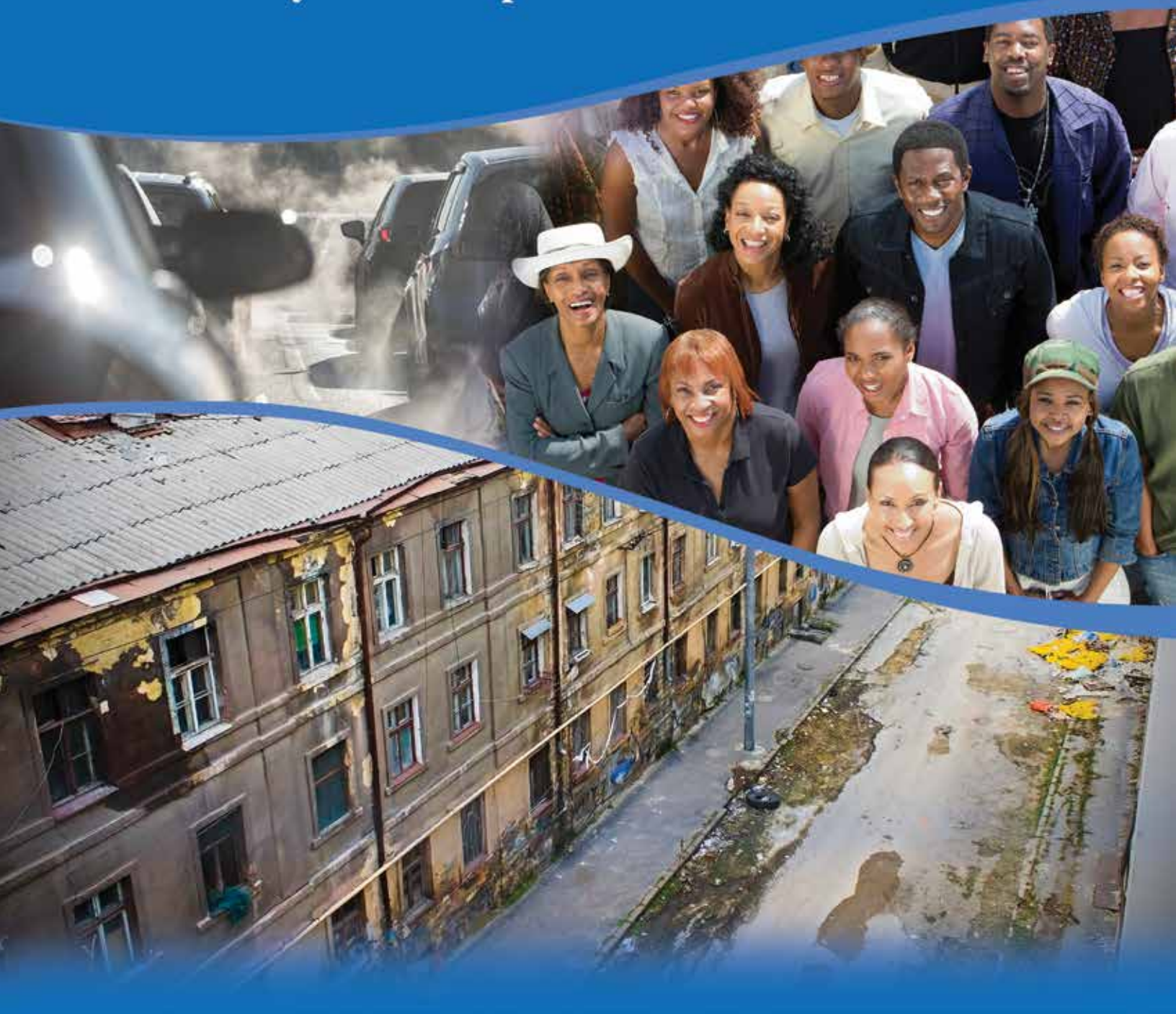


The Pilot EPA-NIMHD Centers of Excellence on Environment and Health Disparities

A Summary of Accomplishments



Disclaimer

The research described in this document has been funded wholly by the U.S. Environmental Protection Agency (EPA) under the Science To Achieve Results (STAR) grants program. The information provided does not necessarily reflect the views of the Agency, and no official endorsement should be inferred. Mention of trade names or commercial products does not constitute endorsement or recommendation by EPA for use. The information presented in this summary report is intended to provide the reader with insights about the progress and scientific achievements of STAR research grants. The report lists the grantees whose research is discussed, and indicates where more detailed peer-reviewed scientific information can be found. This report is not sufficiently detailed nor is it intended to be used directly for environmental assessments or decision making. Readers with these interests should instead consult the peer-reviewed publications produced by the STAR grants and conduct necessary data quality evaluations as required for their assessments.

EPA provided funding support for the Pilot Environmental Health Disparities (EHD) Centers, which were managed and administered by the National Institutes of Health's National Institute on Minority Health and Health Disparities (NIMHD).

EPA and/or its contractor have received permission to use the images within this document.

Prepared for

U.S. Environmental Protection Agency
Office of Research and Development
National Center for Environmental Research
Washington, DC 20460

Prepared by

ICF International, Inc.
9300 Lee Highway
Fairfax, Virginia 22031
Under EPA Contract No. EP-C-14-001



Acknowledgements

Foremost, I would like to acknowledge the crucial role of the EPA-NIMHD Pilot EHD Center Directors, their investigators, and students for their leadership in pioneering the scientific, educational, and community-based advancements to the topic of environment and health disparities research. Their timely response and cooperation to the call for input for this report is greatly appreciated, as it could not have been possible without their great effort and assistance. I would also like to express much gratitude to Nishadi Rajapakse at NIH/NIMHD, for her collaborative support throughout the life of the centers and her contribution to development of this report.

Special thanks and appreciation go to EPA technical reviewers: Andrew Geller, Jim Quackenboss, Cynthia McOliver, and Nicolle Tolve for their thoughtful editorial comments and perspectives on the draft report. Many thanks to the EPA National Center for Environmental Research (NCER) Senior Managers for their guidance and direction, and to the Communications Team for their timely assistance with fine-tuning the report. Last, but not least, a heart-felt thank you to Nica Louie for her dedicated oversight of the support contract for this report and for her infinite source of ideas and inspiration.

Sincerely,
Maggie Breville,
Health Research Program Manager, EPA

TABLE OF CONTENTS

8

Introduction

Executive Summary	9
Background and Origin of the Pilot EPA-NIMHD Centers	11

19

Accomplishments & Impacts of the Pilot EPA-NIMHD EHD Centers

20 Research & Tools Development

IDENTIFYING ENVIRONMENT & HEALTH DISPARITIES	21
Disparities in Environmental Exposure	22
Characterizing exposures to traffic-related air pollution in urban neighborhoods.	22
Investigating and reducing young American Indians' exposures to tobacco smoke.	24

Disparities in Environmental Health Outcomes 26

Center uses environment and health disparities research data infrastructures to investigate disparities in cancer outcomes. 26

Is there a relationship between mental health and diabetes? 28

Complex Factors in Environment & Health Disparities 30

Assessing the impact of neighborhood features on cardiovascular risk disparities. 30

Investigating the interplay between health disparities and social characteristics within Hispanic populations. 33

DEVELOPING SOLUTIONS TO ENVIRONMENT & HEALTH DISPARITIES 37

Collaboration with local community organization evaluated innovative approach to reducing school children's exposures to air pollution. 37

Center research informs intervention to protect against DNA damage caused by arsenic and uranium exposure. 40

COLLECTING & SYNTHESIZING ENVIRONMENTAL HEALTH DISPARITY DATA 42

Transdisciplinary team seeks answers to complex health disparity questions. 42

Building New York City communities' capacity to reduce health disparities. 45

48 Community Outreach & Engagement

COLLABORATIONS TO INFORM POLICY 49

Influencing state legislation to protect children’s health. 49

EMPOWERING COMMUNITIES TO ADDRESS HEALTH DISPARITY ISSUES 51

The FIESTAS project: Empowering women to tackle food insecurity. 53

The Community Block Assessment Project: Community involvement in data collection and analysis. 56

EXPANDING RELATIONSHIPS AND EDUCATING COMMUNITIES 58

Center uses environmental health disparity data to develop community resources. 59

Public participatory geographic information systems help residents be more engaged in local environmental decision-making. 60

PROVIDING DIRECT COMMUNITY BENEFIT 61

Improving health and safety in American Indian community homes and businesses. 61

LIST OF COMMUNITY PARTNERS 63

65 Education & Training

INVOLVING STUDENTS IN PILOT EHD RESEARCH AND OUTREACH 66

INCORPORATING EHD RESEARCH INTO CURRICULA 68

TRAINING COMMUNITY MEMBERS AND PROFESSIONALS ON EHD ISSUES 69

PUBLICATIONS 71

SHARING EHD RESEARCH ACROSS THE WORLD 72

75 MOVING FORWARD

INVESTIGATORS COMMENTS ON THE RESEARCH OF THE PILOT EHD CENTERS 76

CURRENT EHD RESEARCH EFFORTS 80

REFERENCES 84

APPENDIX A. PILOT EPA-NIHMD EHD CENTER PUBLICATIONS 89

List of Acronyms

AI/NA	American Indian/Native American	COEHDR	Center of Excellence on Health Disparities Research
AIHce	American Industrial Hygiene Conference & Exposition	COPD	Chronic Obstructive Pulmonary Disease
ARC	Action for the Retired Community	DNA	Deoxyribonucleic Acid
BC	Black Carbon	EH	Environmental Health
CAICH	Center for American Indian Community Health	EHD	Environment and Health Disparities
CAIHD	Center for Integrative Approaches to Health Disparities	EJ	Environmental Justice
CBPR	Community-Based Participatory Research	EJRADAR	Environmental Justice Radar
CCE-SPHERE	Coordinating Center of Excellence in the Social Promotion of Health Equity in Research & Education	ENAR	Eastern North American Region
CEDREC	Center of Excellence in Disparities Research and Community Engagement	EPA	Environmental Protection Agency
CEED	Center for Excellence in Eliminating Disparities	ETS	Environmental Tobacco Smoke
CHF	Congestive Heart Failure	GIS	Geographic Information Systems
CIAHD	Center for Integrative Approaches to Health Disparities	GPA	Grade Point Averages
COE	Centers of Excellence	HDEF	Health Disparity Environmental Factors
		HDRCOE	Health Disparities Research Center of Excellence
		HHDRC	Hispanic Health Disparities Research Center
		HIPAA	Health Insurance Portability and Accountability Act

HIV/AIDS	Human Immunodeficiency Virus/Acquired Immunodeficiency Syndrome	ORD	Office of Research and Development
HPV	Human Papillomavirus	PI	Principal Investigator
IRB	Institutional Review Board	PM	Particulate Matter
ISEE	International Society for Environmental Epidemiology	PNC	Particle Number Concentration
JHS	Jackson Heart Study	PPB	Parts Per Billion
LVEF	Lower Ventricular Ejection Fraction	SDOH	Social Determinants of Health
LVMI	Left-Ventricular Mass Index	SES	Socioeconomic Status
MESA	Multi-Ethnic Study of Atherosclerosis	SHC	Sustainable and Healthy Communities
NATA	National Air Toxics Assessment	STAR	Science To Achieve Results
NCER	National Center for Environmental Research	UIC	University of Illinois at Chicago
NIEHS	National Institute of Environmental Health Sciences	UNM	University of New Mexico
NIH	National Institutes of Health	UTEP	University of Texas at El Paso
NIMHD	National Institute on Minority Health and Health Disparities	UV	Ultraviolet
NM CARES HD	New Mexico Center for Advancement of Research, Engagement, and Science on Health Disparities		
NOCEMHD	Northern Manhattan Center of Excellence in Minority Health and Health Disparities		
NOMEM	Northern Manhattan Study of Metabolism and Mind		



Introduction

Executive Summary 9

**Background and Origin of the Pilot
EPA-NIMHD EHD Centers** 11

Executive Summary

Minorities and economically-disadvantaged communities continue to bear a disproportionate burden of the exposures to environmental stressors that are associated with adverse health outcomes.¹ Federal efforts to alleviate such health disparities began in the early 1990s. The focus of this report is the collaboration between the U.S. Environmental Protection Agency (EPA) and the National Institute of Health's (NIH's) National Institute on Minority Health and Health Disparities (NIMHD), which supports these federal efforts.

Since 2002, the NIMHD Exploratory Centers of Excellence (COE) have sought to reduce health disparities in several priority diseases and conditions, including cardiovascular disease, stroke, cancer, diabetes, HIV/AIDS, infant mortality, mental health, obesity, and other conditions that disproportionately affect health disparity populations. In 2011, EPA and NIMHD partnered to establish environment and health disparities research centers. In a joint effort, the two agencies issued a limited funding opportunity competition within the existing NIMHD COE network, which already focused on efforts to reduce and ultimately eliminate health disparities, to solicit project amendments that would focus on social and environmental determinants of health and solutions to reduce these disparities in disproportionately impacted populations.²

The competitive supplemental awards process resulted in the establishment of 10 new pilot Centers of Excellence on Environment and Health Disparities research, which are also referred to as the Pilot EPA-NIMHD EHD Centers or Pilot EHD Centers. New environmental cores were added to centers at Columbia University, Georgia State University,

University of Kansas Medical Center, the University of Illinois at Chicago, Meharry Medical College, University of Michigan, the University of New Mexico, University of South Carolina, University of Texas at El Paso, and Cornell University Weill Cornell Medical College.³



The 10 centers were funded for a total of \$7.5 million for a period of up to two years per award. EPA transferred the funds to NIMHD, which provided administrative and scientific oversight of the additional environmental cores along with their monitoring of the other projects and cores at those centers. Through this partnership, enhanced support for addressing social and environmental determinants of health was proposed to have an even greater impact on reducing disproportionate adverse health burden and empower communities to become more involved in social justice issues and promote healthy environments.

The research conducted at the centers in the two years of their existence has produced findings that have advanced the field of environmental health disparities. The centers have focused on research and tools development, community outreach and engagement, as well as education and training. They have conducted research to identify environmental health disparities, develop solutions to these disparities, and collect and synthesize disparity data.

Pilot EHD Center research staff have engaged with their communities in order to form collaborations to inform evidence-based policies, involve the communities in the research process to empower sustainable solutions, and develop community education resources. The Pilot EHD Centers supported the education and training of over a hundred students and junior professionals, who used center research in their theses and dissertations and incorporated EHD research and topics into their university's curriculum.

The centers also trained community members, and other individuals on topics related to EHDs. They have presented EHD research results and findings at over 50 conferences, meetings, and workshops around the world. Pilot EHD Center researchers and their students have also published their work in over 60 peer-reviewed journals. These centers concluded their research in 2014.





Background and Origin of the Pilot EPA-NIMHD EHD Centers

Environmental stressors have a major impact on human and environmental health. Nearly one-fourth of the global burden of disease may be attributed to environmental factors.⁴ Social and economic disparities cause many health problems and are very costly to our society.⁵

The conditions where people are born, grow, live, work, and age shape their health and well-being over their life course. These conditions, commonly referred to as “social determinants of health,” influence health outcomes and include such factors as access to affordable healthy food, clean water, green space, safe housing, clean air, and supportive social networks. Social determinants of health are, in turn, shaped by wider forces, including economics, social policies, politics, and personal and community beliefs and value systems.⁶

The unequal distribution of these conditions and their determinants across various populations is increasingly understood as a significant contributor to persistent and pervasive health disparities. Thus,

environmental influences are not limited to physical, chemical, or biological agents and natural amenities, but also include social and economic stressors, institutional processes, and resiliency factors.

A growing social awareness of these disparities since the early 1990s has led to the coining of the term Environmental Justice, or EJ, which EPA now defines as “the fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income with respect to the development, implementation and enforcement of environmental laws, regulations, and policies.”⁷

EPA works to achieve its mission to protect human health and the environment through a variety of actions and decisions, including regulatory activities, scientific research, outreach, and education. The scientific arm of EPA, the Office of Research and Development (ORD), supports six research programs that identify the most pressing environmental health and ecological research needs of the nation.

In 1995, EPA created the Science To Achieve Results, or STAR Program, its primary competitive extramural grants program. Managed by the National Center for Environmental Research (NCER), one of ORD's national centers, the STAR Program's goal is to stimulate and support scientific and engineering research that advances EPA's mission to protect human health and the environment. It is a competitive, peer-reviewed, extramural research program that provides access to the nation's best scientists and engineers in academic and other nonprofit research institutions. STAR funds research on the environmental and public health effects of air quality, environmental changes, water quality and quantity, hazardous waste, toxic substances, and pesticides. STAR has provided funding support to top researchers in the nation to identify and solve environmental problems and provide scientific leadership to protect our planet and our health.⁸ The competitive, peer-reviewed grants supported by the STAR Program range in focus across various scientific and technical environmental disciplines, and often incorporate successful models of community engagement.

The National Institute on Minority Health and Health Disparities (NIMHD) is one of 27 institutes and centers of the National Institutes of Health (NIH). NIMHD's work supports millions of Americans burdened by disparities in health status and healthcare delivery, including race and ethnic minority groups, rural populations, and other populations, including those with low socioeconomic status.⁹ Mandated by the Minority Health and Health Disparities Research and Education Act of 2000 (P.L. 106-525), the NIMHD Centers of Excellence (COE) Program has supported development of the infrastructure, capacity, and intellectual expertise in health disparities through establishment of centers within colleges and universities.

Since 2002, the NIMHD Exploratory COEs have sought to reduce health disparities in several priority diseases and conditions, including cardiovascular disease, stroke, cancer, diabetes, HIV/AIDS, infant mortality, mental health, obesity, and other conditions that disproportionately affect health disparity populations. They have supported over 80 COEs in 31 states, the District of Columbia, Puerto Rico, and the U.S. Virgin Islands in majority institutions, medical schools, Historically Black Colleges and Universities, Hispanic Serving Institutions, tribal colleges, and liberal arts colleges. The COEs have conducted research independently or in formal partnership with one or more institutional partners; provided research training opportunities to students, researchers and junior faculty from health disparity populations; and engaged in health promotion, and health information dissemination activities through established partnerships with community-based organizations.¹⁰

In response to the growing EJ awareness, Executive Order 12898 was issued in 1994, requiring all federal agencies to work toward ending the disproportionate exposures of minority and low-income communities to many environmental hazards.¹¹ While much has been accomplished since the early 1990s, minority and economically disadvantaged populations continue to bear a disproportionate share of environmental exposures and related illnesses.¹¹ Concern for inequity is based not only on their potentially higher levels of exposure to environmental hazards, but also on the synergistic effect of exposure to multiple environmental hazards and social stressors like poverty, psychosocial stress, and discrimination.

Today, environmental health and health disparities researchers blend biological and social science approaches with traditional environmental science methods. For example, interdisciplinary approaches and collaboration with sociologists, psychologists, and social epidemiologists must examine the joint effects of social and environmental stressors.

The Federal Healthy People 2020 initiative, the 10-year national health agenda for the American population, also set the elimination of health disparities and achieving health equity as a top national priority. The succeeding Healthy People 2030 initiative will set new science-based national objectives for health promotion and disease prevention in 2030.¹²

EPA, along with the NIH and other federal and academic collaborators held two workshops; one in 2005 and another in 2010, to explore options for connecting social and environmental factors, for measuring and tracking environment and health disparities, and for strengthening EJ research and decision making. Several critical issues and factors emerged from these gatherings: 1) stronger funding support is needed for community-based participatory research in environment and health disparities, 2) race/ethnicity and socio-economic position need to be included in environment and health disparities research, and 3) models to elucidate the interrelationships between social, physical, and built environment should continue to be developed and empirically tested.¹³

Key factors that likely contribute to higher burdens of environmental exposure and risk affecting race/ethnicity and low-income communities include, proximity to sources of environmental hazards; unique exposure pathways; multiple cumulative impacts; susceptibility and vulnerability; vulnerable physical infrastructure; diminished capacity to participate in decision-making; and chronic psychosocial stress.¹⁴

1994

Executive Order 12898 is issued to end disproportionate environmental exposures of minority and low-income populations.

Figure 1. Timeline of the Pilot EPA-NIMHD EHD Center Research

2002

NIMHD establishes the Exploratory Centers of Excellence on Health Disparities program.

2005

EPA & partners hold a technical workshop on social factors and EHD.

2010

EPA & partners hold a symposium on strengthening EJ decision-making.

Existing programs established independently by EPA and NIMHD have fostered collaboration across disciplines and enabled multidisciplinary teams of community and academic experts from diverse backgrounds to conduct research and training in environment and health disparities. With the common goal of addressing the social determinants of health affecting disproportionately impacted populations across the nation, and fueled by the 1994 Executive Order, the EPA-NIMHD collaboration seemed to be a natural, almost inevitable union, leading to the signing of a memorandum of understanding and an inter-agency agreement by the two organizations in 2011.

Through this partnership, they would support the establishment of transdisciplinary networks of excellence in health disparities research that would engage in the complex interaction of biological, social, and environmental determinants of population health. This research partnership was a significant effort toward advancing scientific understanding of disease etiology for environmental related diseases. It also supported the development of innovative tools and methods to assess exposure, cumulative health effects and disproportionate health risks and impacts, and then increased understanding of population vulnerability. Figure 1 depicts a timeline of the major events surrounding the partnership.

Under this agreement, EPA transferred a total of \$7.5 million to NIMHD, which managed and administered the Pilot EHD Centers. The competitive supplemental awards process resulted in the establishment of ten (10) awards to the EPA-NIMHD Pilot Centers of Excellence on Environment and Health Disparities research, also known as the Pilot EHD Centers. The centers were funded for a period of up to two years per award. Figure 2 shows the locations of the 10 Pilot EHD Centers. A brief description of each center is also provided below.

2011

EPA & NIMHD signed Memorandum of Understanding to form partnership, and Inter-Agency Agreement to support EHD research.

2011

EPA & NIMHD issued a limited solicitation among the NIMHD COEs for environmental core additions to the existing centers.

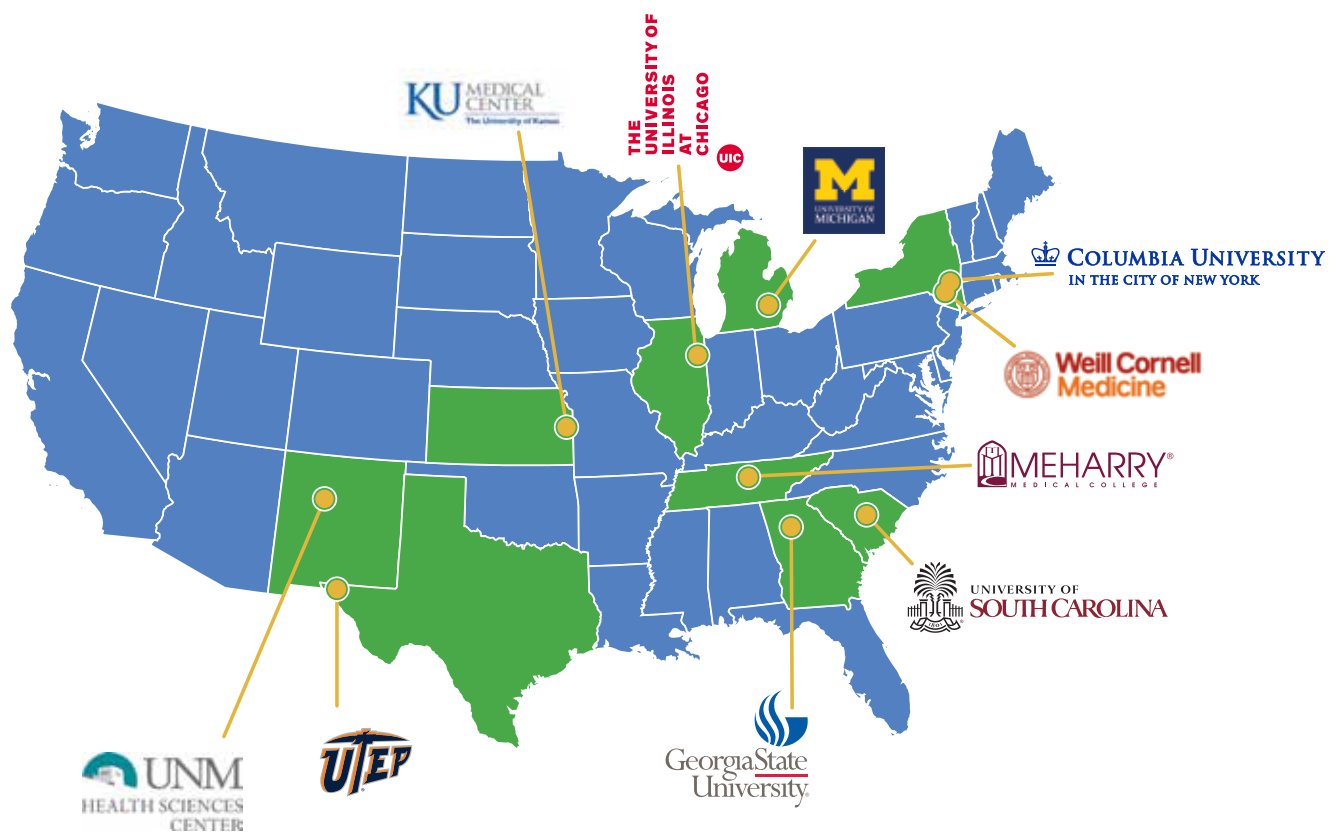
2012

The 10 Pilot EHD Centers were competitively awarded.

2014

The 10 Pilot EHD Centers concluded their research and submitted final technical reports.

Figure 2. Pilot EPA-NIMHD Centers of Excellence on Environment and Health Disparities Research





Northern Manhattan Center of Excellence in Minority Health and Health Disparities (NOCEMHD) - Columbia University – New York, NY – José Luchsinger, PI

NOCEMHD examined how social determinants of health modified the effect of interventions and exposures of interest on specific health outcomes in a clinical trial and a cohort study, respectively. The center sought to determine the influence of Health Disparity Environmental Factors (HDEF) on health outcomes, such as cardiovascular conditions and mental health. Researchers also explored how HDEF modify responses to community-based interventions at the national, state, city, neighborhood, and individual levels.



Center of Excellence on Health Disparities Research (COEHDR) - Georgia State University – Atlanta, GA – Michael Eriksen, PI

COEHDR focused on identifying the syndemic burden on populations experiencing health disparities in urban Atlanta (syndemic refers to the aggregation and interaction of two or more diseases in a population that tend to develop under conditions of health disparity). Investigators explored how research and mitigation activities could be strengthened and expanded.



Central Plains Center for American Indian Community Health (CAICH) - The University of Kansas Medical Center – Kansas City, KS – Christine Daley, PI

CAICH, also known as GreeNation, used community-based participatory research methods to understand how to address health disparities faced by the American Indian/Native American (AI/NA) population, which includes such conditions as asthma, obesity, and diabetes. Researchers explored the state of housing conditions in AI/NA communities and how community members could be linked to programs that would help to solve their problems. Research also explored the extent of AI/NA exposure to environmental tobacco smoke (ETS) and how to address this health concern.



Health Disparities Research Center of Excellence (HDRCOE) - Meharry Medical College – Nashville, TN – Paul Juarez, PI

The HDRCOE, with local communities in Alabama, Arkansas, Georgia, Indiana, Kentucky, Louisiana, Mississippi, North Carolina, South Carolina, Tennessee, and Virginia, focused on the built, social, and policy environments. The center's overall goal was to expand the capacity of health services researchers and other biomedical scientists to use a transdisciplinary systems approach to study the environmental context of health disparities.



Center for Excellence in Eliminating Disparities (CEED) - The University of Illinois at Chicago – Chicago, IL – Elizabeth Calhoun, PI

CEED explored the mechanisms explaining racial differences in exposure to environmental hazards, on access to care, and to health outcomes. Researchers compiled neighborhood-level data on environmental hazards and access to care in Cook County, Illinois, and linked them to other social determinants data.



Center for Integrative Approaches to Health Disparities (CIAHD) - University of Michigan – Ann Arbor, MI – Ana Diez-Rouz, PI

The goal of CIAHD was to investigate the multilevel determinants of health disparities in cardiovascular risk by integrating social and biological factors. Researchers added an environmental assessment core in order to enhance the environmental measures available in the Jackson Heart Study and the Multi-Ethnic Study of Atherosclerosis (MESA).



New Mexico Center for Advancement of Research, Engagement, and Science on Health Disparities (NM CARES HD) - University of New Mexico – Albuquerque, NM – Robert Williams, PI

NM CARES HD explored how to reduce health disparities among AI/NA and Hispanic communities in New Mexico. They also sought to determine what interventions and solutions could address socioeconomic, natural, chemical, and built environment issues faced by the communities.



Coordinating Center of Excellence in the Social Promotion of Health Equity in Research, Research Education and Training, and Community Engagement and Outreach (CCE-SPHERE) - University of South Carolina – Columbia, SC – Sandra Glover, PI

CCE-SPHERE focused on six areas of health disparities that contribute disproportionately to premature death and morbidity found among low-income and race/ethnic minorities (cancer, cardio/metabolic disease, HIV/AIDS, infant mortality, intentional/unintentional injury, and mental health/substance abuse). They studied these concerns in eleven southeastern states (Alabama, Arkansas, Georgia, Indiana, Kentucky, Louisiana, Mississippi, North Carolina, South Carolina, Tennessee, and Virginia).



Hispanic Health Disparities Research Center (HHDC) - The University of Texas at El Paso – El Paso, TX – Elias Provencio-Vasquez, PI

HHDC sought to advance the understanding of the interrelationships between environmental and social determinants of health disparities, particularly within heterogeneous Hispanic populations. Through a commitment to transdisciplinary research, the center utilized this knowledge to influence policy change, public health practice and community-based interventions to reduce disparities.




**Weill Cornell
Medicine**

Center of Excellence in Disparities Research and Community Engagement (CEDREC) - Cornell University, Weill Cornell Medical College – New York, NY – Carla Boutin-Foster, PI

CEDREC was a community-academic collaboration, which brought together a multi-disciplinary team to address environmental health issues through education, research and policy. The Environmental Health Disparities Research Core (EH Core) gave CEDREC the capacity to collaboratively examine environmental factors that drive health disparities and develop innovative and transdisciplinary solutions.

“Disparities in the environment demand a holistic approach to understand all risks as an organic unit. Environmental health research requires comprehensive and multidisciplinary resources to eliminate health disparities and to enhance health for all.”

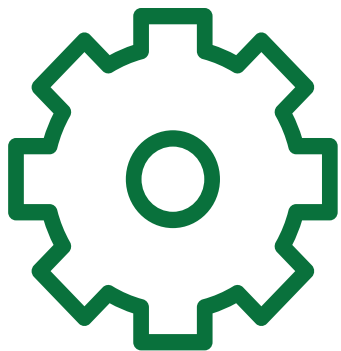
- Dr. Michael Eriksen, Director, COEHDR, Georgia State University



Accomplishments & Impacts of the Pilot EPA-NIMHD EHD Centers

The Pilot EPA-NIMHD EHD Centers have broadly impacted the field of health disparities research by advancing cutting-edge research in several critical areas. Specifically, the centers focused their efforts on (1) researching health disparities and potential solutions for reducing them, (2) engaging communities to ensure that research findings are translated into action, and (3) educating community members and training the next generation of health disparities researchers. This section highlights impacts that the centers have made in each of these fields.

Research & Tools Development	20
Community Outreach & Engagement	48
Education & Training	65



RESEARCH & TOOLS DEVELOPMENT

Tackling environment and health disparities requires an interdisciplinary and multi-faceted research approach. The Pilot EPA-NIMHD EHD Centers conducted innovative research to identify such disparities, developed solutions to mitigate or eliminate the problems identified in their research, and built tools and data infrastructures to advance future environmental health disparities research.

IDENTIFYING ENVIRONMENT & HEALTH DISPARITIES

21

Disparities in Environmental Exposure

Characterizing exposures to traffic-related air pollution in urban neighborhoods.

Investigating and reducing young American Indians' exposures to tobacco smoke.

Disparities in Environmental Health Outcomes

Center uses environment and health disparities research data infrastructures to investigate disparities in cancer outcomes.

Is there a relationship between mental health and diabetes?

Complex Factors in Environment & Health Disparities

Assessing the impact of neighborhood features on cardiovascular risk disparities.

Investigating the interplay between health disparities and social characteristics within Hispanic populations.

DEVELOPING SOLUTIONS TO ENVIRONMENT & HEALTH DISPARITIES

37

Collaboration with local community organization evaluated innovative approach to reducing school children's exposures to air pollution.

Center research informs intervention to protect against DNA damage caused by arsenic and uranium exposure.

COLLECTING & SYNTHESIZING ENVIRONMENTAL HEALTH DISPARITY DATA

42

Transdisciplinary team seeks answers to complex health disparity questions.

Building New York City communities' capacity to reduce health disparities.



Identifying Environment & Health Disparities

The centers investigated important and unique questions related to disparities in exposure, outcomes, and the relationships between the two. For example, is dementia and cognitive decline more common in Hispanic populations? Are high poverty areas exposed to more traffic-related air pollution? Why do tribal college students show higher rates of smoking than non-tribal students? Is there a Hispanic Health Paradox in air pollution sensitivity?

"The greatest opportunity [of the center] is to complete exposure pathways that address real world conditions. Completed exposure pathways identify the source of exposures in the environment, how the chemical or non-chemical stressor gets under the skin, biomarkers of exposure, biomarkers of disease, disease phenotype, clinical diagnosis, and population-level disparities."

**- Dr. Paul D. Juarez, Director
HDRCOE, Meharry Medical College**

Disparities in Environmental Exposure

Centers conducted research on how and why different populations experience disparities in exposures to pollutants and other environmental hazards, and identified geographic areas and sub-populations at highest risk for those exposures.

Characterizing exposures to traffic-related air pollution in urban neighborhoods

Center of Excellence on Health Disparities Research (COEHDR) at Georgia State University

The Center of Excellence on Health Disparities Research at Georgia State University investigated environmental contributors to urban health disparities, such as air and water pollution and the potential for unequal

burdens of pollution. Center researchers estimated community exposures to traffic-related air pollution in diverse Atlanta neighborhoods, where public housing community members reside.

They installed monitors to detect nitrogen dioxide in the air over a two-week period in four census tracts with varying proportions of low-socioeconomic status (SES) residents. Nitrogen dioxide primarily gets in the air from the burning of fuel. Long exposures to elevated air concentrations of nitrogen dioxide may contribute to the development of asthma and potentially increase susceptibility to respiratory infections.¹⁵ It is also a precursor to hazardous ozone.¹⁶ The measured nitrogen dioxide concentrations ranged from 7 to 21 parts per billion. Geospatial analysis revealed that higher concentrations were directly related to highway proximity.¹⁵ Results also suggested that air pollution exposure varies across poverty levels, with high poverty areas experiencing significantly higher levels of air pollution than lower poverty areas.

RESEARCH IN ACTION AT COEHDR

Installed 26 air monitoring stations that measured nitrogen dioxide in 4 census tracts in Atlanta.



Collected and analyzed 300 soil and road dust samples for lead.



Presented research results to, and collaborated with, community-based organizations. Engaged in citizen science research.

The center also collected soil and road dust samples in Sacramento, California, and analyzed them for lead. Sources of lead in dust include lead-based paint degradation and the particulates from leaded gasoline before it was banned. Lead in dust is a concern for children's health—young children are particularly susceptible to the health effects of lead and are more likely to be exposed because of hand-to-mouth behaviors. The collected samples were used to generate spatial distributions of lead concentrations, which can then be used to predict areas of elevated lead concentrations.

The center's work is an important step toward addressing environment and health disparities. Stakeholders and decision makers can use such information to better understand exposures and take appropriate action.¹⁶ For example, center researchers are using this knowledge and their expertise to work with the Federal Highway Administration to identify tools and opportunities to address environmental health in transportation projects. They are developing the basis for including a health disparities assessment in the protocols for reviewing proposed transportation projects in the U.S.

ACCOMPLISHMENTS & IMPACTS



Examined the association between traffic-related air pollutants and key socio-economic and demographic measures (e.g., poverty and proximity to freeways and railroads) from communities in Atlanta.



Collected and analyzed air and dust monitoring data, and shared results with community members.
Developed methods for review of



transportation-related disparities to incorporate health disparity assessments in transportation projects.





Investigating and reducing young AI/NA students' exposures to tobacco smoke

*Center for American Indian Community Health (CAICH)
at the University of Kansas Medical Center*

American Indians have the highest cigarette smoking rates of any race or ethnic group in the US.¹⁷ Despite warning labels and other tribal health intervention efforts, their smoking prevalence has not decreased at the same rate as it has for non-minority populations.¹⁸

The health concerns for this community extend to nonsmokers—family members or friends nearby—who might be exposed to secondhand smoke. Secondhand smoke—also known as environmental tobacco smoke or ETS—is a complex mixture of smoke given off by the burning of tobacco products and the smoke exhaled by smokers. EPA estimates that exposure to secondhand smoke causes approximately 3,000 lung cancer deaths per year in nonsmokers.¹⁹



Nearly 35 percent of tribal college students were smoking when they were surveyed.¹⁸

Exposure to secondhand smoke has also been shown in a number of studies to increase the risk of heart disease and stroke.¹⁹ The Center for American Indian Community Health (CAICH) at the University of Kansas Medical Center gathered data needed to design more effective health interventions for AI/NA communities. They surveyed over 1,200 tribal college students and found that 34.7 percent smoked. The mean age for participants' first cigarette was 14 years old.¹⁸ Researchers mapped and compared the availability and marketing of tobacco products, as well as accessibility of healthy foods and activities, at two universities in Lawrence, Kansas (University of Kansas and Haskell Indian Nations University).

Students at both universities had wide availability of tobacco products and were exposed to significant tobacco marketing.¹⁸ Students at the University of Kansas, a public university, had a wider range of options for healthy foods and activities than students at Haskell Indian Nations University, which is solely attended by enrolled or official members of recognized AI/NA tribes of the U.S.¹⁹ Finally, the CAICH team conducted focus groups with students to gauge the students' understanding of and preferences for tobacco policies on campus.



On average, tribal students who smoked tried their first cigarette when they were 14 years old.¹⁸

With this knowledge, the center has tailored interventions to promote healthy behaviors for tribal students in Lawrence, Kansas. Investigators presented baseline data at multiple national conferences and meetings. The results are being used to develop strategies to address the current disparities in smoking among AI/NA college students.²⁰

ACCOMPLISHMENTS & IMPACTS



Examined demographic, cultural, and environmental characteristics of smoking and quitting among AI/NA communities.



Surveyed more than 1,200 tribal college students about their tobacco use, exposure to ETS, contact with tobacco marketing and products, and other health-related behaviors.



Informed development of culturally-tailored smoking cessation and prevention and other healthy behavior programs for AI/NA college students.

Disparities in Environmental Health Outcomes

The prevalence of diseases and other adverse health outcomes vary dramatically across age, sex, ethnicity, income level, and other population characteristics. The Pilot EPA-NIMHD EHD Centers worked to identify and understand why these disparities exist.

Disease prevalence, such as heart disease, cancer, and dementia, are reportedly higher in minority and in the disadvantaged groups.²² The centers explored pioneering and creative solutions to the disparities they observed, such as using trees and bushes to reduce exposure to traffic-related air pollution (Center of Excellence on Health Disparities Research, Georgia State University), or using zinc supplements to alleviate the damage inflicted on DNA from concurrent exposure to ultraviolet light, arsenic, and uranium (New Mexico Center for Advancement of Research, Engagement, & Science on Health Disparities, University of New Mexico).

Center uses environment and health disparities research data infrastructures to investigate disparities in cancer outcomes

Center for Excellence in Eliminating Disparities (CEED) at the University of Illinois at Chicago

Researchers at the Center for Excellence in Eliminating Disparities (CEED) at the University of Illinois at Chicago (UIC) gathered data and developed data infrastructures to assist researchers and students nationwide with analyzing and utilizing environmental health disparities data. Compiling and organizing dissimilar data from a wide variety of sources is an enormous task and is often a major obstacle for environment and health disparities research projects. As a result of this effort, CEED researchers identified several important disparities in cancer outcomes related to race and SES.

CEED acquired 3.7 million data records from the Cook County (Illinois) Assessor's Office containing anonymized attributes of Cook County residents and properties, including age, type, class, assessed values of land and buildings, zoning (e.g., grocery stores and gas stations), and other variables.²¹ The center also used data from EPA, U.S. Census American Community Survey, Health Resources and Services Administration, and Illinois Department of Public Health to gather information on cancer incidence, environmental hazards, access to healthcare facilities, and other factors.²¹



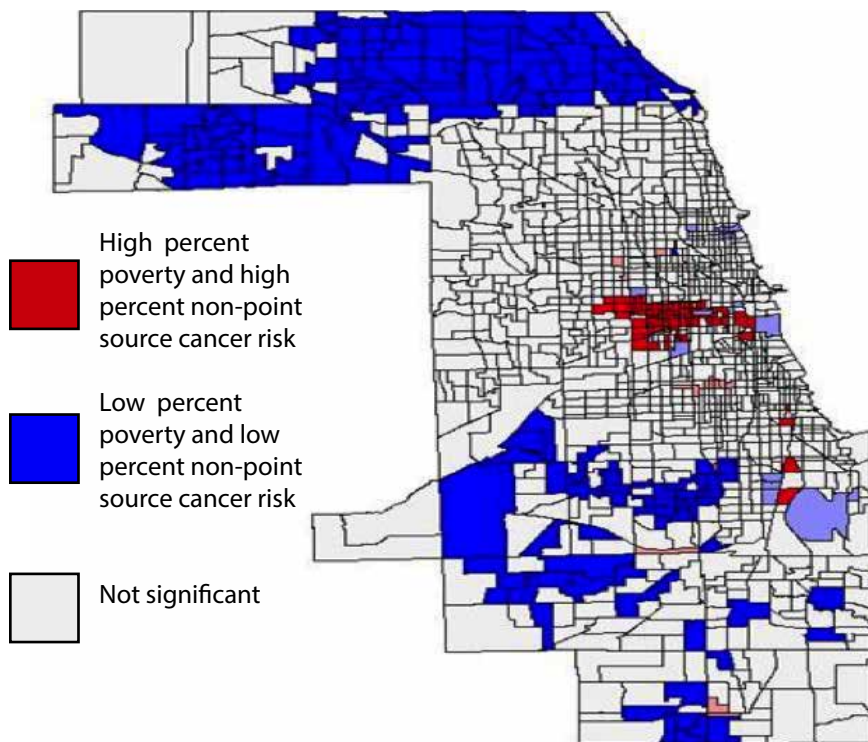


Figure 3. Poverty and non-point source cancer risks in Cook County, Illinois

Utilizing this set of data, researchers investigated how cancer-related outcomes vary across race and SES in Cook County, Illinois. In a study of women diagnosed with epithelial ovarian cancer, women with lower SES were more likely than women with a high SES to have three markers of aggressive ovarian cancer: 1) tumors that are of a higher grade, 2) tumors that are late-stage, and 3) tumors that remain after surgical attempts to remove them. In another study CEED researchers examined, then considered associations between the spatial distributions of race, SES, environmental cancer risks, and cancer rates in census tracts around Chicago. To make comparisons across census tracts, researchers mapped the percentage of specific sociodemographic characteristics (African American, Hispanic, and low SES) in each tract.

They also mapped the 2011 National Air Toxics Assessment (NATA) total cancer risk (based on emissions data), as well as cancer incidence rates for each tract. CEED's analysis revealed the spatial relationships between all of these factors; for example, census tracts with a high percent of the population in poverty also had a high percent of the population's non-point cancer risks (and vice versa, see Figure 3).²³ By utilizing these novel methodologies and comprehensive data infrastructures, this exploratory research has opened the door for future investigation into these health disparities.

FINDINGS

Underprivileged women are more likely to have ovarian cancer tumors that:



Are high-grade.



Have progressed to a later stage (e.g., moved to other parts of the body).



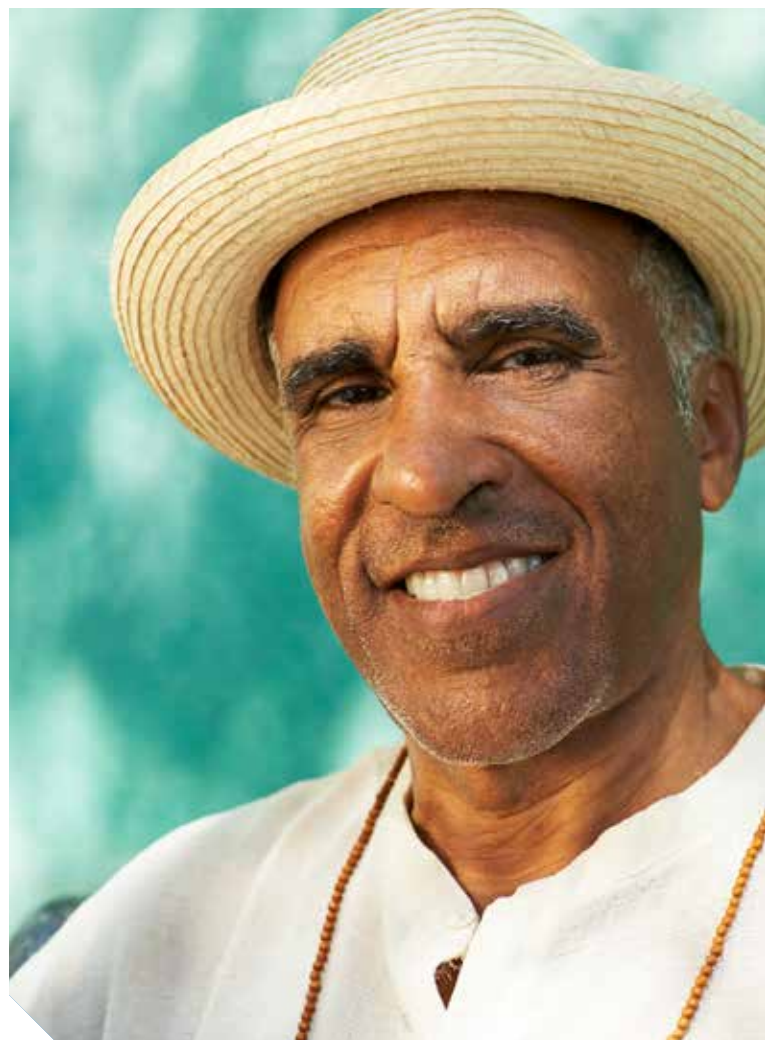
Are considered to be sub-optimally removed after surgery.²²

Is there a relationship between mental health and diabetes?

Northern Manhattan Center of Excellence in Minority Health and Health Disparities (NOCEMHD) at Columbia University Medical Center

As part of the Northern Manhattan Study of Metabolism and Mind (NOMEM) cohort, researchers at the Northern Manhattan Center of Excellence in Minority Health and Health Disparities (NOCEMHD) at Columbia University Medical Center, NY, gathered data on 600 Hispanic men and women, aged 55–64 years, to study the relationship between diabetes and mental health.²⁴ NOMEM revealed that over two thirds of middle-aged Hispanics in Northern Manhattan are overweight or obese and have pre-diabetes or diabetes.²⁵ Additionally, the Columbia University Center discovered that pre-diabetes and diabetes are strongly associated with worse cognitive performance in multiple domains assessing verbal memory and dementia (Selective Reminding Test) as well as executive function (Color Trails Test).²⁵

In 2012, 21 million people in the U.S. had diabetes, which was the seventh leading cause of death in 2010.²⁶ Diabetes is associated with serious health problems, including heart disease, stroke, blindness, kidney failure, limb amputation, and death.²⁶ Diabetes has also been implicated as a risk factor for dementia, along with smoking, obesity, hypertension, and high cholesterol.²⁷ Dementia is most commonly brought on by Alzheimer's disease, a degenerative brain disease, and is characterized by difficulties with memory, language, problem-solving, and other cognitive skills.²⁷ 5.5 million Americans have been diagnosed with Alzheimer's dementia, and this number is predicted to rapidly escalate over the coming years as the baby boomer generation ages.²⁷



2 out of 3 middle-aged Hispanics in Northern Manhattan have pre-diabetes or diabetes.²⁴

ACCOMPLISHMENTS & IMPACTS



Gathered data on over 600 Hispanic men and women in Northern Manhattan.



Provided additional support for the relationship between diabetes and dementia in a population disproportionately affected by both diseases.¹³

Significant disparities exist across race and ethnicity in the prevalence of diabetes and dementia. Older African-Americans are twice as likely as older Caucasians to have Alzheimer's or other dementias, and older Hispanics are about 1.5 times as likely.²⁷ 12.8 percent of Hispanics and 13.2 percent of non-Hispanic African Americans aged 20 years or older have been diagnosed with diabetes, compared to 7.6 percent of non-Hispanic Caucasians.²⁶

While there have been previous studies on the relationship between diabetes and dementia, they have had several limitations: an older sample population, a lack of data on participants' mid-life cognitive ability (prior to a dementia diagnosis), and a failure to assess participants' pre-diabetes status.^{24,26} The researchers at NOCEMHD sought to address those limitations and provide a strong analysis of the relationship between diabetes and dementia.

Pre-diabetes, diabetes, and normal glucose tolerance were assessed by examining participants' clinical history and measuring participants' levels of hemoglobin A1c (a stable measure of blood sugar over the past 3 months). Several tests were used to assess memory, executive abilities, and overall cognitive performance.²⁴ The results showed that hemoglobin levels and diabetes were both related to worse performance on memory tests, and pre-diabetes was associated with worse executive abilities.²⁴

Given the vast number of Americans affected by diabetes, and the debilitating impact of dementia and other diseases related to cognitive decline, it is important to understand the risk factors for each. NOCEMHD's research provides extraordinary evidence of the relationship between the two diseases and continues to develop solutions and encourage lifestyle changes (e.g., regular physical activity and a healthy diet) to address them.²⁷

Complex Factors in Environment & Health Disparities

Research into the causes and impacts of environmental health disparities is not complete without a critical analysis of the complex relationship between individual risk factors. Several of the Pilot EHD Centers explored these interactions to deepen their understanding of the disparities in their communities.

To ensure a broad and long-lasting impact, the centers collected and synthesized data in a format that has aided further research for themselves and other researchers' work across the country. Thousands of data records on community and neighborhood attributes, individual characteristics, environmental exposures, health outcomes, and other factors were gathered and integrated into databases that support mapping websites, conceptual frameworks, community profiles, and additional tools.

Assessing the impact of neighborhood features on cardiovascular risk disparities

Center for Integrative Approaches to Health Disparities (CIAHD) at the University of Michigan

Heart disease was the leading cause of death in 2008 for people of most race and ethnic groups in the U.S., including African Americans, Hispanics, and Caucasians.²⁸



Heart disease costs the U.S. about \$207 billion each year, including the cost of health care services, medications, and lost productivity.²⁹





NIH has funded large-scale observational studies to investigate the causes of cardiovascular disease among diverse study populations. Two of these studies are the Multi-Ethnic Study of Atherosclerosis (MESA) and the Jackson Heart Study.³⁰ MESA studies 6,000 African American, Asian, Hispanic, and Caucasian adults from six field locations across the country. The Jackson Heart Study studies 5,306 African American adults from urban and rural counties in Jackson, Mississippi. These studies are generating a wealth of data critical to identifying risk factors and prevention approaches.³¹

The Center for Integrative Approaches to Health Disparities (CIAHD) at the University of Michigan used the cardiovascular disease and neighborhood characteristics information from MESA and the Jackson Heart Study, combined with state-of-the-art spatial modeling, to identify environmental risk factors for cardiovascular health. Neighborhood data included air pollution concentrations, sociodemographic characteristics, locations of resources (e.g., food, physical activity resources, social engagements, and walking destinations), food and cigarette prices, and information about conditions of the social environment (e.g., neighborhood social cohesion, violence, and neighborhood problems)

collected from 2000 to 2012. With this large combined dataset, CIAHD also investigated the variability of disease risk and healthy behaviors within ethnic groups.

Results revealed important environmental and social factors that may contribute to disparities in cardiovascular health. For example, CIAHD investigated whether changes in neighborhood characteristics after moving to a new home were linked to changes in walking for transportation, for leisure, or for reduction in body mass index in adults. The analysis found that moving to areas with higher walkability (e.g., higher street connectivity) was associated with an increase in transport walking as well as a decrease in body mass index.³¹

The researchers also sought to better understand spatial inequities in exposure to air pollution and the extent that other neighborhood factors modify the impact of air pollution on health. To do this, they estimated associations of neighborhood- and individual-level SES with estimates of residential ambient air pollution concentrations.

Researchers found that air pollutant concentrations were more strongly associated with neighborhood SES than individual SES. Considering the entire study population, the average concentration of fine particulate matter (PM) and nitrogen oxides decreased with increasing neighborhood SES. However, this did not hold true for every city. For example, they observed higher air pollution concentration in high-SES neighborhoods in New York.³³

CIAHD also evaluated the modifying interactions between social disadvantage or psychosocial adversity and air pollution on two cardiovascular outcomes that indicate long-term cardiac stress. Greater left-ventricular mass index (LVMI) and lower ejection fraction (LVEF) of the heart are predictors of cardiovascular disease. As concentrations of fine particulate matter (PM) increased, LVMI decreased, while LVEF increased. Both cardiovascular measures increased as concentrations of nitrogen oxide

and nitrogen dioxide increased as well. CIAHD researchers found fine particulate matter was not related to the SES index; however, as PM concentrations increased, psychosocial adversity index scores decreased. Generally, CIAHD did not find consistent evidence of interactions between air pollution and SES, psychological adversity, or any measure of race/ethnicity segregation with respect to either of the cardiovascular outcomes they evaluated.³⁴

CIAHD's spatial analysis of large, high-quality health and environmental data improved understanding of cardiovascular disease risk factors among minorities. This knowledge is critical for the identification of approaches to reduce both the risk and high prevalence of cardiovascular disease in the U.S.

ACCOMPLISHMENTS & IMPACTS



Combined data from large, diverse studies of cardiovascular risk with neighborhood information to identify environmental risk and benefit factors.



Published one of the first studies to examine joint associations between social and psychosocial factors, particularly race/ethnicity residential segregation, and air pollution with certain measures of cardiovascular outcomes.



Identified the importance of examining associations present in specific geographic regions and specific population samples before deciding how to account for SES in health disparities research.

Investigating the interplay between health disparities and social characteristics within Hispanic populations

Hispanic Health Disparities Research Center (HHDC) at the University of Texas at El Paso (UTEP)

Historically, health disparities research has tended to rely on traditional categorizations of race and ethnicity (e.g., Hispanic, African American, Caucasian). This simplification assumes uniformity within a minority population when it is likely that other factors among an ethnic group affect health, such as differences in language proficiency, SES, and culture. The Hispanic Health Disparities Research Center (HHDC) at the University of Texas at El Paso (UTEP) aimed to clarify how race or ethnic status interacts with other social factors to contribute to environmental risks and health outcomes for Hispanic populations in El Paso, Texas.

HHDC surveyed parents of 4th and 5th graders in the El Paso Independent School District to examine the prevalence of respiratory health problems among children, social variables associated with respiratory health outcomes, school performance, and access to health care.³⁵

HHDC researchers gathered and analyzed El Paso air quality monitoring data for nitrogen dioxide and inhalable particles, including PM that is less than 10 microns in diameter and ultrafine particles (or particles that are less than 0.1 microns in diameter).



“The Environmental Health Research Lab created via this NIMHD-EPA Center ... focuses on how interactions between the physical and social environment affect the development of chronic illnesses among vulnerable populations.”

**- Dr. Bibiana Mancera, Investigator
HHDC, University of Texas at El Paso**

Results from the survey revealed that the students had high rates of asthma (17 percent of respondents) and allergies/hay fever (51 percent).³⁵ They also identified environmental exposures and social characteristics that were strongly associated with children's respiratory health outcomes.

Many factors such as gender, obesity, caretaker's language proficiency, prenatal tobacco smoke exposure, higher levels of PM, Hispanic ethnicity, and being born in El Paso were identified as potential variables contributing to increased odds of respiratory health problems.^{35,36,37}

The Hispanic subpopulation is of particular interest, as some studies have shown that Hispanic immigrants in the U.S. have the same or better health outcomes compared to non-Hispanic Caucasians, despite higher poverty rates, less education, and lower access to health care.⁴² This observation, called the "Hispanic health paradox," had not been studied until HHDRC's work. HHDRC conducted one of the first studies to consider how Hispanic ethnicity interacts with other social characteristics (e.g., age, sex, race, insurance status) to influence the relationship between air pollution and respiratory and cardiovascular health effects.⁴³



FINDINGS

HHDRC also investigated associations between air pollutants and other chemicals and school performance. Their findings included the following:



Higher levels of residential air toxics were statistically significantly associated with lower grade point averages (GPA) even after controlling for additional variables such as economic deprivation, maternal education, teenage motherhood, race, maternal language proficiency, and children's gender/age.³⁸ (See In the News).



Subjective health status and higher levels of residential air toxics, combined, were also statistically significantly associated with lower GPA.³⁹



Higher levels of school-based hazardous air pollution were associated with lower GPA.⁴⁰



Residential concentrations of metabolic disruptors (chemicals that interfere with human endocrine and metabolic functioning) were statistically significantly associated with lower GPA.⁴¹

IN THE NEWS

The following are example media reports on one of the HHDRc studies. (Clark-Reyna, Grineski, and Collins 2016).³⁸



Environmental Health News

"Bad air means lower grade point averages in Texas"
July 24, 2015



Scientific American

"Dirty air correlates with lower grades in Texas schoolchildren"
July 24, 2015



Texas Standard, public radio program

"New study links pollution with low GPAs"
July 29, 2015



Mother Jones

"Kids who breathe more pollution have lower grades"
September 5, 2015

HHDRc compiled and analyzed data on daily asthma, Chronic Obstructive Pulmonary Disease (COPD), and congestive heart failure (CHF) hospital admissions in El Paso. Their results revealed that Hispanics were at greater risk for fine PM-associated asthma, COPD, and CHF hospital admissions as compared to non-Hispanic Caucasians and non-Hispanics of other races. Conversely, Hispanics were at lower risk for nitrogen dioxide-related asthma, COPD, and CHF admissions as compared to non-Hispanic Caucasians and non-Hispanics of other races. In terms of other social characteristics, researchers found that the risk of fine PM-associated asthma was higher for children and Hispanics on Medicare (compared to elderly and private insurance, respectively), while the risk of PM-associated CHF was higher for Hispanics on private insurance (compared to all other insurance types).⁴⁴

These results provide some evidence of a Hispanic health paradox for nitrogen dioxide-related sensitivity, but not for fine PM-related sensitivity, and underscore the necessity of additional research to understand the mechanisms behind these relationships. This work represents a significant contribution to understanding the Hispanic health paradox in air pollution epidemiology.

HHDRc researchers also identified persistent disparities in access to healthcare that were dependent on generational status. In contrast to previous studies that assumed that individuals assimilate into U.S. culture by the third generation, HHDRc examined fourth generations and higher.



They determined that the higher immigrant generations continue to have better access to care. However, they also identified greater persistence of barriers in access to healthcare than previously reported.⁴⁵

With a better understanding of disparities of health and exposure among Hispanics, especially children, HHDRRC has worked collaboratively with 40 stakeholders from environmental, public health, social justice, and educational organizations in order to facilitate the translation of environmental health disparities research into policy, public health practice, and community-based engagement. HHDRRC researchers engaged professionals from state and

local agencies, as well as private environmental health organizations, in stakeholder meetings and surveys in 2013 that asked about important environmental health issues and key research needs. HHDRRC researchers also hosted a 2-day conference in 2014 titled *Environmental Health Disparities on the U.S.-Mexican Border*, which brought together academics from El Paso, Las Cruces, and Ciudad Juarez, community stakeholders and service providers, national experts in EHDs and EJ, and representatives from national-level funding agencies.

ACCOMPLISHMENTS & IMPACTS



Surveyed more than 1,800 parents in El Paso to gather health and social information for their 4th and 5th grade children.



Conducted one of the first studies examining the role of social factors in modifying associations between air pollution and respiratory/cardiovascular outcomes.



Found an association between Texas children's exposure to air pollution and a measure of school performance (i.e., grade point average).



Revealed new considerations about the role of air pollution in predicting geographic inequalities in health outcomes.


Developing Solutions to Environment & Health Disparities

While it is critical that the Pilot EPA-NIMHD EHD Centers of Excellence research the existence and drivers of environmental health disparities, determining practical and effective solutions to these disparities was an equally important facet of their work.

Collaboration with local community organization evaluated innovative approach to reducing school children's exposures to air pollution

Center of Excellence on Health Disparities Research at Georgia State University

Exposure to air pollutants emitted by cars and trucks is a major concern for schools located in close proximity to major roadways. Long-term exposure to traffic-related air pollution can lead to asthma onset and exacerbation, decrements in lung function, and other health effects in children.⁴⁶ This is a nationwide problem—in 2005–2006, an assessment of the proximity of U.S. schools to major roadways found that 6.4 million children attended a school located 250 meters or closer to a major roadway.⁴⁷ The assessment also found that schools serving predominantly African American students were 18 percent more likely to be located near a major roadway, and schools with the majority of students eligible for free or reduced price meals (a proxy for income levels) were also more likely to be near a roadway.⁴⁷



6.4 million children attended a school located 250 meters or closer to a major roadway.⁴⁷

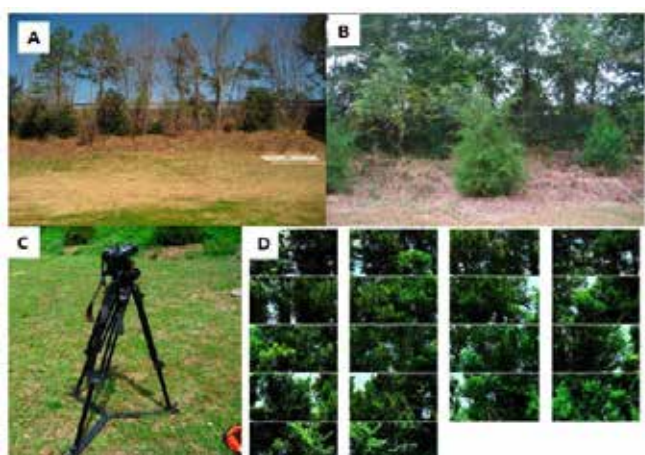


Figure 4. Images taken during the vegetative barrier study

Image A shows a section of the barrier during time of lower leaf area index. Image B shows a section of the barrier during a time of higher leaf area index. Image C shows the camera the investigators used to take photos to calculate the leaf area index values. Image D shows photos used to calculate leaf area index values.⁴⁶

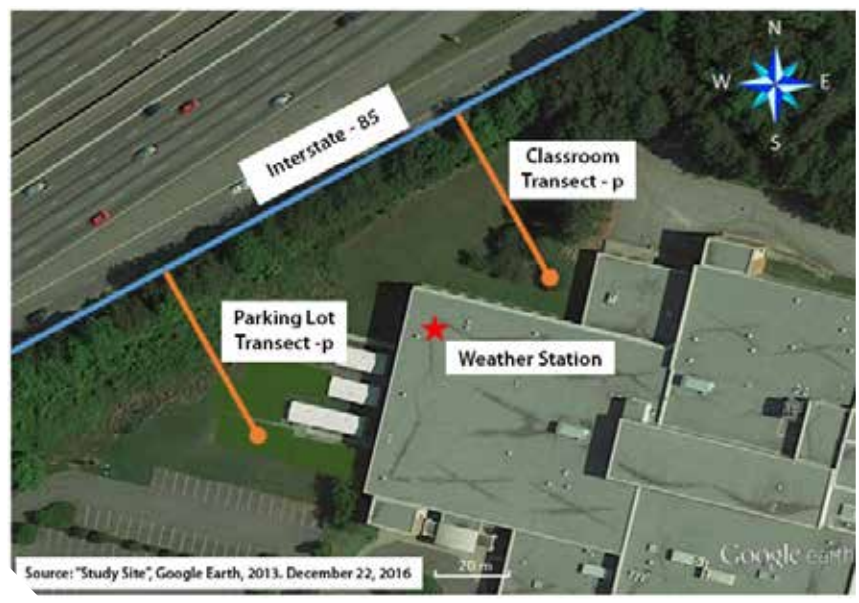
Given the magnitude of this issue, the associated inequalities, and the lack of technologies and policies to completely eliminate traffic-related air emissions, efforts to reduce the amount of traffic-related air pollution near schools are vital. Novel, inexpensive, and simple methods to address this nationwide concern would be even better.

The Center of Excellence on Health Disparities Research at Georgia State collaborated with local community group Mothers & Others for Clean Air to test a strategy to reduce schools' traffic-related air pollution exposures using trees and bushes, referred

to as "vegetative barriers."⁴⁸ Vegetative barriers, if designed and implemented properly, have been shown to effectively improve air quality in urban environments.⁴⁶

Over a one-year period the researchers measured total particle number concentrations (PNC) and black carbon (BC) concentrations at a Georgia middle school next to a major highway with a vegetative barrier in the middle. Taking advantage of the natural changes in vegetative cover that occur throughout the fall, winter, and spring months, the researchers tested the effect of the vegetative barrier on air pollution concentrations.

Figure 5. Study site and monitoring transects⁴⁶



They observed consistent decreases in BC concentrations with increased distance from the highway, but not in PNC. Furthermore, at either distance, BC concentrations were highest during the winter months when vegetative cover was the lowest. Additionally, time of year, hour of day, downwind conditions, temperature, and relative humidity were all found to be significant predictors of pollutant concentrations.⁴⁶

Because the study considered both distance and vegetation together, the center results were unable to show a definitive benefit of vegetation alone in reducing air pollution exposures. However, the trend indicates that additional investigations into this solution would be worthwhile.

Vegetative barriers have the potential to be a low-cost, sustainable, and simple method to reduce school childrens' exposures to air pollution associated with road traffic.

ACCOMPLISHMENTS & IMPACTS



Collaborated with a community-based organization to monitor the impacts of air pollution near schools.



Engaged school teachers and students in air pollution monitoring and installation of vegetative barriers.



Helped to build capacity for researching environmental contributors to urban health disparities.



Center Research informs intervention to protect against DNA damage caused by arsenic and uranium exposure

New Mexico Center for Advancement of Research, Engagement, & Science on Health Disparities (NM CARES HD) at the University of New Mexico

In one of the first studies of its kind, the New Mexico Center for Advancement of Research, Engagement, & Science on Health Disparities (NM CARES HD) at the University of New Mexico proposed an easy-to-implement intervention of zinc supplementation to protect against arsenic and uranium toxicity. NM CARES HD's research contributed to the understanding of the physiological mechanisms of heavy metals exposures, such as arsenic and uranium, and how they combine with ultraviolet light exposure to cause DNA damage.

Exposure to heavy metals is a concern in settings where the population relies on natural resources, as is common in many Native American communities. Health disparities in heavy metals exposure have been observed within Native American lands proximate to abandoned uranium mines throughout the western U.S. In previous studies, researchers established that low levels of arsenic in drinking water (as low as 10 ppb) disrupts DNA repair mechanisms.⁴⁹

While these low levels are not cytotoxic, arsenic depletes zinc from target proteins, which leads to an increase in DNA damage after exposure to ultraviolet light.³⁸ Researchers also suggest that uranium may lead to similar zinc-based DNA repair disruption.⁵⁰ If so, over-the-counter dietary zinc supplementation could mitigate the DNA damage and protect against uranium toxicity.

Examining these effects in the Navajo Birth Cohort Study, researchers at NM CARES HD found preliminary indications that an over-the-counter, preconception zinc supplement was associated with decreased DNA damage after ultraviolet co-exposure with arsenic and uranium.⁵¹ The research also demonstrated that zinc

supplementation can mitigate or reverse the effects of arsenic on a particular enzyme's (PARP-1) activity and ultraviolet light-induced DNA damage in human cell and mouse models.

ACCOMPLISHMENTS & IMPACTS



Researchers at NM CARES HD discovered that prenatal zinc supplementation taken before pregnancy decreased the amount of UV-driven DNA damage after exposure to uranium and arsenic.



This was one of the first studies to investigate the mechanisms of uranium-dependent DNA repair deficiency.



The research informs an easily-implemented intervention to decrease DNA damage caused by arsenic and uranium exposure.

“The outcomes from the UNM CARES HD Center Program Environmental Supplement provided the scientific underpinnings to design and implement a mechanism-based intervention, sympathetic to Native American holistic views, using zinc supplementation to alleviate toxicity associated with mine waste metal exposures. A successful low-cost, easily implemented intervention could have broad public health implications.”

- Dr. Laurie Hudson, Investigator, UNM CARES HD, University of New Mexico

Collecting & Synthesizing Environment and Health Disparity Data

The Pilot EPA-NIMHD EHD Centers gathered enormous amounts of data and built infrastructures to store, synthesize, and analyze that data for use by researchers across the country for future environmental and health disparity research. The data will ensure that the work conducted under this grants program have long-lasting and far-reaching impacts on the people affected by environmental health disparities.

Transdisciplinary team seeks answers to complex health disparity questions

Health Disparities Research Center of Excellence (HDRCOE) at Meharry Medical College

Why are some individuals more susceptible to health problems than others? The reasons are not simple. Health status is a result of incredibly complex interactions and variability among genetics, age, nutrition, exposures to hazards, lifestyle, behaviors, and socioeconomic variables over one's



lifetime. Understanding lifetime exposures and interactions will make it easier to find health interventions that work.

The Health Disparities Research Center of Excellence (HDRCOE) at Meharry Medical College in Nashville, Tennessee tackled this complexity with a multidisciplinary team of experts in public health, medicine, mathematics, geography, urban planning, and social sciences. They developed a public health “exposome” framework and gathered data to assess relationships between environment, personal health, and population level disparities.^{52,53} The framework organizes the integration of environmental exposures across a person’s entire life. It addresses exposures to hazards, personal attributes, stressors, community attributes, and moderating factors to assess the ways critical life stages might be affected, from molecular to population levels.

HDRCOE used the framework to aggregate health outcome data with thousands of sources of environmental exposures. From this framework, a publicly available database was developed to allow tracking and analysis of environmental health data over time, place, and space. Users can create interactive maps, tables, and charts at local levels (e.g., by county) where available.

The framework and database provide tremendous opportunities to integrate, manipulate, and analyze variables from a wide range of scientific disciplines to allow for the examination of complex social problems such as health disparities.⁵³ These achievements strengthen the evidence base for health disparities research, practice, policy, community engagement, and research training.

WHAT IS THE "EXPOSOME?"

The “exposome” is defined as the cumulative measure of all exposures during an individual’s lifetime and how those exposures relate to health.⁵² These exposures or factors can be organized into three categories, illustrated here with examples. The concept of the exposome is important because it captures non-genetic factors that determine health.⁵⁴



Internal factors such as hormones, body type, physical activity, and age.

Specific external factors such as radiation, pathogens, pollutants, and diet.

General external factors such as education, financial status, and psychological stress.



“As important as ... sequencing of the human genome was, sequencing the public health exposome is likely to have a much greater impact. Completing exposure pathways over the life course will provide us with greater opportunities to target personal and public health interventions with tailored, data driven initiatives.”

**- Paul D. Juarez, Director
HDRCOE, Meharry Medical College**

ACCOMPLISHMENTS & IMPACTS



Pioneered the concept of a public health exposome framework that encompassed a lifetime analysis approach to understanding environmental health exposures and their interactions.



Developed a large repository of environmental health disparities data that can be used by researchers across the nation.



Strengthened the evidence base for disparities research practice, policy, community engagement, and research training.

Building New York City communities' capacity to reduce health disparities

Center of Excellence in Disparities Research and Community Engagement (CEDREC) at Weill Cornell Medical College

The Center of Excellence in Disparities Research and Community Engagement (CEDREC) at Weill Cornell Medical College compiled environmental health information for the communities of color and investigated new ways to engage with hard-to-reach populations in these communities.

The largely African-American communities of the South Bronx and Harlem have among the highest cardiovascular disease and cancer death rates in New York City, and one in three residents live in poverty.^{55,56} To effectively disseminate research findings and solutions and build community capacity for change to reduce cardiovascular disease and cancer risks, CEDREC sought to communicate health information and find research partners from within communities at a high risk of cardiovascular disease or cancer. For example, one effort involved using local barbershops to recruit older African-American men for blood pressure and colorectal cancer screening. Additionally, the center developed HeartSmarts, a faith-based cardiovascular disease prevention initiative developed in partnership with a hospital.



"Community engagement in research ensures that researchers understand community priorities, promote culturally-responsive research, while simultaneously enhancing a community's capacity to address its own health needs and health disparities issues."

- Dr. Carla Boutin-Foster, Director, CEDREC, Weill Cornell Medical College

They contacted faith-based organizations with the assistance of an established ecumenical group (Brooklyn District Public Health Office Advisory group) and used a train-the-trainer approach to develop lay health ambassadors in these organizations. These ambassadors then communicated information to members of their congregation.

CEDREC partnered closely with a number of local organizations to improve data collection and transfer of information and benefits to the community. These community partners included Youth Ministries for Peace and Justice, Mothers on the Move, Families United for Racial and Economic Equality, Good Old Lower East Side, and the Chinese Progress Association. The center researched and developed comprehensive community environmental health profiles and shared the information with local partners.⁵⁷



These profiles mapped New York City Department of Health data and community partner catchment areas to describe a number of community characteristics, including:

- Socioeconomic and demographic indicators (e.g., ethnicity, income levels, housing, census, and employment data)
- Condition of the natural and built environments
- Land use
- Transportation
- Air quality (indoor and outdoor)
- Water quality
- Soil contamination
- Emissions from vehicles, industry, and power plants
- Use of pesticides
- Food safety and systems
- Schools
- Open spaces
- Waste removal and disposal
- Availability of health care services, including outreach and services by government agencies, hospitals and medical facilities, and first responders
- Ecological data on land use changes and flooding risk

In collaboration with the New York City Department of Health and Mental Hygiene, the center overlaid health statistics data onto the community profiles. The research team provided the five community partners with access to these data-rich profiles that serve as a valuable resource in examining environmental factors that drive health disparities and in developing innovative and transdisciplinary solutions. The research contributed to achieving the goals of the NIH strategic plan to reduce and ultimately eliminate health disparities.

ACCOMPLISHMENTS & IMPACTS



Applied a participatory approach where community partners were engaged throughout the study and provided benefits to researchers and the community.



Created new collaborations that informed novel community-based programs.



Accelerated the dissemination of cardiovascular disease and cancer health information and research findings that supported community capacity for change.



COMMUNITY OUTREACH & ENGAGEMENT

Partnering with and educating communities impacted by environment and health disparities bridges the gap between research and implementation. Many of the Pilot EPA-NIMHD Centers of Excellence focused on increasing community outreach and engagement activities with communities impacted by health disparities. Through these activities, the centers successfully empowered communities, informed policy, strengthened community networks, educated community members and organizations, and provided services to communities that directly addressed health disparity concerns. The centers worked to initiate and expand relationships between communities, health organizations, researchers, health practitioners, and policy makers in order to:

COLLABORATIONS TO INFORM POLICY

49

Influencing state legislation to protect children's health

EMPOWERING COMMUNITIES TO ADDRESS HEALTH DISPARITIES ISSUES

51

Photovoice Project: Tool for aiding communities in identifying EHD issues

The FIESTAS Project: Empowering women to tackle food insecurity

The Community Block Assessment Project: Community involvement in data collection and analysis

EXPANDING RELATIONSHIPS AND EDUCATING COMMUNITIES

58

Center uses environmental health disparity data to develop community resources.

Public participatory geographic information system help enhances residents' engagement in local environmental decision-making.

PROVIDING DIRECT COMMUNITY BENEFIT

61

Improving health and safety in American Indian community homes and businesses.

LIST OF COMMUNITY PARTNERS

63

The centers' work is exemplary of community outreach and engagement that both enhances awareness of local health disparity issues among community members and stakeholders, while simultaneously educating community leaders.



Collaborations to Inform Policy

The Pilot EHD Centers provided evidence-based research, which aids in producing public policy built on their scientific findings. Such research findings and interventions that prevent or mitigate certain exposures are important considerations when writing new legislation to protect public health. EPA-NIMHD EHD Center investigators inform this process by developing research partnerships and collaborations, and sharing their research findings with local, state, and national lawmakers.

Influencing state legislation to protect children’s health

New Mexico Center for Advancement of Research, Engagement, & Science on Health Disparities (NM CARES HD) at the University of New Mexico

The New Mexico Center for Advancement of Research, Engagement, & Science on Health Disparities (NM CARES HD) has identified, initiated, and advanced partnerships with health organizations, which helped influence state legislation to address public health concerns. NM CARES HD organized a multi-stakeholder team that worked on children’s asthma and secondhand smoke as a significant health disparity indicator in the state of New Mexico.

Additionally, NM CARES HD initiated partnerships with the New Mexico Coalition on Asthma, American Lung Association (local chapter), American Thoracic Association, New Mexico Thoracic Society, UNM Pulmonary and Fierce Pride. This expanded collaboration allowed for the identification of gaps to inform policy, research, and practice and the achievement of further public health advancements. Together, they identified pediatric exposure to secondhand smoke in vehicles as a particular concern.

In response to the strength of this collaborative effort fostered by NM CARES HD, the New Mexico State Legislature, in 2015, introduced a law prohibiting smoking in vehicles when children are present in an effort to protect children's health by reducing their exposure to secondhand smoke.⁶⁰

ACCOMPLISHMENTS & IMPACTS



Collaborations between the New Mexico Center for Advancement of Research, Engagement, & Science on Health Disparities (NM CARES HD) and numerous health organizations played an important role in the introduction of a house bill by the New Mexico State Legislature to protect children from exposure to secondhand smoke in vehicles in New Mexico. The bill prohibited smoking in vehicles if minors are present.⁶⁰



Why is secondhand smoke a children's health concern?

Children have no control over their environment, including where and when the adults in their life choose to smoke. Secondhand smoke is a complex mixture containing about 70 carcinogenic chemicals. Multiple adverse health effects have been associated with childhood exposure to secondhand smoke, including respiratory illness and health effects in adulthood (e.g., cancer and cardiovascular health).⁵⁸

Empowering Communities to Address Health Disparity Issues

The importance of creating enduring, long-term, beneficial change in communities and individuals cannot be understated. Projects and research initiatives come and go, but the people remain. It is essential to determine the methods and strategies that are most effective at providing communities with the education and tools they need to continuously improve their lives.

Through community-based participatory research projects, the Pilot EHD Centers involved community members in planning and implementing interventions and public health strategies to address health disparity issues. Initiatives, such as holding community meetings and involving community members in data collection and analysis, gave these communities the resources and sense of empowerment necessary for sustainable improvement of their environments.



Photovoice Project: Tool for aiding communities in identifying EHD issues

Coordinating Center of Excellence in the Social Promotion of Health Equity in Research, Research Education and Training, and Community Engagement and Outreach, University of South Carolina

Residents of Orangeburg County, South Carolina, share concerns about environmental health disparities, especially in HIV, HPV, cervical cancer, and head and neck cancers that affect the community. In response to community concerns, the University of South Carolina developed a tool to learn more about perceptions of the environment and health. The tool, called Photovoice, uses photography to document perceptions of local environmental hazards, pollution sources, and potential impact on health among community members.

Photovoice was designed for community leaders to use when discussing and developing policy at the local level. The goal is that it will be used to guide discussions about how the environment affects health and to inform local policy action to address environmental health disparities.

A sample of adult residents were recruited to participate in the implementation of Photovoice. Participants took photos and wrote descriptions that tell a story about how the environment affects health. Photos depict both positive and negative perceptions of the environment and health. In collaboration with Community Action Board Inc. and community leaders, the research board reviewed photos and descriptions. Seven themes emerged from the photos: Recreation and Leisure; Food Access; Hazards and Pollution; Health, Human, and Social Services; Economic Issues; Beautification; and Accommodation and Accessibility.



"This is where I live. There is a foul odor, smell, mosquitoes in this sitting water, and I am concerned about the water."

– Resident of Orangeburg County, SC

Above is an example PhotoVoice entry by a community member. Photovoice has empowered community members to take action and notice environmental health concerns, become active in educating others about environmental health issues, and practice health lifestyles. The Environmental Health Core will continue to collaborate with stakeholders and residents of Orangeburg County to improve health and reduce health disparities.⁵⁹

Resident perceptions of environment and health fell into seven themes:

- Recreation and Leisure
- Food Access
- Hazards and Pollution
- Health, Human, and Social Services
- Economic Issues
- Beautification
- Accommodation and Accessibility



The FIESTAS project: Empowering women to tackle food insecurity

New Mexico Center for Advancement of Research, Engagement, and Science on Health Disparities (NM CARES HD) at the University of New Mexico

FIESTAS was a two-year project run by the New Mexico Center for Advancement of Research, Engagement, and Science on Health Disparities (NM CARES HD) at the University of New Mexico, which focused on improving food security in Santa Barbara-Martineztown, Albuquerque, New Mexico. The goal of the project was to understand the communities everyday experiences in relation to food, create opportunities for community members to develop supportive social relationships, obtain useful information about available food and health resources, and envision strategies that could improve nutrition and strengthen social networks in the neighborhood.

What is food insecurity?

Food insecurity is when the availability of nutritionally adequate and safe foods, or the ability to acquire acceptable foods in socially acceptable ways, is limited or uncertain.⁴⁹

NM CARES HD researchers found that families in Santa Barbara-Martineztown experienced food insecurity rates twice the state average; 1 in 3 families had trouble feeding their families, compared to 1 in 6 in the rest of the nation. They also found that availability and quality of food was lower in Santa Barbara-Martineztown than in other areas of the country.

Researchers conducted a food security survey, assessed the neighborhood food environment, and interviewed local community members about their struggles and strategies for dealing with food insecurity.

The results of these inquiries revealed serious food insecurity issues in this community. While the impacts of food insecurity on physical health are concerning, the stress and despair reported by individuals affected by food insecurity are equally disturbing. Women, in particular, experienced significant distress related to issues of food insecurity. Most concerning, women felt alone in their struggle, embarrassed about seeking support or counsel from their fellow community members, even though most members of their community were also experiencing the same issues.

With a deeper understanding of the issues plaguing this community, NM CARES HD researchers worked with community members to conceptualize and

implement strategies to improve food access, food security, and nutrition. Throughout the project, the research team engaged the community by holding community board meetings and other FIESTAS events for the community members to develop solutions. The purpose of the events was to prepare and share meals, discuss community issues, develop and write interview questions, and interpret survey and assessment findings. The researchers continue to actively involve the community in developing solutions.

Rather than designing and implementing solutions for the community, researchers gave community members the tools and knowledge to create change themselves. Community meetings served as opportunities for women to strengthen relationships with fellow community members, increase their knowledge of available local resources, and gain an understanding that they were not alone in their struggles.⁶⁰

FIESTAS identified how food insecurity intersected with everyday experiences for women in Santa Barbara-Martineztown. "Women struggle with the experience of food insecurity in a variety of physically and emotionally challenging ways. Women ... connect shame, fear, family conflict, the potential for child abuse, feelings of failure, having to sell beloved family pets, the risk of becoming homeless, not knowing where to turn for help, and actual physical distress ... with food insecurity."

- Dr. Janet Page-Reeves, Investigator, NM CARES HD, University of New Mexico



Researchers found that women who participated in the FIESTAS project reported that they felt personally empowered by the experience, giving them a new sense of possibility for themselves and the community. By providing a structured space for open dialogue between community members and educating them about available tools and resources, NM CARES HD researchers created a sense of empowerment in Santa Barbara-Martinez town that will enable long-lasting beneficial change brought about by its own members.

"The vision emerging from [FIESTAS] is contributing to a new sense of possibility for the community and for women individually in their own lives."

**- Dr. Janet Page-Reeves, Investigator
NM CARES HD, University of New Mexico**

ACCOMPLISHMENTS & IMPACTS



Connected individuals struggling with food insecurity to fellow members of their community experiencing the same hardships removed feelings of shame and embarrassment, and empowered them to work on solutions to improve food security and nutrition.



Empowered women in the community to formulate and apply strategies to improve food security and nutrition for themselves and others in their community, including the following:

1. Women's supper club,
2. Bulk-buying initiative,
3. Walking group,
4. Multidimensional grocery store pilot,
5. Community kitchen, and
6. Community garden.⁶⁰

The Community Block Assessment Project: Community involvement in data collection and analysis

Coordinating Center of Excellence in the Social Promotion of Health Equity in Research, Research Education and Training, and Community Engagement and Outreach (CCE-SPHERE) at the University of South Carolina

To thoroughly understand how ecological features of the environment act as primary drivers of health and disease in a community, researchers must have a complete picture of the distribution of positive and negative features in the area of study. The Coordinating Center of Excellence in the Social Promotion of Health Equity in Research, Research Education and Training, and Community Engagement and Outreach (CCE-SPHERE) undertook such an assessment of the ecological features in North Charleston and Orangeburg County, South Carolina. The CCE-SPHERE felt it was pertinent to involve community members with the collection and interpretation of community data.



What are pathogenic and salutogenic features?

Pathogenic features increase the negative effect of environmental hazards on community health and well-being.

Examples: Psychosocial stressors (i.e., racism, crime, and violence), pawn shops, liquor stores, poor sewer, water, and road infrastructure, and traditional environmental pollutants such as landfills and Superfund sites.

Salutogenic features act as buffers and help to mitigate and/or moderate the effects of stressors on the health of individuals and communities.⁶¹

Examples: Good housing stock, parks, green space, recreational facilities, supermarkets, and social service organizations.

CCE-SPHERE researchers used a Community Block Assessment methodology to assess **pathogenic** and **salutogenic** features of the two communities. They recruited and trained over 30 members of the Charleston and Orangeburg counties to become “block raters,” who then went out into their communities and collected data on the physical and social features of over 100 blocks. Data collected included, the physical layout of the block face, types of structures, adult and youth activity, and physical and social order, were used to calculate descriptive statistics for each study block and to create maps of the communities with pathogenic and salutogenic features overlaid. The researchers reviewed the findings with the community surveyors and held evaluation sessions to discuss the block assessment methodology and the utility of the maps.

The results of the Community Block Assessment revealed important characteristics about these counties and enabled comparisons between the two. Data gathered from the study are intended to inform community-based organizations’ planning and community development initiatives to address environment and health disparities at the local level. On a broader scale, researchers evaluated the success of involving community members in the data collection process.

Results showed that community participants felt empowered by the experience. They were more confident in recognizing features in their communities that contribute to health, and felt that the data they gathered would be extremely useful in helping them to advocate and change policies in their neighborhoods.⁶²

ACCOMPLISHMENT & IMPACT



Empowered community members to recognize positive and negative features in their communities related to environmental health, and taught them to understand how that information can be used to effect real change.



Expanding Relationships and Educating Communities

Researchers at the Pilot EPA-NIMHD Centers of Excellence engage with local organizations and citizens to empower them to take individual actions that will improve public health and decrease environment and health disparities within their community. These types of community-level interventions have a direct impact and are most effective at reaching those in most need.

Center uses environmental health disparity data to develop community resources

Center of Excellence in Eliminating Disparities at the University of Illinois at Chicago (UIC)

As part of their Environment Core, the Center of Excellence in Eliminating Disparities at the University of Illinois at Chicago (UIC) gathered and analyzed health disparities research data for Chicago from a variety of sources, for use by their own and other researchers across the country. In addition, they took the important step of making this data accessible and directly useful to the local community.

Center researchers worked with the UIC Urban Data Visualization Lab, dedicated to data visualization and geographic mapping, to develop websites for direct community benefit.⁶² The UIC Center developed prototype websites to share results of this work. For example, the researchers developed a prototype

website to provide healthcare access information to wider Cook County residents. This website listed locations of Federally Qualified Health Centers, local and state public health clinics, and community health Centers.⁶³

The UIC Center provided consultation to the Chicago Consortium for Community Engagement, which is a network of academic institutions engaged in community research, to encourage Chicago citizens to participate in and access local health research.

The UIC Center assisted with development of a Chicago Community Research Map website—an interactive map of the 77 Chicago community areas, which is searchable by geography, research topic, and investigator.⁶⁴ Center researchers have also provided support to the Illinois Breast and Cervical Cancer Program and to the state of Illinois' Affordable Care Training to help identify effective ways to reach those most in need.

ACCOMPLISHMENTS & IMPACTS



Developed website that provided health care information for the disadvantaged and uninsured in the state of Illinois.



Consulted for the Chicago Consortium for Community Engagement that created relevant, accessible, and effective programs to increase Chicago communities' use of health research.



Funded the Beating Breast Cancer Program that collaborated with other agencies in Chicago to help navigate uninsured women to obtain screening mammograms after an Illinois health program had to reduce efforts when faced with state budget cuts.



Provided expertise to and worked with Illinois state agencies to conduct an evaluation of an Illinois health program to look at effective ways to reach those in most need.



Public participatory geographic information systems help residents be more engaged in local environmental decision-making

Environmental Health Core at the University of South Carolina

Members of communities in Orangeburg and North Charleston, South Carolina, expressed concerns about environmental stressors. Their concerns included industrial pollution sources, goods movement activity, soil contamination, indoor pollution, and health disparities related to cardiovascular disease, asthma, cancer, diabetes, stroke, and birth outcomes.⁶⁵ The Environmental Health Core at the University of South Carolina conducted research and tool development responsive to these concerns.

A number of stressors are present throughout the region. Some of the stressors identified include environmental stressors— such as brownfields, leaking underground storage tanks, air toxics,

and facilities reporting releases of toxic substances tracked by EPA’s Toxic Release Inventory, while others include social stressors, such as segregation and socioeconomic status disparities. The center developed the Environmental Justice Radar (EJRADAR) tool to improve community access to relevant exposure and risk-related information for these stressors.⁶⁶ This tool allows community members to map study data and visualize burden and exposure disparity data. The tool includes hazard, pollution, socioeconomic, and sociodemographic data; allows data queries to be performed; and offers the capability to upload photos of environmental stressors.⁶⁷

Community issue profiles can be generated by the tool. The tool and information provide communities with “issue profiles” of cumulative risk information. This information helps communities identify individual-level potential “hot spots,” vulnerable subpopulations, and allows them to prioritize or manage risk issues.⁶⁷

ACCOMPLISHMENTS & IMPACTS



Developed EJRADAR tool, which allowed community-level mapping of research, hazard, pollution, and sociodemographic data, and the ability to upload community photos of environmental stressors.



Held two in-person trainings at the 2013 Charleston Area Environmental Justice Conference and Community Summit to share information on EJRADAR. Provided interactive demonstrations of the tool.



Provide Direct Community Benefit

Thorough and groundbreaking research is essential to improve the lives of families and communities affected by environment and health disparities, but the benefits are often delayed. Researchers at the Pilot EPA-NIMHD Centers of Excellence strive to achieve more immediate and direct positive impacts on their communities. They perform local-level research, engage local organizations, raise awareness, and directly implement community-level initiatives.

Improving health and safety in AI/NA community homes and businesses

*Center for American Indian Community Health (CAICH)
at the University of Kansas Medical Center*

The Center for American Indian Community Health (CAICH) at the University of Kansas provided healthy home assessments and environmental health education to local AI/NA communities. These services assisted vulnerable populations at tribal facilities and schools on multiple reservations in Kansas and South Dakota.

"We identified problems in over half of the homes and facilities assessed, many that required simple solutions by home owners/renters. If larger problems are found, we help people into programs that assist with the cost of renovations or other solutions. We received numerous comments from community members about how much these assessments helped them, particularly from individuals in whose homes we found gas leaks."

**- Dr. Christine Daley, Director
CAICH, Kansas Medical Center**

With the assistance of Masters of Public Health students who were fully trained in EPA's Healthy Homes guidelines, the center provided 72 assessments for AI/NA homeowners, home renters, and business owners.⁶⁹ They collected samples to examine allergens such as dust and mold, potential safety hazards, as well as air flow and quality.

CAICH identified potential hazards and problems in more than half of the assessed sites. Many of the issues could be resolved with simple solutions, such as installing smoke and carbon monoxide detectors or providing fire extinguishers and allergen-free cleaning supplies. When larger or more complex problems were found, such as widespread mold, the center provided referrals to programs that assist with renovations and other solutions. The assessments served as opportunities for community members to improve home safety and to expand their knowledge on potential hazards around their living environments. The center received numerous positive comments about how helpful the assessments were, especially from individuals whose homes were found to have gas leaks.

Education plays a critical role in addressing environmental health issues. The center has developed and presented educational materials to 240 community members about home safety and how to maintain a healthy home, 30 facility maintenance personnel about building safety, and 30 health care providers about asthma and improving the home environment of patients.⁶⁹

University of Kansas Center researchers conduct a Healthy Homes assessment



ACCOMPLISHMENTS & IMPACTS



Performed 72 healthy home assessments that identified ways to improve home safety and residents' health.



Identified gas leaks in some of the assessed homes—information that helped avert potentially serious threats to life and property.



Raised awareness of potential hazards in home environments and provided the tools and knowledge to properly address environmental issues around them.



Research staff leveraged local organizations' community knowledge and connections to help ensure that the centers addressed the critical needs specific to that population.

List of Community Partners

The Pilot EPA-NIMHD EHD Centers engaged directly with community partners when conducting their research. Research staff leveraged local organizations' community knowledge and connections to help ensure that the centers addressed the critical needs specific to that population. The following organizations partnered with Pilot EHD Centers researchers.

Community Organizations

- Fierce Pride
- Mothers on the Move
- Navajo Nation
- New Mexico Coalition on Asthma
- Proctor Creek Stewardship Council
- Santa Barbara-Martineztown Community Learning Center
- Youth Ministries for Peace and Justice

Federal, State, and Local Governments

- Fulton County Department of Health and Wellness
- Georgia Department of Public Health
- Illinois Department of Public Health
- Metropolitan Nashville Public Schools
- New York City Department of Health
- Pan-American Health Organization
- Shelby County Health Department
- South Carolina Commission for Minority Affairs
- South Carolina Department of Health and Environmental Control
- South Carolina Network for the Elimination of Health Disparities
- South Carolina Rural Health Research Center
- Tennessee Department of Health
- Tennessee Department of Transportation
- U.S. Centers for Disease Control and Prevention

Health Associations and Hospitals

- Associations for Schools and Programs of Public Health
- Border Epidemiology and Environmental Health Center
- Children's Mercy Hospital
- National Environmental Health Association

Non-Profit Organizations

- Action for the Retired Community (ARC) Fort Washington Senior Center
- Alianza Dominicana
- Alzheimer's Association
- American Indian Arts and Crafts Association
- American Lung Association
- American Thoracic Association
- Charleston Community Research to Action Board
- Chattahoochee Riverkeepers
- Chinese Progress Association
- Eco-Action
- English Avenue Neighborhood Association
- Familias Unidas de Chamizal
- Families United for Racial and Economic Equality
- Federal Reserve Bank
- Good Old Lower East Side
- GreenLaw
- Low Country Alliance for Model Communities
- Metropolitan Chicago Breast Cancer Task Force
- Mothers and Others for Clean Air
- New Mexico Thoracic Society
- Riverstone Senior Life Services
- The Conservation Fund
- Walk/Bike Nashville
- West Atlanta Watershed Alliance

Research Groups and Studies

- Charleston Area Pollution Prevention Partnership
- Design for Health
- Healthy Cities Collaborative
- Navajo Birth Cohort Study
- The Jackson Heart Study
- The Multi-Ethnic Study of Atherosclerosis

Colleges and Universities

- Allen University
- Benedict College
- Claflin University
- Emory University School of Medicine
- Emory University School of Public Health
- Haskell Indian Nations University
- Jackson State University
- Morris College
- Northern New Mexico College
- Northwestern University
- Pratt Institute
- Rush University
- Spelman College
- University of Chicago
- University of Maryland
- University of Mississippi Medical Center
- University of New Mexico Health Sciences Center
- University of Pittsburgh Graduate School of Public Health Center for Minority Health



EDUCATION & TRAINING

The Pilot EPA-NIMHD Centers of Excellence supported the education and training of students, professionals, and the communities they served in several ways: involving students in their research and community outreach, training professionals and community members on topics related to EHDs, incorporating EHD research and topics into their university's curriculum, and sharing EHD research at meetings, workshops, and conferences around the world.

INVOLVING STUDENTS IN PILOT EHD CENTERS RESEARCH AND OUTREACH	66	PUBLICATIONS	71
INCORPORATING EHD CENTERS RESEARCH INTO CURRICULA	68	SHARING EHD RESEARCH AROUND THE WORLD	72
TRAINING COMMUNITY MEMBERS AND PROFESSIONALS ON EHD ISSUES	69		

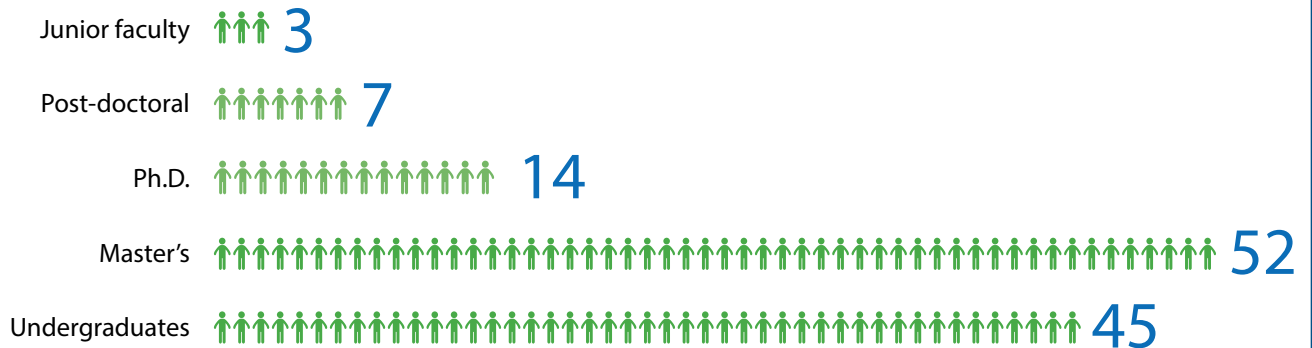


Over 120 students and early career professionals have been involved in the research, training, and community outreach of the Pilot EHD Centers.

Involving Students in Pilot EHD Center Research and Outreach

Students and junior faculty used center research in their theses and dissertations, participated in monitoring, assessments, and other hands-on activities, and benefited from mentorship from center faculty and investigators, among other types of involvement.

Students and Junior faculty Involved in Center Activities





“In our [CAICH] opinion, the greatest success and greatest impact of this funding was in training of our AI/NA students. AI/NA communities face some of the greatest disparities in education of anyone in the U.S., and through this funding, we were able to make a real difference for students who are now working in environmental health and making a difference in their community.”

**- Dr. Christine Daley, Director
CAICH, University of Kansas Medical Center**



Incorporating EHD Research into Curricula

Several of the Pilot EHD Centers developed new courses, concentrations, or seminars at their parent institutions. These opportunities gave more students a chance to engage in environment and health disparities research and bring about increased participation in the environmental health workforce by highly-trained scientists, some of whom are also from underserved populations.

The Center of Excellence on Health Disparities Research (COEHDR) at Georgia State University

developed an environmental health curriculum and launched an environmental health concentration in the Master of Public Health and Ph.D. programs.

The New Mexico Center for Advancement of Research, Engagement, & Science on Health Disparities (NM CARES HD) at the University of New Mexico

incorporated environment and health disparities topics into the University of New Mexico General Preventive Medicine and Public Health Residency curriculum.


The Center of Excellence in Disparities Research and Community Engagement (CEDREC) at Weill Cornell Medical College in New York

broadened the health disparities track of an established Master of Science Program in Clinical Epidemiology and Health Services Research to include an environment and health disparities seminar series focused on environmental justice. Each seminar was taught by a different community partner organization.

The Center for Excellence in Eliminating Disparities (CEED) at the University of Illinois at Chicago

offers a health disparities research course entitled Quantitative Methods of Health Disparities Research. It examines quantitative and qualitative methods of measuring health disparities and health equity using local data. The center also developed and introduced a Social Vulnerability course.

Training Community Members and Professionals on EHD Issues



Students were not the only group that received education and training from the centers; community members, health care professionals, and other individuals also benefited from the knowledge they shared.

Center for American Indian Community Health (CAICH) – University of Kansas Medical Center

- Educated 240 AI/NA community members and 30 facilities maintenance workers on environmental health, focusing on healthy homes.
- Educated 30 health care providers on treating children with asthma, and educated the parents of the children about their home environment.

New Mexico Center for Advancement of Research, Engagement, & Science on Health Disparities (NM CARES HD) – University of New Mexico

- Trained Navajo Nation Community Health Representatives on environmental health research and health disparities.
- Delivered a four-part tele-education series focusing on environmental health, uranium exposure history and legacy, community-based studies, and laboratory mechanistic studies to a tribal college network.
- Delivered three tele-health presentations focused on New Mexico-specific research on the prevalence of children's secondhand smoke exposures, risk factors for asthma and respiratory symptoms, and smoking restrictions as a means to reduce environmental health risks for children to clinicians across New Mexico.

Center of Excellence in Disparities Research and Community Engagement (CEDREC) – Weill Cornell Medical College

- Helped 23 members of partner community-based organizations obtain Health Insurance Portability and Accountability Act (HIPAA) and Institutional Review Board (IRB) certification.





Publications

Center researchers published their work in various peer-reviewed journals. A list of publications is provided in **Appendix A**, listed in alphabetical order by author and then by date.

Sharing EHD Research Around the World

The Pilot EPA-NIMHD EHD Centers researchers presented their environment and health disparities research at more than 50 conferences, meetings, and workshops, both nationally and internationally. Presentations are listed by year and then by month, beginning with the most recent.

2017

- Annual Meeting of the Population Association of America. Chicago, Illinois (April)
- Community Mapping Public Health Hackathon. Nashville, Tennessee (March)

2015

- 27th Annual Conference of the International Society for Environmental Epidemiology (ISEE). Sao Paulo, Brazil. (August)
- Annual Meeting of the American Sociological Association. Chicago, Illinois (August)

2014

- National Institute on Minority Health and Health Disparities (NIMHD) Grantees' Conference. National Harbor, Maryland (December)
- 7th American Association for Cancer Research Conference on the Science of Cancer Health Disparities in Racial/Ethnic Minorities and the Medically Underserved. San Antonio, Texas (November)
- 142nd Annual Meeting of the American Public Health Association. New Orleans, Louisiana (November)



2013

- 8th Conference on Metal Toxicity and Carcinogenesis. Albuquerque, New Mexico (October)
- International Society for Environmental Epidemiology (ISEE) Young Researchers Conference on Environmental Epidemiology. Barcelona, Spain (October)
- Annual Meeting of the American Sociological Association. San Francisco, California (August)
- Centers for Population Health and Health Disparities Annual Meeting. Los Angeles, California (May)
- Conference on Addressing Environment, Public Health and Social Justice. El Paso, Texas (May)
- Environmental Health Disparities on the US-Mexico Border Conference. El Paso, Texas (May)
- Water Microbiology Conference. Chapel Hill, North Carolina (May)
- 11th International Conference on Urban Health. Manchester, United Kingdom (March)
- 74th Annual Meeting of the Society for Applied Anthropology. Albuquerque, New Mexico (March)
- Southwest Social Science Annual Meeting. San Antonio, Texas (April)
- 7th Health Disparities Conference, Xavier University of Louisiana. New Orleans, Louisiana (March)
- Eastern North American Region (ENAR) International Biometric Society Spring Meeting. Baltimore, Maryland (March)
- 20th Annual Meeting of the Society for Research on Nicotine and Tobacco. Seattle, Washington (February)
- University of New Mexico Environmental Toxicology Seminar Series. Albuquerque, New Mexico (January)
- 6th American Association for Cancer Research Conference on the Science of Cancer Health Disparities in Racial/Ethnic Minorities and the Medically Underserved. Atlanta, Georgia (December)
- Colonias Working Group. El Paso, Texas (December)
- 112th Annual Meeting of the American Anthropological Association. Chicago, Illinois (November)
- 141st Annual Meeting of the American Public Health Association. Boston, Massachusetts (November)
- U.S. EPA Sustainable and Healthy Communities Research Program (SHCRP) Webinar (November)
- Water and Health Conference: Where Science Meets Policy. Chapel Hill, North Carolina (October)
- 1st Annual University of Kansas Medical Center Women in Medicine and Science Poster Session. Kansas City, Kansas (September)
- Annual Meeting of the American College of Epidemiology. Louisville, Kentucky (September)
- Charleston Area Pollution Prevention Partnership (CAPs) Environmental Justice and Health Conference and Community Summit. North Charleston, South Carolina (September)
- 15th International Medical Geography Symposium. East Lansing, Michigan (July)
- 6th Annual James E. Clyburn Health Disparities Lecture. Columbia, South Carolina (April)
- Annual Meeting of the American Association of Geographers. Los Angeles, California (April)
- New Mexico Public Health Association and the New Mexico Center for the Advancement of Research, Engagement & Science on Health Disparities (NM CARES) Joint Conference. Albuquerque, New Mexico (April)

- 6th Annual Academic and Health Policy Conference on Correctional Health. Chicago, Illinois (March)
- 76th Annual Meeting of the Midwest Sociological Society. Chicago, Illinois (March)
- Urban Health Disparities Summit: Shaping Action to Reduce Disparities. Atlanta, Georgia (March)
- Annual Minority Health in the Midwest Conference. Chicago, Illinois (February)

2012

- Summit on the Science of Eliminating Health Disparities. National Harbor, Maryland (December)
- 111th Annual Meeting of the American Anthropological Association. San Francisco, California (November)
- 6th Annual Urban and Regional Information Systems Association (URISA) Caribbean Geographic Information Systems (GIS) Conference, Montego Bay, Jamaica (November)
- Geological Society of America Annual Meeting and Exposition. Charlotte, North Carolina (November)
- 140th Annual Meeting of the American Public Health Association. San Francisco, California (October)
- 7th Conference on Metal Toxicity and Carcinogenesis. Albuquerque, New Mexico (October)
- NIMHD-EPA Centers of Excellence in Environment and health disparities. Webinar (October)
- North Carolina Environmental Justice Network Annual Summit. Whitakers, North Carolina (October)
- Southwest Conference on Disability. Albuquerque, New Mexico (October)
- Annual Meeting of the American College of Epidemiology. Chicago, Illinois (September)
- Congressional Black Caucus Environmental Justice Braintrust: Social Determinants and Environmental Justice. Washington, DC (September)
- University of New Mexico Biomedical Research Symposium. Albuquerque, New Mexico (August)
- National Conference on Health Statistics. Washington, DC (August)
- National Conference on Tobacco or Health. Kansas City, Missouri (August)
- National Cancer Institute Community Networks Program Centers Meeting. Bethesda, Maryland (July)
- 28th Annual Academy Health Research Meeting. Orlando, Florida (June)
- American Industrial Hygiene Conference & Exposition (AIHce). Indianapolis, Indiana (June)
- International HIV Treatment as Prevention Workshop. Vancouver, Canada (April)
- New Mexico Public Health Association and the New Mexico Center for the Advancement of Research, Engagement & Science on Health Disparities (NM CARES) Joint Conference. Albuquerque, New Mexico (April)
- 22nd Annual Association for Environmental Health and Sciences (AEHS) Foundation International Conference on Soil, Water, Energy, and Air. San Diego, California (March)
- 5th Annual Academic and Health Policy Conference on Correctional Health. Atlanta, Georgia (March)
- South Atlantic National Research Conference (SANC). Raleigh, North Carolina (March)

2011

- Advancing Hispanics/Chicanos & Native Americans in Science (SACNAS) National Conference. San Jose, California (October)
- 3rd North American Congress of Epidemiology. Montreal, Canada (June)



MOVING FORWARD

Investigators Comments on the Research of the Pilot EHD Centers	76
Current EHD Research Efforts	80
References	84
Appendix A. Pilot EPA-NIHMD EHD Center Publications	89

Investigators Comments on the Research of the Pilot EHD Centers

The Pilot EHD Center Directors were asked for their thoughts on what the next steps and future directions for environmental health disparity research should be, as well as what research gaps need to be addressed, and what opportunities for progress they think exists. They provided the following statements.

“There is a need to account for the cumulative net impact of social determinants of health (SDOH) on health. This is especially relevant for disparities science, which seeks to explain and mitigate within- and between-group differences in health in the context of inequality.

I believe that this is a precious program, I am grateful and privileged to be part of it, and highly supportive for the continuation of this line of study.”



Dr. Jose A. Luchsinger,
Principal Investigator,
NOMCEMHD, Columbia
University Medical Center

"Gaps exist in fully evaluating and disentangling the complex ways all of the economic, social and environmental stressors operate alone and interact with each other in urban environments. We continue to pursue research that focuses on distinct mechanisms of how environmental agents impact health as well as broader ecological perspectives on the association between the environmental and social determinants of health. Cumulative environmental risk assessment can provide a framework for examining the role of these stressors on health."



Dr. Michael Eriksen, Principal Investigator, COEHDR, Georgia State University



Dr. Christine Daley, Principal Investigator, CAICH, University of Kansas Medical Center

"Unfortunately, in American Indian communities, we are behind the curve in terms of environmental health research and education. There are still dramatic environmental issues in Native communities, particularly on reservations... Both the natural and built environments on reservations are problematic and the health consequences are easily seen. We still do not have a basic understanding of natural and built environment issues in these communities."

"Incorporating both spatial and temporal dimensions to data and analytics that will allow us to analyze the effects of environmental exposures both at key lifestages and across the life span. Using computational methods that allow us to apply big data analytics to complex environmental health issues. Linking environmental exposure data to health outcome measures. Support transdisciplinary training of environmental health professions students. Completing environmental exposure pathways."



Dr. Paul D. Juarez, Principal Investigator, HDRCOE, Meharry Medical College



Dr. Elizabeth Calhoun, Principal Investigator, CEED, University of Illinois at Chicago

“We see comparative research as a good approach to examine different patterns of environmental risk distributions that are affected by divergent socioeconomic and demographic developments in cities. Comparative research methods can provide unique insight into how different arrangements and contexts influence the ways where environmental health disparities take place in cities. Space and time are two key elements in comparative research. Contrasting historical trajectories, cultures or policies may contribute to present similar/different outcomes.

Environmental health disparity research could be strengthened by exploring more organizational, social relations, and local political dynamics. Our explanatory factors have expanded to include local organizational arrangement, social capital to deal with their own issues and draw external resources, changes in work relations, and gentrification processes.”

“There continues to be a need to understand how broadly defined “environmental” factors interact with each other and with individual-level factors to affect health. This requires not only understanding their interrelations but also how they interact. “Systems approaches” are key here.

Another critical area is policy evaluation and capitalizing on natural experiments to get a better handle on what policies or interventions may be most successful in creating environmental change that then impacts health disparities.”



Dr. Ana Diez-Roux, Principal Investigator, CIAHD, University of Michigan



Dr. Melissa Gonzales, Principal Investigator, NM CARES HD, University of New Mexico

“The greatest need is to further develop and refine multi-level approaches to research design and analytical techniques in environmental health. These approaches are needed to effectively understand combined effects of social, biological and environmental determinants to environmental health disparities.”



Dr. Saundra Glover, Principal Investigator, CCE-SPHERE, University of South Carolina

“A comprehensive research agenda that combines expertise in environmental, social and behavioral science, and an expansive community network to conduct environmental, community-based participatory and translational research focused on addressing environmental stressors, particularly in rural/minority communities. [Additionally, there was a need for] funding to support the training and development of more underrepresented minority researchers in the conduct of community-based participatory research in vulnerable and underserved communities. A final area of emphasis needs to be the development, implementation, and evaluation of programs to increase environmental health literacy among minority youth who are from overburdened communities such as North Charleston, South Carolina, and empower youth to be more engaged in activities to improve environmental health and address local environmental injustice and environmental health disparities.”

“Intra-ethnic heterogeneity is an important yet still under-recognized factor in environmental health disparities. Few scholars are looking at disparities within ethnic groups (e.g., based on language, nativity, country of origin), which can be substantial and can be masked in aggregate groups (e.g., when looking at “Asians” or “Hispanics”).”
“A focus on epigenetics.”



Dr. Bibiana Mancera, Investigator, HHDR, University of Texas at El Paso



Dr. Carla Boutin-Foster, Principal Investigator, CEDREC, Weill Cornell Medicine College

“There is a gap in our understanding of how cumulative environmental determinants contribute to diseases. New disease models need to be developed that better explicate the interactions between environment and health while taking into consideration individual factors such as perceived stress, ethnicity, gender, and comorbidity.

Environmental health research can benefit from the application of a translational paradigm that links scientists with community partners. The integration of scientists will enable specimens from the community to be taken back to the lab where the physiologic impact of environmental toxins can be tested. The involvement of community partners can guide the measurement of mediating factors such as psychosocial and neighborhood level factors. Key partners were brought together from various sectors and collaboratively conducted surveys. The EH Core demonstrated the feasibility of engaging community partners in research initiatives that focused on environmental health disparities.”

Current EHD Research Efforts

The Pilot EPA-NIMHD EHD Centers brought life and energy to the topic of environment and health disparities research. They produced a new and unusual blending of environmental evaluation and health disparities research that was truly unique and ground breaking, and that revitalized the faculty, students, and the impacted communities on which they focused. The numerous successes and positive impacts of the Pilot EHD Centers precipitated the future direction of research on this topic well before their grants even concluded, setting the foundation for the next generation of environmental health disparities research.

The interim research findings of the 10 Pilot EHD Centers were just coming to light when a new partnership began to form, setting the foundation for the next phase of environmental and health disparities research. In addition, the successes of the EPA-NIMHD partnership attracted the involvement of another NIH institute, namely the NIEHS, which joined

in collaboration to produce a new federal partnership for EHD research. The two NIH institutes (NIMHD and NIEHS) together contributed \$17.5M, and EPA added an additional \$7.5M, to produce a \$25M interagency partnership in 2013.

In October 2014, NIH-EPA partnership issued a new funding opportunity announcement to establish the Centers of Excellence on Environmental Health Disparities Research (P50) to stimulate basic and applied research on environmental health disparities. Investigators, in coordination with their community partners, were encouraged to propose basic, biological, clinical, epidemiological, behavioral and/or social scientific investigations of disease conditions associated with significant morbidity and mortality in low SES and health-disparate populations, and to determine whether specific windows of susceptibility (i.e., life stages associated with enhanced sensitivity) put individuals in these populations at greater risk of illness and health disparities.⁷⁰

Of particular interest were proposals that focused on environmentally driven health disparities integrating etiology, genetics and diagnosis. Investigators were also encouraged to conduct studies in geographic areas that have been understudied for the suite of factors that contribute to environmental health disparities; e.g., in inner city or rural and remote communities, tribal communities (on and off reservations), migrant communities, and/or immigrant communities.⁷⁰

Under the new federal partnership, five new EHD research centers were competitively awarded in 2015, and are jointly funded by 5-year grants. These new grants, named the NIH-EPA Centers of Excellence on Environmental Health Disparities research, are managed separately by NIMHD and NIEHS (through their P50 grants mechanism) and by EPA (through its STAR grants program). The centers support research efforts, mentoring, capacity building, research translation, and information dissemination, and are designed to address program-specific research priorities.

The investigators of these centers have proposed a wide array of research focus for their programs, ranging from better incorporation of epigenetics to modeling methods and data analytics, to enhanced understanding of how multiple factors interact to influence environmental health disparities. The new centers and their specific goals are highlighted below.⁷¹

The EPA research manager responsible for spearheading the EPA-NIMHD partnership emphasized that it was the collaboration between EPA and NIMHD that made the Pilot EHD Centers possible. Modeled after the EPA-NIEHS Children's Research Centers, the Pilot EPA-NIMHD centers produced research and knowledge that is used as scientific evidence to address environmental justice concerns. These centers worked with local communities to empower and engage them to become more informed about environmental health disparities and the actions they can take to foster healthier environments. (D. C. Payne-Sturges, Email Communication, August 8, 2017).

The Pilot EHD Centers were also successful in helping to empower communities to become more involved in social justice issues and promote healthy environments. The NIMHD Program Director who collaborated with the EPA to establish the Pilot EHD centers highlighted the transdisciplinary nature of the centers and effective use of resources. This approach supported the centers' use of existing infrastructure to conduct research allowing them to understand how environmental, social, and biological factors contribute to health disparities. (N. Rajapakse, Email Communication, July 16, 2017).

The NIH-EPA Centers of Excellence on Environmental Health Disparities Research

Disparities in Exposure and Health Effects of Multiple Environmental Stressors Across the Life Course (CRESSH)

Harvard T.H. Chan School of Public Health and Boston University School of Public Health, Francine Laden and Jon Levy, Center Directors

Researchers investigate how housing conditions may affect birth weight, childhood growth trajectories, and risk of death from cardiovascular disease, and whether improved urban housing may benefit health.

Comparing Urban and Rural Effects of Poverty on COPD (CURE COPD)

The Johns Hopkins University, Nadia Hansel, Center Director

Investigators compare urban and rural effects of poverty on chronic obstructive pulmonary disease (COPD), and the impact of improved dietary intake on preventing or mitigating disease progression.

Maternal and Developmental Risks from Environmental and Social Stressors (MADRES Center)

University of Southern California, Frank Gilliland, Center Director

Investigators study how environmental factors may contribute to childhood obesity and excessive weight gain during pregnancy in Hispanic and Latino communities.

Center for Indigenous Environmental Health Research (CIEHR)

University of Arizona, Jeffery Burgess, Center Director

This center works with indigenous populations to examine chemical contamination of traditional foods, water, air, and household environments, and increase environmental health literacy.

Center for Native American Environmental Health Equity Research

University of New Mexico, Johnnye Lewis, Center Director

This research team examines how contact with metal mixtures from abandoned mines affects rural Native American populations through exposures related to inadequate drinking water infrastructure, reliance on local foods, and other uses of local resources to maintain their traditional lifestyle and culture.

The new EHD centers will add their contribution to the scientific evidence base, informing effective solutions to environment and health disparities and forging stronger community partnerships. The investigators of these centers are expected to conclude their research and submit final technical reports beginning in the year 2020.

Given that the causes of health disparities are multi-factorial and hence require a coordinated and interdisciplinary approach to eliminate them, NIMHD currently funds several programs in this area while continuing to lead the federal effort at the NIH to stimulate new research.

Many of the current NIMHD funding opportunities focus on the environment and its impact on health disparities, for example research focused on the etiology of health disparities from a biological point of view in understanding the chemical and non-chemical stressors on epigenetics pathways. NIMHD will continue their work to improve the health conditions of minority Americans and other underserved groups experiencing disparities in health status across their lifespan, and promote programs aimed at expanding the participation of underrepresented minorities in all aspects of biomedical and behavioral research.

“Optimized protection and welfare of public and environmental health is best achieved through a holistic approach. The Pilot EPA-NIMHD EHD Centers explored this widely under-studied paradigm. Their enhanced support for addressing social and environmental determinants of health promotes a model of enhanced community engagement that is better poised for reducing disproportionate adverse health burden, while empowering communities toward social justice and promoting healthy environments.”

- Maggie Breville, Health Research Program Manager, ORD/EPA



References

(in order of citation)

1. Mays, Vickie M, et al. Race, Race-Based Discrimination, and Health Outcomes Among African Americans. Retrieved from <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4181672/>. Accessed October 17, 2017.
2. Request for Information (RFI): Establishing Centers of Excellence on Environment and Health Disparities. Retrieved from https://cfpub.epa.gov/ncer_abstracts/index.cfm/fuseaction/display/files/fileID/15462. Accessed on October 12, 2017.
3. Transdisciplinary Network of Excellence on Environment and Health Disparities Request for Applications. Retrieved from https://cfpub.epa.gov/ncer_abstracts/index.cfm/fuseaction/recipient.display/rfa_id/539/records_per_page/ALL. Accessed on October 12, 2017.
4. Cohen, Aaron J, et al. Estimates and 25-year trends of the global burden of disease attributable to ambient air pollution: an analysis of data from the Global Burden of Diseases Study 2015. Retrieved from [http://www.thelancet.com/pdfs/journals/lancet/PIIS0140-6736\(17\)30505-6.pdf](http://www.thelancet.com/pdfs/journals/lancet/PIIS0140-6736(17)30505-6.pdf). Accessed October 11, 2017.
5. Adler, Nancy E. and Newman, Katherine. Socioeconomic Disparities in Health: Pathways And Policies.2002. Retrieved from <http://content.healthaffairs.org/content/21/2/60.full>. Accessed on October 17, 2017.
6. Social Determinants of Health. Retrieved from <https://www.healthypeople.gov/2020/topics-objectives/topic/social-determinants-of-health>. Accessed on October 17, 2017.
7. Learn About Environmental Justice. Retrieved from <https://www.epa.gov/environmentaljustice/learn-about-environmental-justice>. Accessed on October 11, 2017.
8. National Academies of Sciences, Engineering, and Medicine. 2017, A Review of the Environmental Protection Agency's Science To Achieve Results Research Program. Washington, DC: The National Academies Press. doi: <https://doi.org/10.17226/24757>.
9. National Institute on Minority Health and Health Disparities Fact Sheet. Retrieved from <https://www.nimhd.nih.gov/docs/about-nimhd-factsheet.pdf>. Accessed October 11, 2017.
10. NIH/NIMHD Exploratory and Comprehensive Centers of Excellence. Retrieved from <https://www.nimhd.nih.gov/programs/extramural/coe/exploratory.html>. Accessed October 11, 2017.
11. Summary of Executive Order 12898 - Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations. Retrieved from <https://www.epa.gov/laws-regulations/summary-executive-order-12898-federal-actions-address-environmental-justice>. Accessed October 11, 2017.
12. Development of Healthy People 2030. Retrieved from <https://www.healthypeople.gov/2020/About-Healthy-People/Development-Healthy-People-2030>. Accessed September 18, 2017.
13. Payne-Sturges, D. S., et al. (2006). Workshop summary: Collecting social and environmental factors to measure and track environmental health disparities. *Environmental Research*, 102, 146-153.
14. Nweke, O. C., Payne-Sturges, D. S., Garcia, L., Lee, C., Zenick, H., Grevatt, P., William, S. H., . . . Dankwa-Mullan, I. (2011). Symposium on integrating the science of environmental justice into decision-making at the Environmental Protection Agency: An overview. *American Journal of Public Health*. 101(S1):S19-S26.

15. Pickering R. A., Amarnath K. K., Combs A., Kaplan H., Martinez M. C., Winsor M., . . . Deocampo D, M,. (2012). Soil and atmospheric chemistry in urban Atlanta: Findings from the CSAW (Community, Soil, Air, and Water) NSF Research Experiences for Undergraduates Site. Geological Society of America Conference Presentation Abstract, Charlotte, NC. Available at <https://gsa.confex.com/gsa/2012AM/webprogram/Paper208977.html>. Accessed July 31, 2017.
16. Combs, A., Martinez, M. C., Amarnath, K. K., Kaplan, H., Winsor, M., Pickering, R. A., . . . Fuller, C. H. (2012). Quantitative community geography: A preliminary evaluation of nitrogen dioxide levels and possible solutions to exposure rates in NPU-V, Atlanta, GA. Geological Society of America Conference Presentation Abstract, Charlotte, NC. Available at <https://gsa.confex.com/gsa/2012AM/webprogram/Paper208997.html>. Accessed July 31, 2017.
17. Centers for Disease Control and Prevention. (2017). American Indians/Alaska Natives and Tobacco Use. Available at <https://www.cdc.gov/tobacco/disparities/american-indians/index.htm>. Accessed September 6, 2017.
18. Choi, W. S., Nazir, N., Pacheco, C. M., Filippi, M. K., Pacheco, J., White Bull, J., . . . Daley C. M. (2016). Recruitment and baseline characteristics of American Indian tribal college students participating in a tribal college tobacco and behavioral survey. *Nicotine & Tobacco Research*, 18(6):1488-1493. DOI: 10.1093/ntr/ntv226.
19. U.S. EPA. (2017). Secondhand Tobacco Smoke and Smoke-Free Homes. Retrieved from <https://www.epa.gov/indoor-air-quality-iaq/secondhand-tobacco-smoke-and-smoke-free-homes>. Accessed April 17, 2017.
20. Haskell Indian Nations University. (2017). Admission Information. Retrieved from <http://www.haskell.edu/admissions/app-info/>. Accessed August 4, 2017.
21. University of Illinois at Chicago, Center of Excellence in Eliminating Disparities Environmental Supplement. (2015). Final Report. Available at https://cfpub.epa.gov/ncer_abstracts/index.cfm/fuseaction/display.highlight/abstract/9668/report/F. Accessed August 7, 2017.
22. Peterson, C., Rauscher, G., Johnson, T., Kirschner, C., Barrett, R., Kim, S., . . . Davis F. (2014). The association between neighborhood socioeconomic status and ovarian cancer tumor characteristics. *Cancer Causes Control*, 25(5):633-637. PMID: 24532025.
23. Osiecki, K., Kim, S., Chukwudozie, I., Calhoun, E. (2013). Utilizing exploratory spatial data analysis to examine health and environmental disparities in disadvantaged neighborhoods. *Environmental Justice*, 6(3):81-87. PMID: 26594302.
24. Luchsinger, J. A., Cabral, R., Eimicke, J.P., Manly, J. J., Teresi, J. (2015). Glycemia, diabetes status, and cognition in middle aged Hispanics. *Psychosomatic Medicine*, 77(6):653-663. DOI: 10.1097/PSY.0000000000000208. Available at <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4503370/>. Accessed August 4, 2017.
25. Columbia University Medical Center, Northern Manhattan Center of Excellence in Minority Health and Health Disparities. (2016). Final Report.
26. Centers for Disease Control and Prevention. (2014). National Diabetes Statistics Report. Available at <https://www.cdc.gov/diabetes/data/statistics/2014statisticsreport.html>. Accessed August 4, 2017.
27. Alzheimer's Association. (2017). Alzheimer's disease facts and figures. *Alzheimer's Document*, 13:325-373. Available at http://www.alz.org/documents_custom/2017-facts-and-figures.pdf. Accessed August 4, 2017.
28. Heron, M. (2012). Deaths: Leading causes for 2008. *National Vital Statistics Reports*, 60(6):1-94. PMID: 22827019.

29. Mozzafarian, D., Benjamin, E. J., Go, A. S., et al., on behalf of the American Heart Association Statistics Committee and Stroke Statistics Subcommittee. (2016). Heart disease and stroke statistics—2016 update: A report from the American Heart Association. *Circulation*, 133(4):e38-e360. DOI: 10.1161/CIR.0000000000000350.
30. Multi-Ethnic Study of Atherosclerosis (MESA) Coordinating Center. (2017). Retrieved from <https://www.mesa-nhlbi.org/default.aspx>. Accessed May 11, 2017.
31. Jackson Heart Study. (2015). Retrieved from <https://www.jacksonheartstudy.org/>. Accessed May 11, 2017.
32. Hirsch, J., Moore, K., Roux, A. D., Evenson, K., Rodriguez, D. (2014). Change in walking and body mass index following residential relocation: The Multi-Ethnic Study of Atherosclerosis. *American Journal of Public Health*, 104(3):e49-e56. DOI:10.2105/AJPH.2013.301773.
33. Hajat, A., Diez-Roux, A. V., Adar, S. D., et al. (2013). Air pollution and individual and neighborhood socioeconomic status: Evidence from the Multi-Ethnic Study of Atherosclerosis (MESA). *Environmental Health Perspectives*, 121(11-12):1325-1333. DOI:10.1289/ehp.1206337.
34. Hicken, M. T., Hajat, A., Kershaw, K. N., Do, D. P., Barr, R. G., Kaufman, J. D., Diez-Roux, A. V. (2016). Air pollution, social disadvantage, and cardiovascular outcomes: The Multi-Ethnic Study of Atherosclerosis. *Epidemiology*, 27(1):42-50. PMID: 26618771.
35. Grineski, S., Collins, T., Chavez-Payan, P., Jimenez, A., Clark-Reyna, S., Gaines, M., Kim, Y. (2014). Social disparities in children's respiratory health in El Paso, Texas. *International Journal of Environmental Research and Public Health*, 11:2941-2957. PMID: 24619157.
36. Chavez-Payan, P., Grineski, S. E., Collins, T. W. (2015). Early life and environmental risk factors modify the effect of acculturation on Hispanic children's asthma. *Hispanic Health Care International*, 13:119-130. PMID: 26400390.
37. Grineski, S., Collins, T., Olvera, H. (2015). Local variability in the impacts of residential particulate matter and pest exposure on children's wheezing severity: A geographically weighted regression analysis of environmental health justice. *Population and Environment*, 37(1):22-43. PMID: 26527848.
38. Clark-Reyna, S., Grineski, S. E., Collins, T. (2016). Residential exposure to air toxics is linked to lower grade point averages among school children in El Paso, Texas, USA. *Population and Environment*, 37(3):319-340. PMID: 27034529.
39. Clark-Reyna, S., Grineski, S. E., Collins, T. (2016). Health status and residential exposure to air toxics: What are the effects on children's academic achievement? *Family & Community Health*, 39(3):160-8. PMID: 27214671.
40. Grineski, S. E., Clark-Reyna, S., Collins, T. (2016). School-based exposure to hazardous air pollutants and grade point average: A multi-level study. *Environmental Research*, 147:164-171. PMID: 26875067.
41. Clark-Reyna, S., Grineski S. E., Collins, T. (2016). Ambient concentrations of metabolic disrupting chemicals and children's academic achievement in El Paso, Texas. *International Journal of Environmental Research and Public Health*, 13(9):e874. PMID: 27598179.
42. Morales, L., Lara, M., Kington, R., Valdez, R., Escarce, J. (2002). Socioeconomic, cultural and behavioral factors affecting Hispanic health outcomes. *Journal of Health Care for the Poor & Underserved*, 13(4):477-503. PMID: 12407964.
43. University of Texas El Paso, Hispanic Health Disparities Research Center. (2014). Final Report. Available at https://cfpub.epa.gov/ncer_abstracts/index.cfm/fuseaction/display.highlight/abstract/9677/report/F. Accessed August 7, 2017.
44. Grineski, S. E., Herrera, J. M., Grineski, S. E. (2015). Is there a Hispanic health paradox in sensitivity to air pollution? Hospital admissions for asthma, chronic obstructive pulmonary disease and congestive heart failure associated with NO₂ and PM_{2.5} in El Paso, TX, 2005-2010. *Atmospheric Environment*, 119:314-321. PMID: 26557023.

45. Balcazar, A., Grineski, S. E., Collins, T. (2015). The Hispanic health paradox across generations: The relationship of child generational status and citizenship with respiratory health outcomes. *Public Health*, 129:691-697. PMID: 26002345.
46. Fuller, C. H., Carter, D. R., Hayat, M. J., Baldauf, R., Hull, R. W. (2017). Phenology of a vegetation barrier and resulting impacts on near-highway particle number and black carbon concentrations on a school campus. *International Journal of Environmental Research and Public Health*, 14(2):160. DOI: 10.3390/ijerph14020160.
47. Kingsley, S. L., Eliot, M., Carlson, L., Finn, J., MacIntosh, D. L., Suh, H. H., Wellenius, G. A. (2014). Proximity of US schools to major roadways: A nationwide assessment. *Journal of Exposure Science & Environmental Epidemiology*, 24(3):253-259. DOI: 10.1038/jes.2014.5.
48. Georgia State University, Center of Excellence: Environmental Health Disparities Core to Support Environmental Health Disparities Research. (2015). Final Report.
49. Cooper, K. L., King, B. S., Sandoval, M. M., Liu, K. J., Hudson, L. G. (2013). Reduction of arsenite-enhanced ultraviolet radiation-induced DNA damage by supplemental zinc. *Toxicology and Applied Pharmacology*, 269(2):81-88. PMID: 23523584.
50. Cooper, K. L., Dashner, E. J., Tsosie, R., Cho, Y. M., Lewis, J., Hudson, L. G. (2016). Inhibition of poly (ADP-ribose) polymerase-1 and DNA repair by uranium. *Toxicology and Applied Pharmacology*, 291:13-20. PMID: 26627003.
51. University of New Mexico, New Mexico Center for Advancement of Research, Engagement, & Science on Health Disparities. (2015). Final Report. Available at https://cfpub.epa.gov/ncer_abstracts/index.cfm/fuseaction/display.abstractDetail/abstract/9672/report/F. Accessed August 7, 2017.
52. Centers for Disease Control and Prevention. (2014). Exposome and exposomics. Retrieved from <https://www.cdc.gov/niosh/topics/exposome/>. Accessed August 4, 2017.
53. Juarez, P. D., Matthews-Juarez, P., Hood, D. B., et al. (2014). The public health exposome: A population-based, exposure science approach to health disparities research. *International Journal of Environmental Research and Public Health*, 11(12):12866–12895. DOI: 10.3390/ijerph111212866.
54. Kershenbaum, A. D., Langston, M. A., Levine, R. S., et al. (2014). Exploration of preterm birth rates using the public health exposome database and computational analysis methods. *International Journal of Environmental Research and Public Health*, 11(12):12346–12366. DOI: 10.3390/ijerph111212346.
55. Weill Cornell Medical Center. (2009). Dr. Carla Boutin-Foster to lead Comprehensive Center of Excellence in Disparities Research and Community Engagement at Weill Cornell Medical College. Available at http://hpr.weill.cornell.edu/about_us/2009_11_CEDRIC.html. Accessed August 4, 2017.
56. Williams, R. (2010). Lunch with The Lancet: Carla Boutin-Foster. *The Lancet*. 375:1865. DOI: [http://dx.doi.org/10.1016/S0140-6736\(10\)60861-6](http://dx.doi.org/10.1016/S0140-6736(10)60861-6).
57. Weil Cornell Medical College. (2013). Comprehensive Center of Excellence in Disparities Research & Community Engagement (CEDREC) Environmental Health Core. EPA Progress Report. Available at https://cfpub.epa.gov/ncer_abstracts/index.cfm/fuseaction/display.abstractDetail/abstract/9673/report/0. Accessed August 4, 2017.
58. U.S. Department of Health and Human Services. (2014). The health consequences of smoking—50 years of progress: A report of the surgeon general. Public Health Service, Office of the Surgeon General. Available at https://www.cdc.gov/tobacco/data_statistics/sgr/50th-anniversary/index.htm. Accessed July 31, 2017.
59. Brandt, H.M., Haynes, V.E., Rice, L.J., Campbell, D.A., Williams, E.M., Wilson, S., Glover, S.H. Using Photovoice as tool for community engagement to assess the environment and explore environmental health disparities. *Journal of Health Disparities Research and Practice*. [In Press]

60. New Mexico Center for Advancement of Research, Engagement, and Science on Health Disparities (NM CARES HD). (2015). EPA Final Report. Available at https://cfpub.epa.gov/ncer_abstracts/index.cfm/fuseaction/display.abstractDetail/abstract/9672/report/F. Accessed September 21, 2017.
61. Andersen, E. (1990). Core Indicators of Nutritional State for Difficult to Sample Populations. *Journal of Nutrition*. November 1, 1990. Vol. 120 no. 11 Suppl 1555-1600.
62. Analysis and Action on the Environmental Determinants of Health and Disparities Environmental Health Core (EHC) of the Coordinating Center of Excellence in the Social Promotion of Health Equity in Research, Research Education and Training, and Community Engagement and Outreach (CCE-SPHERE). (2015). EPA Final Report.
63. Chicago Consortium for Community Engagement. (2017). Chicago Community Research Map. Retrieved from http://ccrm.ihrp.uic.edu/CCRMP/CCRMP_Home.php. Accessed August 4, 2017.
64. Illinois Health Matters. (2015). Map of Federally Qualified Health Centers and Free Clinics in Illinois. Retrieved from <http://illinoishealthmatters.org/map-of-federally-qualified-health-centers-and-free-clinics-in-illinois/>. Accessed August 4, 2017.
65. Bullard, R. D., Johnson, G. (2000). Environmentalist and public policy: Environmental justice: Grassroots activism and its impact on public policy decision making. *Journal of Social Issues*, 56:555-578. DOI: 10.1111/0022-4537.00184.
66. Bullard, R. D. (2005). *The quest for environmental justice: Human rights and the politics of pollution*. Berkeley, CA: The University of California Press.
67. Wilson, S. M., Jiang, C., Dalemarre, L., Burwell, K., Murray, R. (2015). Environmental justice radar: A tool for community-based mapping to increase environmental awareness and capacity to address environmental health issues. *Progress in Community Health Partnerships*, 9(3):439-446. PMID: 26548796. DOI: 10.1353/cpr.2015.0066.
68. Perlin, S. A., Wong, D. W., Sexton, K. (2001). Residential proximity to industrial sources of air pollution: Interrelationships among race, poverty, and age. *Journal of Air and Waste Management Association*. 51(3):406-421. PMID: 11266104.
69. American Indian Health Research & Education Alliance. (2015). GreeNation ensures safe and healthy indoor environments. Available at <http://www.kumc.edu/Documents/caich/Healthy%20Home%20Assessments%20FINAL.pdf>. Accessed September 7, 2017.
70. Centers of Excellence on Environmental Health Disparities Research (P50) Funding Opportunity Announcement. (2014). Available at <https://grants.nih.gov/grants/guide/rfa-files/RFA-ES-14-010.html>. Accessed September 21, 2017.
71. National Institutes of Health. (2016). New NIH-EPA research centers to study environmental health disparities. News release. Available at <https://www.nih.gov/news-events/news-releases/new-nih-epa-research-centers-study-environmental-health-disparities>. Accessed July 31, 2017.

Appendix A: Pilot EPA-NIMHD EHD Center Publications (listed alphabetically)

- Burwell-Naney, K., Zhang, H., Samantapudi, A., Jiang, C., Dalemarre, L., Rice, L., . . . Wilson, S. (2013). Spatial disparity in the distribution of superfund sites in South Carolina: An ecological study. *Environmental Health*, 12, 96. doi:10.1186/1476-069X-12-96.
- Chavez-Payan, P. (2013). Low birth weight, prenatal smoking, pest exposure and breastfeeding modify the effect of acculturation on Hispanic children's asthma. The University of Texas at El Paso. Retrieved from <http://digitalcommons.utep.edu/dissertations/AAI1551219/>. Accessed September 20, 2017.
- Chavez-Payan, P., Grineski, S. E., Collins, T. W. (2015). Early life and environmental risk factors modify the effect of acculturation on Hispanic children's asthma. *Hispanic Health Care International*, 13(3), 119-130. doi:10.1891/1540-4153.13.3.119.
- Chen, C. K., Bruce, M., Tyler, L., Brown, C., Garrett, A., Goggins, S., . . . Skelton, T. (2013). Analysis of an environmental exposure health questionnaire in a metropolitan minority population utilizing logistic regression and Support Vector Machines. *Journal of Health Care for the Poor and Underserved*, 24(1 Suppl), 153-171. doi:10.1353/hpu.2013.0046.
- Choi, W. S., Nazir, N., Pacheco, C. M., Filippi, M. K., Pacheco, J., White Bull, J., . . . Daley, C. M. (2016). Recruitment and baseline characteristics of American Indian tribal college students Participating in a Tribal college tobacco and behavioral survey. *Nicotine and Tobacco Research*, 18(6), 1488-1493. doi:10.1093/ntr/ntv226.
- Collins, T. W., Jimenez, A. M., Grineski, S. E. (2013). Hispanic health disparities after a flood disaster: Results of a population-based survey of individuals experiencing home site damage in El Paso, Texas. *Journal of Immigrant and Minority Health*, 15(2), 415-426. doi:10.1007/s10903-012-9626-2.
- Collins, T. W., Kim, Y. A., Grineski, S. E., Clark-Reyna, S. (2014). Can economic deprivation protect health? Paradoxical multilevel effects of poverty on Hispanic children's wheezing. *International Journal of Environmental Research and Public Health*, 11(8), 7856-7873. doi:10.3390/ijerph110807856.
- Cooper, K. L., Dashner, E. J., Tsosie, R., Cho, Y. M., Lewis, J., Hudson, L. G. (2016). Inhibition of poly(ADP-ribose)polymerase-1 and DNA repair by uranium. *Toxicology Applied Pharmacology*, 291, 13-20. doi:10.1016/j.taap.2015.11.017.
- Coughlin, S. S., Matthews-Juarez, P., Juarez, P. D., Melton, C. E., King, M. (2014). Opportunities to address lung cancer disparities among African Americans. *Cancer Medicine*, 3(6), 1467-1476. doi:10.1002/cam4.348.
- Dalemarre, L., Wilson, S., Campbell, D., Fraser-Rahim, H., Williams, E. (2014). Summary on the Charleston Pollution Prevention Partnership Environmental Justice Conference and Summit. *Environmental Justice*, 7(3), 81-86. doi:10.1089/env.2014.0007.
- Fuller, C., Carter, D., Hayat, M., Baldauf, R., Watts Hull, R. (2017). Phenology of a vegetation barrier and resulting impacts on near-highway particle number and black carbon concentrations on a school campus. *International Journal of Environmental Research and Public Health*, 14(2), 160. doi:10.3390/ijerph14020160.
- Grineski, S., Collins, T., Chakraborty, J., McDonald, Y. (2013). Environmental health injustice: Exposure to air toxics and children's respiratory hospital admissions in El Paso, Texas. *The Professional Geographer*, 65(1), 31-46. doi:10.1080/00330124.2011.639625.

- Grineski, S. E., Collins, T. W., Chakraborty, J. (2013). Hispanic heterogeneity and environmental injustice: Intra-ethnic patterns of exposure to cancer risks from traffic-related air pollution in Miami. *Population and Environment*, 35(1), 26-44. doi:10.1007/s11111-012-0184-2.
- Grineski, S. E., Collins, T. W., Chavez-Payan, P., Jimenez, A. M., Clark-Reyna, S., Gaines, M., Kim, Y. A. (2014). Social disparities in children's respiratory health in El Paso, Texas. *International Journal of Environmental Research and Public Health*, 11(3), 2941-2957. doi:10.3390/ijerph110302941.
- Grineski, S. E., Collins, T. W., Chavez-Payan, P., Jimenez, A. M., Clark-Reyna, S., Gaines, M., Kim, Y. A. (2014). Social disparities in children's respiratory health in El Paso, Texas. *International Journal of Environmental Research and Public Health*, 11(3), 2941-2957. doi:10.3390/ijerph110302941.
- Grineski, S. E., Collins, T. W., Olvera, H. A. (2015). Local variability in the impacts of residential particulate matter and pest exposure on children's wheezing severity: A geographically weighted regression analysis of environmental health justice. *Population and Environment*. 37(1), 22-43. doi:10.1007/s11111-015-0230-y
- Grineski, S. E., Herrera, J. M., Bulathsinhala, P., Staniswalis, J. G. (2015). Is there a Hispanic health paradox in sensitivity to air pollution? Hospital admissions for asthma, chronic obstructive pulmonary disease and congestive heart failure associated with NO₂ and PM_{2.5} in El Paso, TX, 2005-2010. *Atmospheric Environment* (1994), 119, 314-321. doi:10.1016/j.atmosenv.2015.08.027.
- Hajat, A., Diez-Roux, A. V., Adar, S. D., Auchincloss, A. H., Lovasi, G. S., O'Neill, M. S., . . . Kaufman, J. D. (2013). Air pollution and individual and neighborhood socioeconomic status: Evidence from the Multi-Ethnic Study of Atherosclerosis (MESA). *Environmental Health Perspectives*, 121(11-12), 1325-1333. doi:10.1289/ehp.1206337.
- Hicken, M. T., Adar, S. D., Hajat, A., Kershaw, K. N., Do, D. P., Barr, R. G., . . . Diez Roux, A. V. (2016). Air pollution, cardiovascular outcomes, and social disadvantage: The Multi-Ethnic Study of Atherosclerosis. *Epidemiology*, 27(1), 42-50. doi:10.1097/EDE.0000000000000367.
- Hirsch, J. A., Diez Roux, A. V., Moore, K. A., Evenson, K. R., Rodriguez, D. A. (2014). Change in walking and body mass index following residential relocation: The Multi-Ethnic Study of Atherosclerosis. *American Journal of Public Health*, 104(3), e49-56. doi:10.2105/AJPH.2013.301773.
- Jimenez, A. M., Collins, T. W., Grineski, S. E. (2013). Intra-ethnic disparities in respiratory health problems among Hispanic residents impacted by a flood. *Journal of Asthma*, 50(5), 463-471. doi:10.3109/02770903.2013.786087.
- Jones, M. R., Diez-Roux, A. V., Hajat, A., Kershaw, K. N., O'Neill, M. S., Guallar, E., . . . Navas-Acien, A. (2014). Race/ethnicity, residential segregation, and exposure to ambient air pollution: The Multi-Ethnic Study of Atherosclerosis (MESA). *American Journal of Public Health*, 104(11), 2130-2137. doi:10.2105/AJPH.2014.302135.
- Juarez, P. (2013). Environmental context of violent crime. In E. A. Waltermaurer, Tim (Ed.), *Epidemiologic Criminology: Theory to Practice*. United Kingdom: Routledge.
- Juarez, P. (2013). Sequencing the public health genome. *Journal of Health Care for the Poor and Underserved*, 24(1 Suppl), 114-120. doi:10.1353/hpu.2013.0035.
- Juarez, P. D., Matthews-Juarez, P., Hood, D. B., Im, W., Levine, R. S., Kilbourne, B. J., . . . Lichtveld, M. Y. (2014). The public health exposome: A population-based, exposure science approach to health disparities research. *International Journal of Environmental Research and Public Health*, 11(12), 12866-12895. doi:10.3390/ijerph111212866.
- Kershbaum, A. D., Langston, M. A., Levine, R. S., Saxton, A. M., Oyana, T. J., Kilbourne, B. J., . . . Juarez, P. D. (2014). Exploration of preterm birth rates using the public health exposome database and computational analysis methods. *International Journal of Environmental Research and Public Health*, 11(12), 12346-12366. doi:10.3390/ijerph111212346.
- Kim, S., Chukwudozie, B., Calhoun, E. (2013). Sociodemographic characteristics, distance to the clinic, and breast cancer screening results. *Journal of Health Disparities Research and Practice*, 6(1), 70. Retrieved from <http://www.ncbi.nlm.nih.gov/pubmed/24466505>. Accessed September 20, 2017.

- Kim, S., Mazza, J. (2014). Reliability, validity, and item response of MOS social support score among incarcerated women. *Women and Criminal Justice*, 24(1), 1-21. doi:10.1080/08974454.2012.733327.
- Kim, S., Mazza, J., Zwanziger, J., Henry, D. (2014). School and behavioral outcomes among inner city children: Five-year follow-up. *Urban Education*, 49(7), 835-856. doi:10.1177/0042085913501895.
- Kim, S., Molina, Y., Glassgow, A. E., Berrios, N., Guadamuz, J., Calhoun, E. (2015). The effects of navigation and types of neighborhoods on timely follow-up of abnormal mammogram among black women. *Medical Research Archives*, 2015(3). doi:10.18103/mra.v0i3.111.
- Kim, S., Ouellet, L. J., Mazza, J., Spaulding, A. C. (2016). Rasch analysis and differential item functioning of a social support measure in jail inmates with HIV infection. *Evaluation and the Health Professions*, doi:10.1177/0163278716644954.
- Kim, Y. A., Collins, T. W., Grineski, S. E. (2014). Neighborhood context and the Hispanic health paradox: Differential effects of immigrant density on childrens wheezing by poverty, nativity and medical history. *Health and Place*, 27, 1-8. doi:10.1016/j.healthplace.2014.01.006.
- Langston, M. A., Levine, R. S., Kilbourne, B. J., Rogers, G. L., Kershenbaum, A. D., Baktash, S. H., . . . Juarez, P. D. (2014). Scalable combinatorial tools for health disparities research. *International Journal of Environmental Research and Public Health*, 11(10), 10419-10443. doi:10.3390/ijerph111010419.
- March, D., Luchsinger, J. A., Teresi, J. A., Eimicke, J. P., Findley, S. E., Carrasquillo, O., Palmas, W. (2014). High rates of depressive symptoms in low-income urban Hispanics of Caribbean origin with poorly controlled diabetes: Correlates and risk factors. *Journal of Health Care for the Poor and Underserved*, 25(1), 321-331. doi:10.1353/hpu.2014.0027.
- March, D., Williams, J., Wells, S., Eimicke, J. P., Teresi, J. A., Almonte, C., . . . Luchsinger, J. A. (2015). Discrimination and depression among urban Hispanics with poorly controlled diabetes. *Ethnicity & Disease*, 25(2), 130-137. Retrieved from <http://www.ncbi.nlm.nih.gov/pubmed/26118138>. Accessed September 20, 2017.
- Matthews-Juarez, P. (2013). Developing a cadre of transdisciplinary health disparities researchers for the 21st century. *Journal of Health Care for the Poor and Underserved*, 24(1 Suppl), 121-128. doi:10.1353/hpu.2013.0037.
- Mejia de Grubb, M. C., Kilbourne, B., Kihlberg, C., Levine, R. S. (2013). Demographic and geographic variations in breast cancer mortality among US Hispanics. *Journal of Health Care for the Poor and Underserved*, 24(1 Suppl), 140-152. doi:10.1353/hpu.2013.0043.
- Molina, Y., Kim, S., Berrios, N., Calhoun, E. A. (2015). Medical mistrust and patient satisfaction with mammography: The mediating effects of perceived self-efficacy among navigated African American women. *Health Expectations*, 18(6), 2941-2950. doi:10.1111/hex.12278.
- Olvera, H. A., Jimenez, O., Provencio-Vasquez, E. (2014). Modeling particle number concentrations along Interstate 10 in El Paso, Texas. *Atmospheric Environment* (1994), 98, 581-590. doi:10.1016/j.atmosenv.2014.09.030.
- Olvera, H. A., Lopez, M., Guerrero, V., Garcia, H., Li, W. W. (2013). Ultrafine particle levels at an international port of entry between the US and Mexico: exposure implications for users, workers, and neighbors. *Journal of Exposure Science and Environmental Epidemiology*, 23(3), 289-298. doi:10.1038/jes.2012.119.
- Osiecki, K. M., Kim, S., Chukwudozie, I. B., Calhoun, E. A. (2013). Utilizing exploratory spatial data analysis to examine health and environmental disparities in disadvantaged neighborhoods. *Environmental Justice*, 6(3), 81-87. doi:10.1089/env.2013.0010.
- Pacheco, C. M., Ciaccio, C. E., Nazir, N., Daley, C. M., DiDonna, A., Choi, W. S., . . . Rosenwasser, L. J. (2014). Homes of low-income minority families with asthmatic children have increased condition issues. *Allergy & Asthma Proceedings*, 35(6), 467-474. doi:10.2500/aap.2014.35.3792.
- Pacheco, J. A., Pacheco, C. M., Lewis, C., Williams, C., Barnes, C., Rosenwasser, L., . . . Daley, C. M. (2015). Ensuring healthy American Indian generations for tomorrow through safe and healthy indoor environments. *International Journal of Environmental Research and Public Health*, 12(3), 2810-2822. doi:10.3390/ijerph120302810.

- Page-Reeves, J. (2014). Conceptualizing food insecurity and women's agency: A synthetic introduction. In J. Page-Reeves (Ed.), *Women redefining the experience of food insecurity: Life off the edge of the table* (pp. 3-44). Lanham, MD: Lexington Books.
- Page-Reeves, J. (2014). *Women redefining the experience of food insecurity: Life off the edge of the table* (J. Page-Reeves Ed.). Lanham, MD: Lexington Books.
- Page-Reeves, J., Moffett, M., Scott, A., Apodaca, V., Apodaca, V. (2014). "I took the lemons and I made lemonade": Women's quotidian strategies and the re-countoring of food insecurity in a Hispanic community in New Mexico. In J. Page-Reeves (Ed.), *Women redefining the experience of food insecurity: Life off the edge of the table*. Lanham, MD: Lexington Books.
- Page-Reeves, J., Niforatos, J., Mishra, S., Regino, L., Gingrich, A., Bulten, R. (2013). Health disparity and structural violence: How fear undermines health among immigrants at risk for diabetes. *Journal of Health Disparities Research and Practice*, 6(2), 30-47. Retrieved from <http://www.ncbi.nlm.nih.gov/pubmed/24052924>. Accessed September 20, 2017.
- Page-Reeves, J., Scott, A. A., Moffett, M., Apodaca, V., Apodaca, V. (2014). "It is always that sense of wanting ... never really being satisfied": Women's quotidian struggles with food insecurity in a Hispanic community in New Mexico. *Journal of Hunger & Environmental Nutrition*, 9(2), 183-209. doi:10.1080/19320248.2014.898176.
- Peterson, C. E., Rauscher, G. H., Johnson, T. P., Kirschner, C. V., Barrett, R. E., Kim, S., . . . Davis, F. G. (2014). The association between neighborhood socioeconomic status and ovarian cancer tumor characteristics. *Cancer Causes & Control*, 25(5), 633-637. doi:10.1007/s10552-014-0357-7.
- Rehr, R., & Wilson, S. (2013). The Maryland Commission on Environmental Justice and Sustainable Communities: A review. *Journal of Health Care for the Poor and Underserved*, 24(1 Suppl), 129-139. doi:10.1353/hpu.2013.0040.
- Rice, L. J., Brandt, H. M., Hardin, J. W., Ingram, L. A., Wilson, S. M. (2015). Exploring perceptions of cancer risk, neighborhood environmental risks, and health behaviors of blacks. *Journal of Community Health*, 40(3), 419-430. doi:10.1007/s10900-014-9952-5.
- Rice, L. J., Jiang, C., Wilson, S. M., Burwell-Naney, K., Samantapudi, A., Zhang, H. (2014). Use of segregation indices, Townsend Index, and air toxics data to assess lifetime cancer risk disparities in metropolitan Charleston, South Carolina, USA. *International Journal of Environmental Research and Public Health*, 11(5), 5510-5526. doi:10.3390/ijerph110505510.
- Robinson, P. L., Dominguez, F., Teklehaimanot, S., Lee, M., Brown, A., Goodchild, M. (2013). Does distance decay modelling of supermarket accessibility predict fruit and vegetable intake by individuals in a large metropolitan area? *Journal of Health Care for the Poor and Underserved*, 24(1 Suppl), 172-185. doi:10.1353/hpu.2013.0049.
- Shea, S., Kothari, D., Teresi, J. A., Kong, J., Eimicke, J. P., Lantigua, R. A., . . . Weinstock, R. S. (2013). Social impact analysis of the effects of a telemedicine intervention to improve diabetes outcomes in an ethnically diverse, medically underserved population: Findings from the IDEATel Study. *American Journal of Public Health*, 103(10), 1888-1894. doi:10.2105/AJPH.2012.300909.
- Solt, M. J., Deocampo, D. M., Norris, M. (2015). Spatial distribution of lead in Sacramento, California, USA. *International Journal of Environmental Research and Public Health*, 12(3), 3174-3187. doi:10.3390/ijerph120303174.
- Staudt, K., Dane'el, M., Marquez-Velarde, G. (2016). In the shadow of a steel recycling plant in these neoliberal times: Health disparities among Hispanics in a border colonia. *Local Environment*, 21(5), 636-652. doi:10.1080/13549839.2015.1016902.
- Staudt, K., Marquez-Velarde, G., Dane'el, M. (2014). Stories, Science, and Power in Policy Change: Environmental health, community-based research, and community organizing in a US-Mexico border colonia. *Environmental Justice*, 6(6), 191-199. doi:10.1089/env.2013.0041.
- Williams, C. T., Kim, S., Meyer, J., Spaulding, A., Teixeira, P., Avery, A., . . . Ouellet, L. J. (2013). Gender differences in baseline health, needs at release, and predictors of care engagement among HIV-positive clients leaving jail. *AIDS and Behavior*, 17 Suppl 2, S195-202. doi:10.1007/s10461-012-0391-y.

Wilson, S., Burwell-Naney, K., Jiang, C., Zhang, H., Samantapudi, A., Murray, R., . . . Williams, E. (2015). Assessment of sociodemographic and geographic disparities in cancer risk from air toxics in South Carolina. *Environmental Research*, 140, 562-568. doi:10.1016/j.envres.2015.05.016.

Wilson, S., Zhang, H., Burwell, K., Samantapudi, A., Dalemarre, L., Jiang, C., . . . Naney, C. (2013). Leaking underground storage tanks and environmental injustice: Is there a hidden and unequal threat to public health in South Carolina? *Environmental Justice*, 6(5), 175-182. doi:10.1089/env.2013.0019.

Wilson, S. M., Murray, R. T., Jiang, C., Dalemarre, L., Burwell-Naney, K., Fraser-Rahim, H. (2015). Environmental Justice Radar: A tool for community-based mapping to increase environmental awareness and participatory decision making. *Progress in Community Health Partnerships*, 9(3), 439-446. doi:10.1353/cpr.2015.0066.

