Valuing Science   Informing Decisions

Four Decades of Trusted

Junfeng (Jim) Zhang with monitoring equipment in Hyde Park, London, for an HEI traffic exposure study published in 2009.

HEI investigator Annette Peters and her myocardial infarction registry team with a particulate matter monitor they used in a 2005 HEI study.

Co-PI Jamson Lwebuga-Mukasa, left, prepares with a Harvard investigator to measure acrolein exposure at the Buffalo Peace Bridge in 2006 for an HEI study led by John Spengler.

Photo courtesy East Carolina University

Walter A. Rosenblith New Investigator Kymberly Gowdy, who is leading a forthcoming study related to pulmonary and vascular injury after ozone exposure.

Science

"Uncertainty about the health effects of emissions and effluents is a major factor confounding environmental protection in this country. The problem is that there's too much that we just don't know."

— **Archibald Cox, 1980**

The late 1970s was a time of great upheaval and great uncertainty in the way Americans viewed their environment and their government. When Harvard Law professor and former Watergate special prosecutor Archibald Cox (above right) stepped up to a podium at the National Academy of Sciences building in Washington, DC, in December 1980, he outlined a new way forward — a way to generate trusted science to inform environmental policy decisions.

In that moment, Cox announced the birth of the Health Effects Institute (HEI).

At the time, Congress was set to update the Clean Air Act, and policy makers were grappling with how to interpret research on the health effects of vehicle emissions. "Uncertainty about the health effects of emissions and effluents is a major factor confounding environmental protection in this country," said Cox. "The problem is that there's too much that we just don't know."

Cox outlined how HEI would convene top experts to oversee and assess research on the health effects of air pollution, without weighing in on the policy implications. Critically, the Institute would be independent, with balanced funding from industry and government.

"Testing and research ought to be kept free of any taint or suspicion of financial interests or preconceived policy judgment," Cox said. "The Institute will take the scientific testing and research needed to ascertain health effects out of the adversarial context in which it might otherwise be performed."
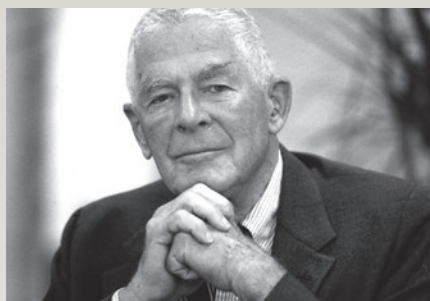
Cox would serve as founding chair of the HEI Board of Directors for more than 20 years. HEI would never lose sight of its founder's vision for generating science that everyone can trust.

In 2020, America found itself in another time of controversy over science and the environment. While much has changed since HEI's launch in 1980, the need for impartial science — a common ground on which to base decisions — endures.

A Model That Endures — Because It Works

HEI earns the trust of stakeholders because of two central tenets: rigor and independence. Its unique model ensures that research follows the highest standards of quality and that the results are presented without hype or bias. The impacts of HEI's work are testament to the fact that scientific research — conducted with transparency and integrity — remains more relevant than ever. The HEI model requires these important steps:

- HEI's Board of Directors appoints widely respected experts to the Institute's scientific committees and consults with a wide range of stakeholders to guide research priorities.

- The Research Committee creates targeted research programs and oversees competitively funded scientific studies.

- The Review Committee assesses study results to ensure the scientific integrity of the methods and findings.

With Gratitude to HEI Sponsors

HEI BY THE NUMBERS

40 YEARS
as a go-to source for decision makers

More than
360 RESEARCH PROJECTS funded

203* PEER-REVIEWED RESEARCH REPORTS published

22 SPECIAL REPORTS published

More than
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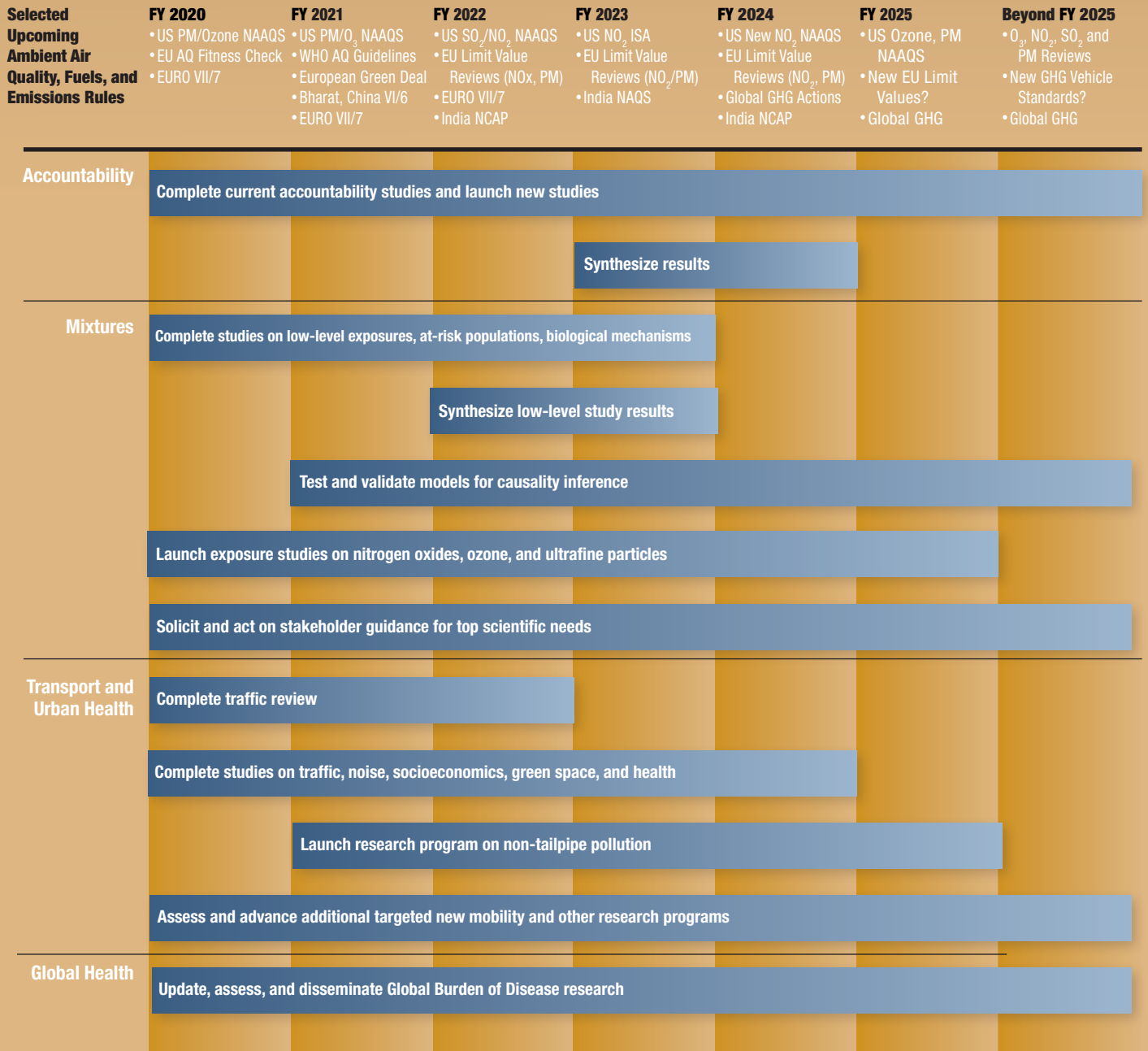
30 WALTER A. ROSENBLITH New Investigators

More than
25 COUNTRIES FROM 5 CONTINENTS represented at last five HEI annual conferences

*290+ including separately published Parts

Implementing the HEI Strategic Plan 2020–2025

This time line highlights HEI's key research areas selected for the 2020–2025 Strategic Plan period.

Selected Upcoming Ambient Air Quality, Fuels, and Emissions Rules	FY 2020	FY 2021	FY 2022	FY 2023	FY 2024	FY 2025	Beyond FY 2025
	• US PM/Ozone NAAQS • EU AQ Fitness Check • EURO VII/7	• US PM/O_3 NAAQS • WHO AQ Guidelines • European Green Deal • Bharat, China VI/6 • EURO VII/7	• US SO_2/NO_2 NAAQS • EU Limit Value Reviews (NOx, PM) • EURO VII/7 • India NCAP	• US NO_2 ISA • EU Limit Value Reviews (NO_2/PM) • India NAQS	• US New NO_2 NAAQS • EU Limit Value Reviews (NO_2, PM) • Global GHG Actions • India NCAP	• US Ozone, PM NAAQS • New EU Limit Values? • Global GHG	• O_3, NO_2, SO_2 and PM Reviews • New GHG Vehicle Standards? • Global GHG

Accountability

Complete current accountability studies and launch new studies

Synthesize results

Mixtures

Complete studies on low-level exposures, at-risk populations, biological mechanisms

Synthesize low-level study results

Test and validate models for causality inference

Launch exposure studies on nitrogen oxides, ozone, and ultrafine particles

Solicit and act on stakeholder guidance for top scientific needs

Transport and Urban Health

Complete traffic review

Complete studies on traffic, noise, socioeconomics, green space, and health

Launch research program on non-tailpipe pollution

Assess and advance additional targeted new mobility and other research programs

Global Health

Update, assess, and disseminate Global Burden of Disease research

Vision for the Future

Every five years, HEI's staff and Board of Directors take stock of the organization's activities and chart a path for the future. The HEI *Strategic Plan for Understanding the Health Effects of Air Pollution 2020–2025* captures a point in time — reflecting the insights gained and impacts achieved over the past five years — and offers a guiding vision for air quality research moving forward.

Envisioning — and Creating — a More Inclusive Future

Heartened by the renewed attention to the persistent racism that excludes certain people and groups from the full opportunity to engage in endeavors of American society, including scientific education and research, HEI recently outlined a commitment to promote inclusion in its work by

- taking every step to engage and provide a welcoming environment for underrepresented scientists in the scientific work of HEI,

- providing a safe and welcoming environment for all at HEI, free from discrimination of all types, including race, gender, LGBTQ+, ethnicity, national origin, and disability, and

- supporting these goals with both immediate and sustained action.

HEI will hold itself accountable to these commitments by analyzing its track record for engaging underrepresented scientists in its work. It will set goals for improving performance, monitor progress, and report publicly and regularly on that progress.

In keeping with HEI's driving focus on advancing science that's useful to stakeholders, the Strategic Plan was informed by consultations with HEI sponsors in EPA and industry, as well as individuals and organizations in the scientific community, the environmental community, state and international agencies, and others. Taking into consideration this diversity of perspectives ensures that HEI's work responds to the needs and priorities of those who rely on the Institute for high-quality, impartial science.

While a five-year strategic plan necessarily focuses on the near-term future, it is clear that issues around air quality and climate will continue to evolve well past that time frame. This long-term context is reflected in the plan's overarching theme: informing air quality and health decisions for 2020–2025... and beyond.

The vision is built on four major research opportunities:

Accountability: This area focuses on elucidating the links between air quality actions and health by improving methods for assessing these links, understanding causality, and analyzing costs and benefits.

Mixtures: In this area of research, HEI seeks to improve methods for examining how air pollutants affect health in the context of complex pollutant mixtures, low versus high pollutant concentrations, climate change, and variability over time and space.

Transport and urban health: In anticipation of diverse and potentially disruptive changes in transport, this area focuses on both traditional and emerging concerns related to vehicles and transport in the broader setting of urban health, including reviewing the worldwide literature on traffic-related air pollution exposure and health effects.

Nick Burchell

Sally Ng, one of HEI's many Walter A. Rosenblith New Investigator Award recipients over the years. Her work focuses on secondary organic aerosols.

Global health: HEI will continue to shed light on the health effects of air pollution in developing countries and to analyze air pollution's burden of disease around the world.

Cutting across all of these research areas is a continued focus on transparency in policy-relevant science, which requires attention to data access, systematic literature reviews, and rigorous evaluation of statistical methods.

Investing in Next-Generation Science

Science, like air pollution, doesn't sit still. Air quality is in a constant state of change; as technologies, policies, and behaviors shift, so do the pollutants in our environment and the ways in which they impact our health. Fortunately, the opportunities to understand pollution and its health effects have continued to evolve apace. HEI's research programs build on and help advance the latest technological innovations in air quality monitoring, such as sensors and satellites, as well as techniques to model and interpret what the data can tell us about human exposures and health.

A New Generation of Accountability Research

Tracking the real-world impacts of policy decisions is a complex undertaking. HEI's accountability research program has made significant progress in uncovering the outcomes of air quality actions and improving methodology to ensure these studies stand up to scrutiny.

School Bus Retrofits

Sara Adar of the University of Michigan is studying the National Clean Diesel Rebate Program, which allocates funding to school districts across the United States to replace or retrofit old-technology diesel-powered school buses. Her team is comparing student health and educational performance in approximately 400 districts that received funding with about 2,700 districts that did not.

Curbing Coal in China

Two ongoing studies are looking at air quality actions in China. Patrick Kinney of Boston University leads a team to evaluate major national regulations, in particular those that target coal and other specific sources, to assess their impacts on mortality rates. In a separate study, Sam Harper and Jill Baumgartner at McGill University are assessing a coal ban and heat pump subsidy program in the Beijing region, with an eye toward understanding the chemical composition of fine particles from different pollution sources (focusing on household coal use) and their contribution to health outcomes.
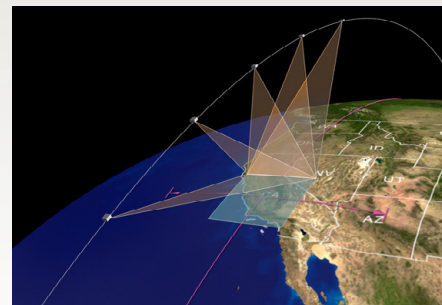
Traffic and Children's Health

Perry Hystad of Oregon State University is assessing the effects of emission-control measures — including national emissions regulations as well as local congestion reduction programs — on birth outcomes associated with traffic-related air pollution in Texas. Texas provides an interesting test case, because about 1.7 million pregnant mothers have lived within 500 meters of a Texas highway or expressway during the past 25 years, a period in which nitrogen dioxide concentrations (a marker of traffic-related air pollution) dropped by more than 50%.

Getting a Handle on Exposure

Pollution can vary widely over time and space. Five HEI-funded studies seek to improve scientists' ability to accurately track people's exposure to pollution and reduce uncertainty in efforts to determine what these exposures might mean for health.

Enhancing Exposure Assessment

Scott Weichenthal of McGill University is studying approaches to assessing the health impacts of long-term exposures to traffic-related air pollution in Canadian cities by comparing results from fixed-site and mobile measurements with the outputs of deep learning models. Gerard Hoek of Utrecht University leads an effort to map air pollution across the Netherlands, assess different types of sensors and monitoring platforms, and evaluate the performance of several exposure models. Kees de Hoogh of the Swiss

HEI investigators use space-based air quality monitoring data produced by NASA's Multi-Angle Imager for Aerosols (MAIA) satellite.

Courtesy NASA/JPL–Caltech

Tropical and Public Health Institute is using cell phone tracking data and air quality data to assess opportunities to improve exposure and health effects estimates by taking people's daily movements into account.

Understanding Uncertainty

Lianne Sheppard of the University of Washington is studying different approaches to air pollution exposure assessment including low-cost sensors, mobile monitoring, and passive samplers, with a focus on determining associations with cognitive decline and dementia incidence.

A team led by Klea Katsouyanni of King's College London is investigating the consequences of measurement error on estimates of health effects of long-term exposure to outdoor air pollution in London with sophisticated exposure models that account for mobility and include outputs from several types of air pollution models.

Air Pollution and COVID-19

As the COVID-19 pandemic emerged, HEI responded with a call for applications for research on the intersection of air pollution exposure and COVID-19 outcomes. The appeal generated 45 letters of intent; 5 studies were funded out of 10 invited full proposals.

Science for Policy

Policy decisions related to air quality can have significant and lasting impacts on businesses and economies, public and environmental health, and our everyday lives. While it is impossible to fully predict the outcomes of each policy, a solid scientific foundation helps policy makers and the public determine when action is warranted, and what form it should take. A robust body of reliable, impartial research is crucial to policy makers' ability to anticipate the benefits and costs of the air quality interventions being pursued at local, national, and regional levels.

Weighing in on EPA Rules

In 2018, the U.S. Environmental Protection Agency (EPA) proposed a rule, "Strengthening Transparency in Regulatory Science," that could prevent EPA decisions based on studies for which the data are not made publicly available. Under the proposed rule, EPA could potentially omit some study findings from consideration that have informed decisions on air and water quality for many years.

In a formal response to this proposed rule submitted in May 2020, HEI staff and Committee members noted the organization's longstanding commitment to enhancing transparency and data access but also identified key challenges of the proposed EPA rule. The best scientific reviews take advantage of the full range of studies available, rather than excluding otherwise very strong studies because of data access concerns alone. In addition, the rule would likely impose significant additional costs on scientists and research institutions, with no plan for covering these costs. The comments

Left: Scientific knowledge supplied to the European Parliament informs environmental and health decisions for the EU's 27 member states.

outlined a more comprehensive mechanism EPA could use to determine which studies to consider in its policy decisions.

Sharing the State of the Science

The Clean Air Scientific Advisory Committee acts as an independent advisor to the EPA to help inform its air quality standards. To support the committee's technical assessments, in October 2019 HEI submitted a series of comments on the state of the science for key topics in air quality research. The comments drew on HEI-funded studies and the broader research context to offer a view of the current understanding in five main areas: particulate matter, ozone pollution, low-level exposures, accountability research, and the determination of causality in assessing linkages between air pollution and health.

Considering a European Green Deal

As the European Union considers updating its air quality policies, HEI joined forces with the World Health Organization and other international scientific organizations to explore the evidence and inform a European Green Deal, an ambitious plan to make the European economy sustainable while addressing climate and environmental challenges. In a meeting in Brussels, Belgium, held in January 2020, 150 participants from HEI, partner organizations, public agencies, industries, and environmentalists addressed the latest science on low-level exposures, the effectiveness of current air quality standards, and the need for a systematic, multilevel, and multisector approach to tackling air pollution and its health effects. A key conclusion from the meeting was that the estimated health benefits of air quality actions by far outweigh the implementation costs.

Evidence of Effects at Low Exposure Levels?

In setting standards for permissible pollutant concentrations, EPA considers what pollutant levels are likely to cause harm. Studies conducted over the past decade have brought increasing attention to the possibility that pollutants may adversely affect health at levels previously thought to be safe, with some calling for EPA to address these potentially harmful low-level exposures in its pollution standards.

Initial results from two HEI-funded studies on this topic, led by Francesca Dominici at the Harvard T.H. Chan School of Public Health and Michael Brauer of The University of British Columbia, were made available to EPA during the agency's process to review the National Ambient Air Quality Standards for particulate matter. While EPA staff recommended tightening the standards, the agency ultimately ruled to retain the current standard. The full results of Dominici's and Brauer's studies, as well as a third study led by Bert Brunekreef at the University of Utrecht, are now complete and are undergoing a detailed examination by a special panel of the HEI Review Committee.

Global Impact

Air pollution doesn't stop at the border, and neither does HEI's work. Engaging with air quality research on the global stage is critical to understanding key pollution sources, the effects of standards and policies, and air pollution's impacts on public health everywhere.

HEI has a long track record of world-leading research on air pollution and its health effects conducted in North America and Europe. With additional funding, many recent projects and programs have focused on China, India, and other low- and middle-income countries where high levels of pollutants are generated, threatening human health regionally and drifting across continents and oceans.

Expanding Knowledge on Air Pollution's Burden

The Global Burden of Disease (GBD) project of the Institute for Health Metrics and Evaluation (IHME) is a leading resource for understanding health around the world, placing risks from air pollution in the context of the full range of health risks such as diet and tobacco. HEI supports and builds on the GBD project in two main ways. First, HEI-funded researchers rigorously examine linkages between air quality and health using IHME data, strengthening the evidence base that GBD scientists use to quantify the contributions of air pollution sources and other factors to illnesses and deaths. Second, HEI collaborates with IHME to develop the State of Global Air, a report and interactive website that offer a comprehensive analysis of air quality trends and health burdens in every country in the world.

A Valued Resource

The reach of the State of Global Air has grown significantly in recent years, reflecting its role as a go-to resource for vetted, trustworthy information on pollution levels and

Making Headlines Worldwide

Source: Meltwater
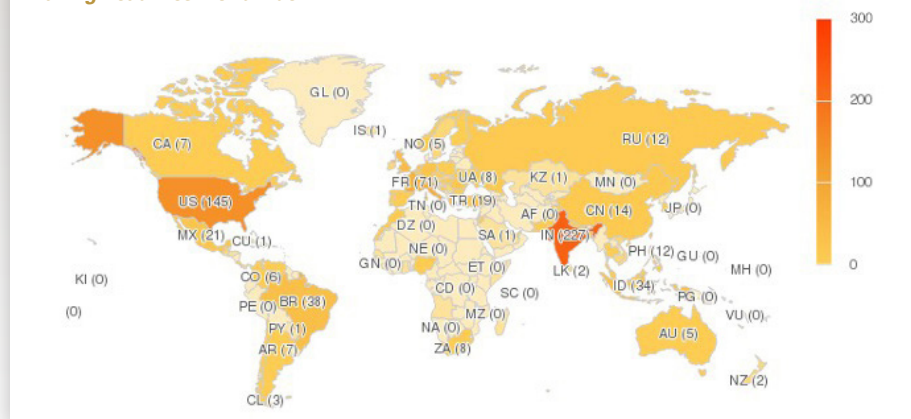
Launch of HEI's State of Global Air 2020 drew significant media interest. Coverage in India and South America has been growing.

key health indicators. In addition to its value for researchers, public health practitioners, and policy makers, the State of Global Air generates substantial media coverage, helping to bring broader public awareness to air quality issues around the world.

Incorporating the Latest Science

Every year, GBD scientists refine estimates of the burden of disease that can be attributed to exposure to air pollution, based on the latest scientific evidence and methods. In 2020, for the first time the State of Global Air included in its estimates air pollution's effects on adverse birth outcomes. A growing body of evidence links mothers' exposure to air pollution during pregnancy with the increased risk of their infants being born too small (low birth weight) or too early (preterm birth). Scientists estimate that in 2019 air pollution contributed to nearly 500,000 deaths among infants in their first month of life. Babies born in sub-Saharan Africa and South Asia face the highest risk.

New HEI-funded research may lead to additional insights on air pollution's health burden among children. A study launched in 2020 and led by Susan Anenberg of The George Washington University is focusing on associations between concentrations of nitrogen oxides and asthma in children.

The team aims to determine the portion of pediatric asthma in each country that may be attributed to nitrogen dioxide exposure for integration into future GBD analyses.

Advancing Science in India

HEI staff and scientists traveled to India on several occasions shortly before the COVID-19 pandemic shut down in-person conferences. In December 2019, three Indian research institutes and HEI co-hosted a workshop aimed at developing a broad strategy for advancing the science on air pollution and health effects in India. Participants outlined potential near- and long-term opportunities for policy-relevant research. They also mapped out a plan to support this work by establishing a national network among research institutions called Collaborative for Air Pollution and Health Effects Research (CAPHER-India).

CAPHER-India was formally launched at a follow-up session in early March during the Indian Public Health Association Conference 2020, where HEI staff and partners also organized a plenary session. The network is preparing to set research priorities and plan for training and capacity building.

Committees 2019—2020

RESEARCH COMMITTEE

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Francesca Dominici
Professor of Biostatistics and Senior Associate Dean for Research, Harvard T. H. Chan School of Public Health

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Professor of Epidemiology and Biostatistics, London School of Hygiene and Tropical Medicine, United Kingdom

Allen L. Robinson
Raymond J. Lane Distinguished University Professor and Head, Department of Mechanical Engineering, and Professor, Department of Engineering and Public Policy, Carnegie Mellon University

New HEI Review Committee Chair

The HEI Board of Directors recently appointed Melissa J. Perry, chair of the Department of Environmental and Occupational Health at The George Washington University Milken Institute School of Public Health, to chair the HEI Review Committee. Perry has a distinguished career as an occupational and environmental epidemiologist. She succeeds James Merchant of the University of Iowa, who served as chair from 2014 until last spring.

New HEI Research Committee Member

The HEI Research Committee welcomed as its newest member Neil Pearce, professor of epidemiology and biostatistics at the London School of Hygiene and Tropical Medicine. He is a Fellow of the Royal Society of New Zealand and the Academy of Medical Sciences and past president of the International Epidemiological Association.

Ivan Rusyn
Professor, Department of Veterinary Integrative Biosciences, Texas A&M University

REVIEW COMMITTEE

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Melissa Ostrow

Bryan Hubbell, EPA (speaking), with Jeffrey Brook of the HEI Research Committee and HEI Principal Scientist Katy Walker.

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Melissa Ostrow

From left: Karen Wesson of the U.S. EPA and Marusia Popovich, ExxonMobil.

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Ongoing Studies and Reports under Review and in Press 2019–2020

ACCOUNTABILITY

Assessing the national health and educational benefits of the EPA's School Bus Retrofit and Replacement Program: A randomized controlled trial design. *Sara Adar, University of Michigan*

How do household energy interventions work? *Sam Harper and Jill Baumgartner, McGill University, Canada*

Quantifying marginal societal health benefits of transportation emission reductions in the United States and Canada. *Amir Hakami, Carleton University, Canada*

Impacts of vehicle emission regulations and local congestion policies on birth outcomes associated with traffic air pollution. *Perry Hystad, Oregon State University*

Accounting for the health benefits of air pollution regulations in China, 2008–2020. *Patrick Kinney, Boston University*

*Improvements in air quality and health outcomes among California Medicaid enrollees due to goods movement actions, Phase 2. *Ying-Ying Meng, University of California, Los Angeles*

AIR POLLUTION EPIDEMIOLOGY

*Susceptibility to multiple air pollutants in cardiovascular disease. *Jane Clougherty, Drexel University*

Air Pollution, Autism spectrum disorders, and brain imaging amongst Children in Europe — the APACHE project. *Mònica Guxens, Barcelona Institute for Global Health (ISGlobal), Spain*

Air pollution exposure and prefrontal connectivity in early adolescence. *Megan Herting, University of Southern California*

Report in the HEI review process as of June 30, 2020

Impact of exposure to air pollution on asthma: A multi-exposure assessment. *Marie Pedersen, University of Copenhagen, Denmark*

Long-term outdoor air pollution and cause-specific mortality in a pooled analysis of 23 Asian cohorts. *Roel Vermeulen, Utrecht University, Netherlands*

EMISSIONS AND EXPOSURE ASSESSMENT

Scalable multipollutant exposure assessment using routine mobile monitoring platforms. *Joshua Apte, University of Texas, Austin*

Accounting for mobility in air pollution exposure estimates in studies on long-term health effects. *Kees de Hoogh, Swiss Tropical and Public Health Institute, Switzerland*

*Characterizing the determinants of vehicle traffic emissions exposure: Measurement and modeling of land-use, traffic, transformation, and transport. *Christopher Frey, North Carolina State University*

Spatial statistical learning methods for estimating ambient air pollution. *Gerard Hoek, Utrecht University, Netherlands*

Investigating the consequences of measurement error of gradually more sophisticated long-term personal exposure models in assessing health effects: The London Study (MELONS). *Klea Katsouyanni, Imperial College, United Kingdom*

Chemical and physical characterization of non-tailpipe and tailpipe emissions at 100 locations near major roads in the Greater Boston area. *Petros Koutrakis, Harvard University*

Optimizing exposure assessment for inference about air pollution effects with application to the aging brain. *Lianne Sheppard, University of Washington*

Comparing the estimated health impacts of long-term exposure to traffic-related air pollution using fixed-site, mobile, and deep learning models. *Scott Weichenthal, McGill University, Canada*

EPIDEMIOLOGY AT LOW EXPOSURES

Identifying the shape of the association between long-term exposure to low levels of ambient air pollution and the risk of mortality: An extension of the Canadian Census Health and Environment Cohort using innovative data linkage and exposure methodology. Phase 2. *Michael Brauer, University of British Columbia, Canada*

*Mortality and morbidity effects of long-term exposure to low-level $PM_{2.5}$, black carbon, NO_2, and O_3: An analysis of European cohorts. *Bert Brunekreef, Utrecht University, Netherlands*

*Assessing adverse health effects of long-term exposure to low levels of ambient pollution. Phase 2. *Francesca Dominici, Harvard University*

GLOBAL HEALTH

Integrating satellites, ground monitoring, and modeling to estimate long-term NO_2 exposures and associated pediatric asthma impacts. *Susan Anenberg, George Washington University*

Global Burden of Disease—Major Air Pollution Sources—a GLOBAL approach. *Michael Brauer, University of British Columbia, Canada; and Randall Martin, Institute for Health Metrics and Evaluation and Washington University*

Publications 2019–2020

Ongoing Studies
(Continued from previous page)

MECHANISMS OF HEALTH EFFECTS

Air pollutants and the gut microbiota and metabolome during early life: Implications for childhood obesity. *Tanya Alderete, University of Colorado*

*Understanding the impact of air quality on the chemistry of ribonucleic acids. *Lydia Contreras, University of Texas, Austin*

*Scavenger receptor B1 regulates oxidized lipid driven pulmonary and vascular inflammation after ozone exposure. *Kymberly Gowdy, East Carolina University*

Formation of reactive oxygen species by organic aerosols and transition metals in epithelial lining fluid. *Manabu Shiraiwa, University of California, Irvine*

TRAFFIC-RELATED AIR POLLUTION AND NOISE

Traffic-related air pollution and birth weight: The roles of noise, placental function, green space, physical activity, and socioeconomic status (FRONTIER). *Payam Dadvand and Jordi Sunyer, Barcelona Institute for Global Health (ISGlobal), Spain*

Intersections as hot spots: Assessing the contribution of localized non-tailpipe emissions and noise on the association between traffic and children's health. *Meredith Franklin, University of Southern California*

Health effects of air pollution components, noise and socioeconomic status ("HERMES"). *Ole Raaschou-Nielsen, Danish Cancer Society Research Center, Copenhagen, Denmark*

Request for Applications 19-2
DECEMBER 2019
Walter A. Rosenblith New Investigator Award
Health Effects Institute

Request for Applications 20-1A
JANUARY 2020
Health Effects of Air Pollution
Health Effects Institute

Request for Applications 20-1B
MAY 2020
Air Pollution, COVID-19, and Human Health
Health Effects Institute

Research Report 192, Part 2
MARCH 2020
Multicenter Ozone Study in oldEr Subjects (MOSES) Part 2: Impacts of Personal and Ambient Concentrations of Ozone and Other Pollutants on Cardiovascular and Pulmonary Function
David Rich and Mark Frampton, University of Rochester

Research Report 200
NOVEMBER 2019
Assessing Adverse Health Effects of Long-Term Exposure to Low Levels of Ambient Pollution: Phase 1
Francesca Dominici, Harvard University

Research Report 202
MARCH 2020
Enhancing Models and Measurements of Traffic-Related Air Pollutants for Health Studies Using Bayesian Melding
Stuart Batterman, University of Michigan

Research Report 203
NOVEMBER 2019
Mortality–Air Pollution Associations in Low-Exposure Environments (MAPLE): Phase 1
Michael Brauer, University of British Columbia, Canada

Special Report 22
DECEMBER 2019
Impacts of Shipping on Air Pollutant Emissions, Air Quality, and Health in the Yangtze River Delta and Shanghai, China
Yan Zhang, Fudan University, China

Strategic Plan
MARCH 2020
Strategic Plan for Understanding the Health Effects of Air Pollution 2020–2025
Health Effects Institute

HEI's New Investigator Awards
The Walter A. Rosenblith New Investigator Award brings new, creative investigators into active research on the health effects of air pollution. It provides three years of funding for a small project relevant to HEI's research interests to a new investigator with outstanding promise at the assistant professor or equivalent level.

Two Rosenblith award recipients began their funded work in the past year: 2019 awardees **Tanya Alderete** (top), assistant professor of epidemiology at the University of Colorado, and **Megan Herting** (left), assistant professor of epidemiology at the University of Southern California in Los Angeles. A complete list of awardees appears on the HEI website.

Financial Summary 2019—2020

HEI made significant progress in fiscal year 2020 toward the objectives of the Health Effects of Air Pollution program with ongoing research on possible health effects from low levels of exposure and examining the potential effects of traffic exposure in its broader context. We have also made progress in expanding our efforts in Global Health Science. These activities were made possible by funding from our core government and industry partners with additional funding from government, industry, and foundation sponsors. Separate funding has also allowed us to move forward with our Energy Research Program. The significant balance in Temporarily Restricted Net Assets ensures we will have funds to continue and expand our current targeted research initiatives in future years.

STATEMENTS OF FINANCIAL POSITION

| | June 30 | |
	2020	**2019**
Assets		
Cash and cash equivalents	$6,984,309	$3,883,423
Restricted cash	147,838	147,705
Contributions receivable	1,125,904	659,388
Unbilled incurred costs on grants	1,369,180	5,985,317
Prepaid expenses	126,131	62,438
Office equipment, office furniture and fixtures, and leasehold improvements, net	73,097	98,647
Total assets	**$9,826,459**	**$10,836,918**
Liabilities and Net Assets		
Liabilities:		
Contracted research payables	$322,063	$565,658
Accrued contracted research	1,493,603	1,883,581
Deferred revenue	-	592,611
Deferred rent payable	59,084	58,768
Other accounts payable and accruals	637,240	640,920
Total liabilities	**2,511,990**	**3,741,538**
Net Assets:		
Without donor restrictions	616,506	616,265
With donor restrictions	6,697,963	6,479,115
Total net assets	**7,314,469**	**7,095,380**
Total liabilities and net assets	**$9,826,459**	**$10,836,918**

The HEI Financial Statement and the Mayer Hoffman McCann P.C. Auditors' Report may be obtained by contacting Jacqueline C. Rutledge at jrutledge@healtheffects.org.

STATEMENTS OF ACTIVITIES

	Years Ended June 30	
	2020	**2019**
Revenues and support:		
EPA grants for the Health Effects of Air Pollution Program	$2,953,933	$5,812,109
EPA contracts for Energy Research	537,944	462,552
Other industry contributions	5,327,001	5,087,321
Other non-federal grant and contract revenue	740,126	1,125,080
Other revenues	241	56,114
Total revenues and support	**9,559,245**	**12,543,176**
Expenses:		
Research programs:		
Research studies	3,504,941	4,522,170
Research planning and study selection	497,873	516,682
Scientific study management	198,562	197,249
Scientific study review	261,988	244,278
Scientific publication and communication	983,426	776,581
	5,446,790	**6,256,960**
Special Scientific projects:		
Energy research	777,527	1,090,916
Traffic studies review	427,040	113,994
Global health science	941,744	1,254,839
	2,146,311	**2,459,749**
Total research and scientific expense	7,593,101	8,716,709
Administration	1,747,055	1,426,414
Total expenses	**9,340,156**	**10,143,123**
Net increase in net assets	**219,089**	**2,400,053**
Net assets at beginning of year	**7,095,380**	**4,695,327**
Net assets at end of year	**$7,314,469**	**$7,095,380**

HEI Staff and Board of Directors 2019–2020

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Board Welcomes Two New Members

Two distinguished leaders joined the Board of Directors in 2020: Karen C. Seto and Richard A. Meserve. Seto is the Frederick Hixon Professor of Geography and Urbanization Science at Yale University's School of the Environment. Meserve is senior of counsel at Covington & Burling LLP, president emeritus at the Carnegie Institution for Science, and former chair of the U.S. Nuclear Regulatory Commission.

Karen Seto   **Richard Meserve**

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Karen C. Seto
Frederick Hixon Professor of Geography and Urbanization Science, Yale University, School of the Environment

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Archibald Cox
Founding Chair, 1980–2001

Donald Kennedy
Vice Chair Emeritus, 1980–2003; Editor-in-Chief Emeritus, Science

HEI-Energy Puts Plan into Action

With oil and gas resource development projected to continue, alongside growing efforts to switch to renewables and conserve energy, a source of credible science is needed to support decisions about how best to ensure the protection of public health as energy industries evolve.

Answering the call is HEI-Energy, launched in 2019 as a nonprofit affiliate of the Institute and built on the HEI model of independent science. Its mission is to provide high-quality and impartial science on potential human exposure and health effects associated with unconventional oil and natural gas development (UOGD) in the United States.

A Comprehensive Plan

To put forth a common understanding of HEI-Energy and the credible science it will deliver, HEI-Energy leadership and staff released the Implementation Plan for a National Energy Research Program in April 2020. The plan describes the program, its overall goals and expectations, and its governance structure.

First Reports

Upon its launch in 2019, the HEI-Energy program's initial focus was to assess the current state of knowledge on potential human exposures and health effects associated with UOGD to identify key gaps where further research would be most useful. The program's first Special Report and Communication survey the scientific literature, focusing on epidemiology studies and exposure studies, respectively, to inform research planning.

New Tool for Energy Research
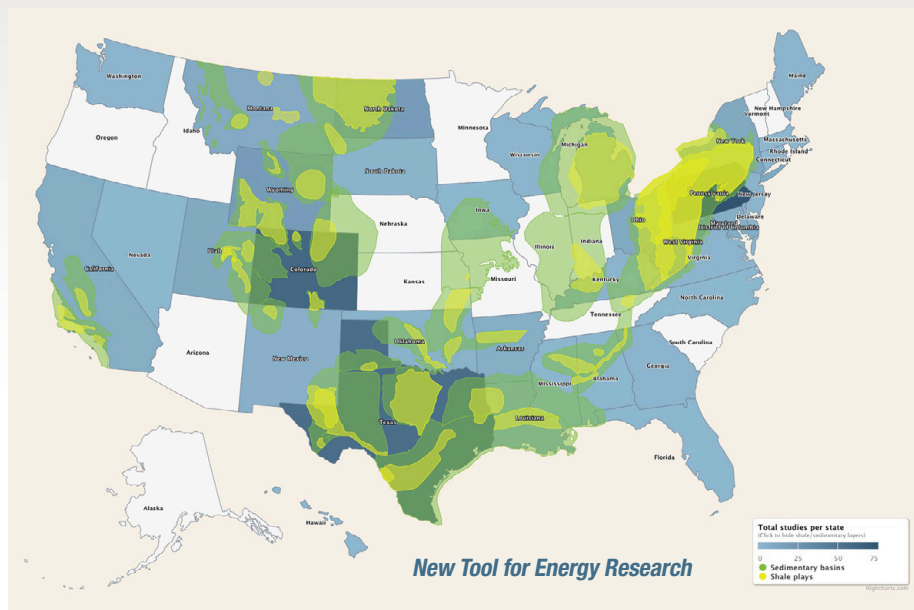
A spatial bibliography, introduced on the HEI-Energy website in November 2020, includes a searchable map enabling users to download curated lists of studies in specific regions of the United States.

The HEI-Energy Committee met in Boston in September 2019.

Future Research

HEI-Energy issued its first two Requests for Applications (RFAs) in 2020, an exciting milestone toward the program's goal of improving the characterization of potential human exposures from UOGD activities. Studies will focus on multiple U.S. regions and explore exposures to noise, chemicals in outdoor air, and chemicals in water originating from UOGD. Funding for the selected studies will be provided jointly by EPA and the oil and natural gas industry.