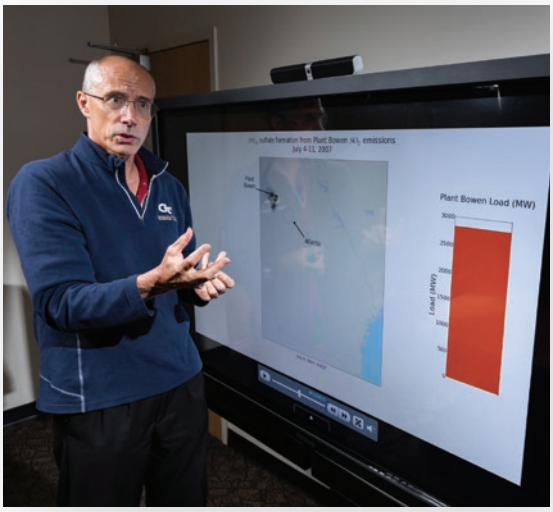
A Voice for Accountability

Purpose

Our mission is to support informed decisions related to air quality.

The HEI M



Rob Felt, Georgia Tech

Quality

Every step — from identifying priorities to supporting projects to interpreting results — is designed to ensure that our work is timely, relevant, and credible. Pictured: HEI investigator Armistead Russell of the Georgia Institute of Technology.

Experts

Paul Schnaittacher

HEI's independent Board of Directors appoints widely respected experts across the full range of scientific disciplines to the Research Committee (above, with HEI staff) and Review Committee.

The Health Effects Institute (HEI) provides trusted science for cleaner air and better health. With balanced funding from government and industry, we support independent investigations into air pollution, its health impacts, and its solutions.

Our Purpose

Our mission is to support informed decisions related to air quality. We do this by funding, overseeing, and critically evaluating research on the health effects of air pollution, and then putting the findings into the context of current trends and debates.

Our Experts

HEI's independent Board of Directors appoints widely respected experts across the full range of scientific disciplines — biology, medicine, toxicology, statistics, engineering, and exposure — to the HEI Research Committee and Review Committee. HEI's scientific staff works with the Research Committee to create targeted science programs to answer key science and policy questions. The Review Committee independently subjects every HEI-funded study to intensive peer review and works with HEI scientific staff to produce commentaries that explain what the studies mean for science and policy.

Our Quality

Under our unique model, we start with extensive consultation with sponsors and the scientific community, and with environmental, industry, and state-level stakeholders, to craft the *HEI Strategic Plan for Understanding the Health Effects of Air Pollution*. Then, in pursuing priorities based on the *Plan*, we separate the rigorous competitive process of selecting and overseeing research projects from the detailed process of critically evaluating and communicating research results. Every step — from identifying priorities to supporting projects to interpreting the results — is designed to ensure that our work is timely, relevant, and credible.

What Makes HEI Different?

Our constituents are everyone with a stake in science and policy.
Whether we're talking to a policy maker, businessperson, public interest group, or nongovernmental organization, it turns out that everyone has essentially the same questions when it comes to air quality regulations: What's the benefit? What's the cost? What changes should I prepare for? HEI answers those questions with unbiased science and objective commentary.

We rely on the evidence.
At HEI, everything we do boils down to a simple question: What does the evidence say? Our balanced funding model and scientific rigor help ensure that our findings, and the way we present them, are strictly impartial. And though HEI produces very policy-relevant science, we never take a policy position, to avoid having our science ever being taken for advocacy.

We get it right.
We take the research process seriously. Over the decades we've honed a meticulous peer-review system ensuring that our research stands up to scrutiny and our commentary adds value. The integrity of this process has made HEI a respected, go-to source for decision makers in both the public and private sectors.

HEI by the numbers

Chartered in **1980**

More than **340** research projects funded to date

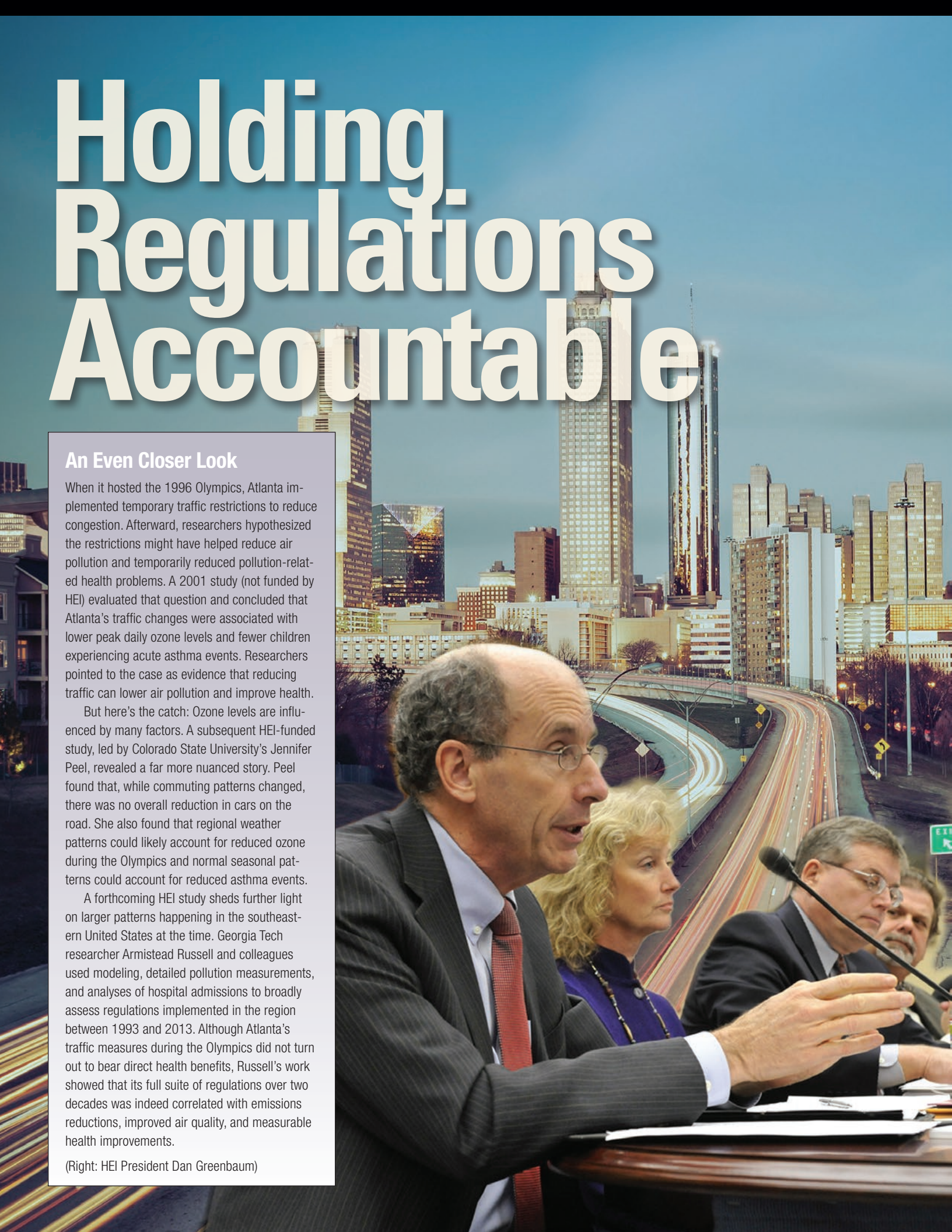
More than **280** peer-reviewed reports produced

32 states represented at last five HEI annual conferences

22 countries represented at last five HEI annual conferences

Results published in **several thousand** journal articles

Holding Regulations Accountable



An Even Closer Look

When it hosted the 1996 Olympics, Atlanta implemented temporary traffic restrictions to reduce congestion. Afterward, researchers hypothesized the restrictions might have helped reduce air pollution and temporarily reduced pollution-related health problems. A 2001 study (not funded by HEI) evaluated that question and concluded that Atlanta's traffic changes were associated with lower peak daily ozone levels and fewer children experiencing acute asthma events. Researchers pointed to the case as evidence that reducing traffic can lower air pollution and improve health.

But here's the catch: Ozone levels are influenced by many factors. A subsequent HEI-funded study, led by Colorado State University's Jennifer Peel, revealed a far more nuanced story. Peel found that, while commuting patterns changed, there was no overall reduction in cars on the road. She also found that regional weather patterns could likely account for reduced ozone during the Olympics and normal seasonal patterns could account for reduced asthma events.

A forthcoming HEI study sheds further light on larger patterns happening in the southeastern United States at the time. Georgia Tech researcher Armistead Russell and colleagues used modeling, detailed pollution measurements, and analyses of hospital admissions to broadly assess regulations implemented in the region between 1993 and 2013. Although Atlanta's traffic measures during the Olympics did not turn out to bear direct health benefits, Russell's work showed that its full suite of regulations over two decades was indeed correlated with emissions reductions, improved air quality, and measurable health improvements.

(Right: HEI President Dan Greenbaum)

Whenever a new environmental rule or regulation is being considered, there is a great deal of focus on its potential costs and benefits. But despite best efforts, there's no crystal ball. Costs can rise unexpectedly; benefits, such as lower emissions and improved health outcomes, can be smaller than expected or fail to materialize. At other times, direct and indirect costs may turn out to be smaller and benefits greater than anticipated.

HEI's science helps policy makers take the long view. Tracking how the real-world impacts of regulations measure up against the projected impacts — for better or worse — is essential to learning the lessons of the past and making better decisions in the future. Over the last 15 years, HEI has proven itself to be a leader in this field.

Our rigorous scientific studies consider the problem from many angles: Was the regulation implemented and enforced as planned? How does the affected population's health compare with that of a similar population in a region where air quality was not affected by the rule? Were there other changes that happened at the same time? How can we parse cause and effect?

With robust study planning, review, publication, and data sharing processes, HEI brings transparency to assessing the impacts of regulations. Our work provides a clear-eyed analysis — what worked, what didn't, what we know, what we can't say for sure. When there have been previous efforts to assess impacts, HEI sometimes reanalyzes the data to validate, or counter, previous findings. Continuing to ask questions is a crucial part of the scientific process — and a crucial part of improving air quality and public health.

A Framework for Accountability

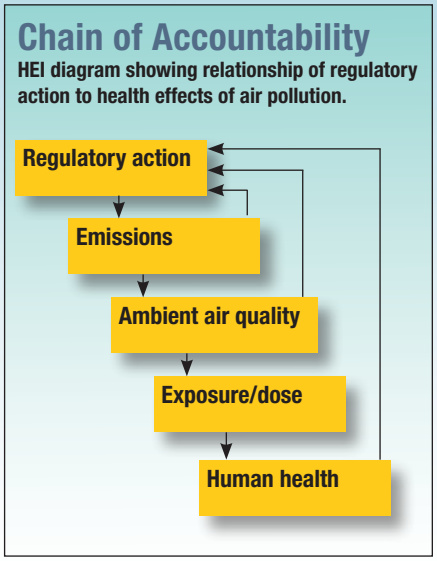
HEI doesn't simply fund research. We apply our extensive scientific and policy expertise to design and guide our studies so that their results will be as useful as possible. To that end, our accountability studies follow a conceptual framework highlighted by an HEI expert group in 2003 and known as the "chain of accountability" (see figure). The chain outlines the key questions that arise when evaluating whether a given policy intervention can actually be linked with human health outcomes.

Asking the Hard Questions

To date, HEI has funded two waves of accountability research, with another currently in the works. The first wave included studies of measures to reduce traffic during the Atlanta Olympic Games (see text box), congestion charging and a low emission zone in London, a wood stove replacement program, legislation to reduce sulfur in fuel in Hong Kong, analysis of limits on sulfur dioxide emissions in the 1990 Clean Air Act Amendments, air quality measures during the Beijing Olympic Games, and a ban on the sale of coal in Irish cities.

Several projects from the second wave of research were recently completed. One, led by Corwin Zigler of the Harvard T.H. Chan School of Public Health and completed in 2016, used new statistical approaches to directly identify cause-and-effect relationships for air pollution interventions. This team demonstrated their methods in two case studies, comparing their results with previous analyses that had used different scientific methods. The HEI Review Committee concluded that the new methods are an important addition to the accountability-science toolkit that can complement the earlier work.

The second study, completed in 2017, was led by Frank Gilliland of the University of Southern California. That study took on a monumental challenge: tracing the impacts of nearly 20 major policy actions implemented in Southern California over a 20-year period. The researchers used data from long-term studies of ambient air pollution and children's health to figure out whether specific actions improved air quality and whether the health of children in the region improved as a result. Although there was some variability among the communities studied, the results revealed that emissions and pollutant levels decreased and the children's health improved significantly over those two decades. The study suggests that environmental policy measures indeed had a beneficial impact on public health.



A Go-To Resource

Our accountability work has made HEI a valued resource for the policy community. This year HEI President Dan Greenbaum, Vice President Bob O'Keefe, and Director of Science Rashid Shaikh were invited to present a briefing on HEI's Accountability Research Program to Lamar Smith (R-Texas), chairman of the House of Representatives Committee on Science, Space, and Technology, along with other members of the committee and its staff. The briefing sparked a lively discussion as committee members probed for more information about specific study findings and acknowledged the broader need to scientifically gauge the impact of governmental rules.

Accountability is also valued at the state and local levels, where many air pollution rules are implemented and enforced. Greenbaum was invited to contribute to the opening session of the Association of Air Pollution Control Agencies' spring 2017 meeting with an overview of the latest developments in risk science and causality.

Making the Data Available

Vast quantities of data are collected every day, reflecting nearly every facet of our lives. Data generated by governments, private industry, and academic research are a potent resource for those seeking to answer fundamental questions related to improving the health of our citizens and our economy. But tapping into these rich data sources can pose challenges.

Recent years have seen a push toward better data sharing throughout the scientific community. At HEI, our longstanding Data Access Policy, which requires HEI-funded researchers to make their data and methods available to others, has put us ahead of the curve. This policy is crucial to our scientific credibility and to the transparency of our process — two assets that are at the heart of HEI's model and success.

Getting the Most Out of Research Investments

Replication and reanalysis are central to the scientific method. Yet all too often these practices are neglected in favor of other research priorities, or made more challenging by the cost and effort involved in sharing data. But sharing existing data enables others to independently validate findings and analytical methods and perform alternative analyses — helping to strengthen the evidence base and support more informed decisions.

HEI's Commitment in Action

Our Data Access Policy has markedly expanded the impact of HEI's research over the years. In 2005 and 2007, for example, HEI released the two-part *Relationships of Indoor, Outdoor, and Personal Air (RIOPA)* study quantifying the complex mixture of pollutants found in and around 100 homes in each of three urban areas across the United States: Los Angeles, California; Elizabeth, New Jersey; and Houston, Texas. The investigators collected air samples at different times of the year, both indoors and out, to analyze the types, concentrations, and sources of ambient air pollutants.

While these were excellent studies in their own right, the true extent of RIOPA's benefits came to fruition years later, as other research teams tapped into the freely available RIOPA data sets to conduct further analyses. To date, more than 40 research publications have drawn on these data, generating valuable insights on outdoor and indoor exposure to a range of pollutants.

In a more recent HEI project, researchers led by Francesca Dominici of the Harvard T.H. Chan School of Public Health are using data from about 61 million people enrolled in Medicare and Medicaid to examine health effects of low levels of air pollution in the United States. In addition to looking at the possible connections between pollutants and disease, one of the study's explicit aims is to develop new tools for accessing and analyzing these large health and pollution data sets. By widely sharing such tools, the study will contribute not only to scientific knowledge but also to expanding the research capabilities of others. The team is also documenting their work with specific instructions so that other researchers can access the data in order to reproduce and test their analyses.

A Balancing Act

Sharing data isn't always a straightforward proposition. Today's data sets can be extremely large and complex, leading to questions about who should shoulder the cost of storing and managing all that information, and how to make it interoperable with analytical tools and other data sets. In addition, many data sets involve proprietary, private, or sensitive medical information, raising the need to introduce strong protections against misuse while affording access and transparency where feasible. HEI works closely with its research partners to strike the right balance and establish data sharing solutions that are robust and sustainable.

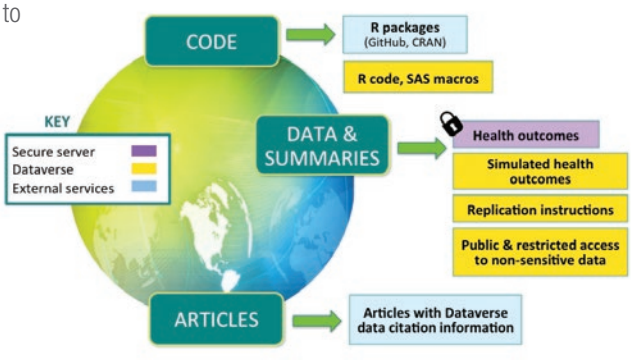
A Rich New Data Source

While ozone's detrimental effects on respiratory health are well known, what's been less clear is whether the pollutant also affects cardiovascular health. To fill this knowledge gap, HEI funded the Multicenter Ozone Study in oldEr Subjects (MOSES), a large study that investigated cardiovascular health markers in older adults who were exposed in a laboratory to levels of ozone that are relevant to real-world conditions

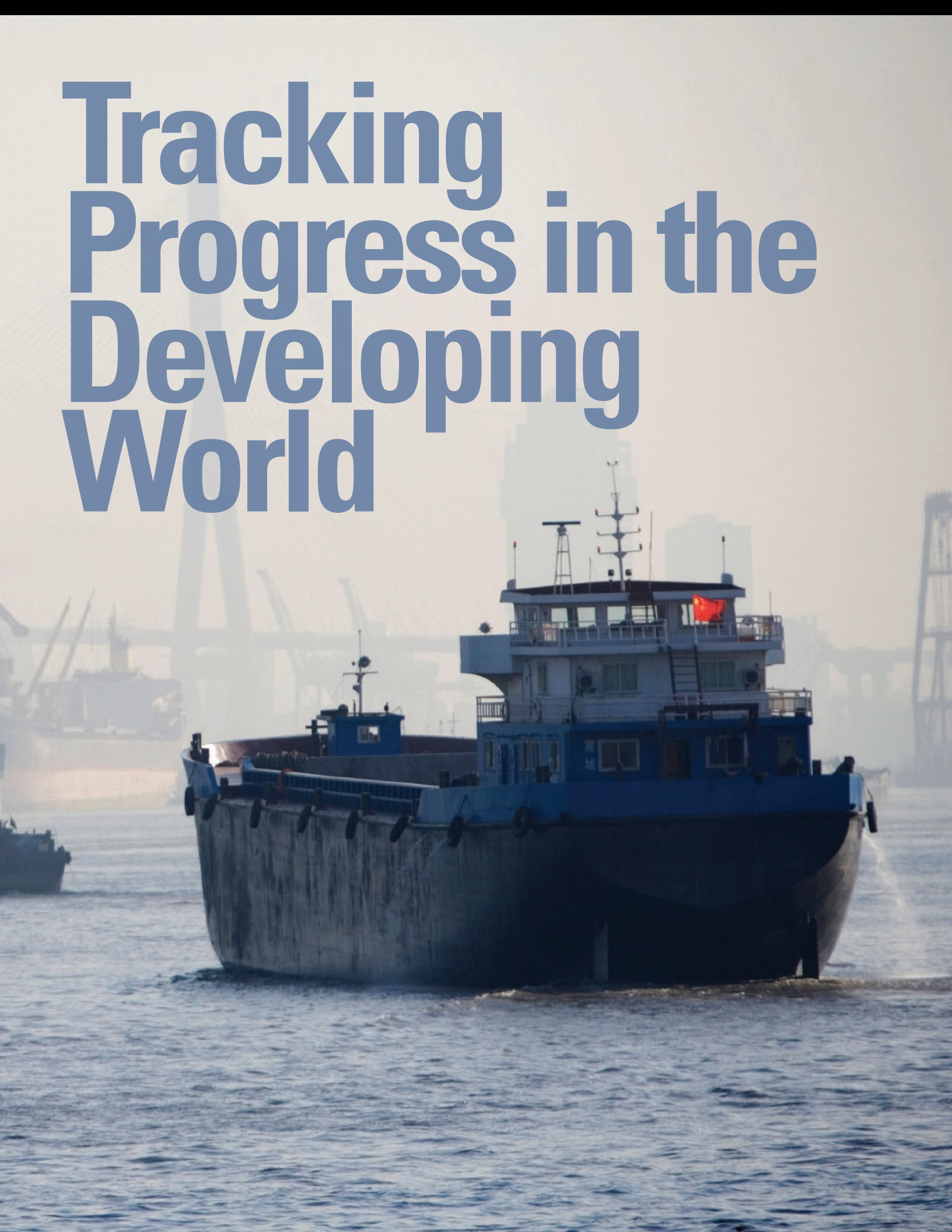
The project's initial results, published in 2017, revealed that ozone exposure had no effect on a large suite of cardiovascular outcomes, though it was, as expected, associated with moderate changes in lung function and inflammation. In the coming year, the full MOSES database will be made freely available for research purposes. As the largest and most comprehensive data set ever generated for controlled ozone exposure, this rich resource is expected to facilitate further advances toward understanding ozone's health effects.

Tools for Data Access and Reproducibility

An ongoing HEI study by Francesca Dominici and colleagues on the effects of exposure to low levels of air pollution will employ these tools for access to study data. (Chart adapted from poster presented at HEI Annual Conference 2017.)



Tracking Progress in the Developing World



More than 90 percent of the world's population lives in areas that exceed global air quality guidelines for fine-particulate pollution. The problem is most acute in developing countries, where activities related to industry, electricity generation, and household heating and cooking introduce large quantities of pollutants into the air, and where people are often burdened by other health problems.

Air pollution ranks among the top risk factors for premature death globally — people exposed to high ambient air pollution tend to die sooner than they would otherwise. They also more frequently suffer illnesses, such as respiratory and cardiovascular problems, that cause them to miss school or work and need medical care.

Additionally, it is increasingly clear that air pollution travels far beyond the countries or areas where it is produced. Research shows, for example, that pollution generated in Asia drifts eastward and crosses the Pacific, driving up the levels of certain pollutants in the air over the western United States. It is vital to study this global transport of pollutants in order to gain a more complete picture of the current and future health impacts of air pollution in all populations.

For these reasons and others, HEI has made substantial investments, with support from a range of foundations and international agencies, in tracking pollution and health around the globe, and the policies that affect them.

Pinpointing Pollution Sources

The Global Burden of Disease (GBD) initiative, led by the Institute for Health Metrics and Evaluation, is esteemed as the most comprehensive and systematic assessment of the risk factors for the major causes of death and disability worldwide. Since 2000, HEI has led the air pollution working group for this important international project.

In recent years, HEI has expanded its contributions to this high-profile initiative by spearheading the Global Burden of Disease from Major Air Pollution Sources (GBD MAPS) project. While GBD analyses rely on overall pollutant levels, GBD MAPS builds on that framework by estimating the disease burden attributable to specific pollution sources. This degree of granularity is important to informing policy decisions that can best target the pollution sources with the biggest influence on human health.

During the first phases of GBD MAPS, investigators analyzed pollution sources in China and India, two of the world's most populous countries, which are experiencing very high air pollution levels. To help connect the results with practical solutions, the analyses also estimate the disease burden expected through 2030 (China) or 2050 (India) under different policy-relevant scenarios.

Complementing these studies, HEI also is supporting additional investigations into specific pollution sources in Asia, including contributors to household air pollution and the impacts of shipping activities.

Sharing the State of Global Air

Reliable data and rigorous analyses are clearly essential to understanding global air pollution, but so is the ability to effectively share the results in a way that can inform on-the-ground decisions. To that end, HEI is part of a joint effort to communicate key outcomes of the Global Burden of Disease initiative. Along with our partners, we launched the State of Global Air (*www.stateofglobalair.org*), a website designed to serve as a one-stop shop for the latest data on air quality trends in every country and world region. Featuring downloadable

reports and access to an updated database on pollution levels and health effects, the website has become a resource appreciated by researchers, decision makers, and the general public alike. The site also serves as a source of trusted information and has been cited in numerous high-impact media outlets including the *New York Times*, the *Washington Post,* Reuters, and the *Times of India.*

Energy Research Program Launch

Trusted Science on Oil and Natural Gas Development

The development of oil and natural gas from shale and other unconventional resources has expanded rapidly in recent years as technological and scientific innovations have opened new doors for oil and gas extraction. These innovations have led to a dramatic increase in oil and gas production. The use of natural gas for electricity generation and industrial activity has skyrocketed as a result, a shift that could help reduce air pollution as natural gas — a cleaner-burning fuel — replaces coal and becomes a leading energy source.

As development of unconventional oil and natural gas resources has increased and spread to new areas, nearby residents, community groups, and public health and environmental organizations have raised questions about the potential effects of such practices on human health and the environment. These unresolved questions have fueled controversy in many communities among residents, elected officials, regulators, and industry professionals.

A Dearth of Credible Information

Such questions have been raised without a large base of data about actual exposures resulting from these activities and their potential health impacts. To inform sound decisions, what's needed most is credible scientific research to illuminate potential human exposures and how they might affect health.

Courtesy of University of Pittsburgh

Alan Ducatman, of West Virginia University and HEI's Special Scientific Committee on Unconventional Oil and Gas Development in the Appalachian Basin, at a public workshop hosted by HEI.

Hydraulic fracturing system. (Source: Schlumberger)

To that end, HEI is launching a new, independent program to bring credible science to bear on discussions of the potential for population exposure and health effects associated with the development of oil and natural gas from unconventional resources. This effort represents a significant expansion of HEI's model to address questions involving not only oil- and gas-related emissions to air, but also releases to water and other potential exposures that might have health effects.

A Better Way Forward

HEI has been laying the groundwork for the new Energy Research Program for several years. In 2015, the Institute released a seminal *Strategic Research Agenda* that identified and prioritized emerging questions about the potential impacts related to unconventional oil and natural gas development, focusing on the Appalachian Basin but with broad relevance to other major oil- and gas-producing regions in the United States. That effort grew out of a public–private initiative in Pennsylvania, which tapped HEI to assemble a balanced, impartial body of experts to advise on key research directions for addressing concerns related to possible impacts of unconventional oil and gas development. The committee carefully reviewed the scientific literature, industry documentation, and public input, ultimately identifying 35 priority research questions.

Since that *Strategic Research Agenda* was released, HEI has secured commitments from leading oil and gas companies for the first year of a five-year program to begin answering key research questions identified in the Agenda about potential human exposure and effects, and is working to secure balanced government funding as well. In Year 1, HEI will conduct systematic reviews of both the exposure and health literature to summarize what is known and what knowledge gaps remain and to plan accordingly for the research, which will begin in Year 2. The launch of this program is a testament to the value of the HEI model and our unique ability to offer trusted science in order to shed light on key national priorities.

Committees 2016–2017

RESEARCH COMMITTEE

David L. Eaton, *Chair*
Dean and Vice Provost of the Graduate School, *University of Washington–Seattle*

Jeffrey R. Brook
Senior Research Scientist, Air Quality Research Division, *Environment Canada*, and Assistant Professor, *University of Toronto, Canada*

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

David E. Foster
Phil and Jean Myers Professor Emeritus, Department of Mechanical Engineering, Engine Research Center, *University of Wisconsin–Madison*

Amy H. Herring
Professor of Statistical Science and Global Health, *Duke University*

Barbara Hoffmann
Professor of Environmental Epidemiology, *Institute of Occupational, Social, and Environmental Medicine, University of Düsseldorf, Germany*

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

New HEI Review Committee Members


Courtesy Keck School of Medicine, USC

Kiros Berhane

Frank Kelly

The HEI Board of Directors appointed two prominent scientists to the Review Committee in September 2017. Kiros Berhane is a professor of biostatistics and director of graduate programs in biostatistics and epidemiology in the Department of Preventive Medicine at the Keck School of Medicine, University of Southern California, Los Angeles. Frank Kelly is a professor of environmental health and director of the Environmental Research Group at King's College London, UK.

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

REVIEW COMMITTEE

James A. Merchant, *Chair*
Professor and Founding Dean Emeritus, College of Public Health, *University of Iowa*

Michael Brauer
Professor, School of Environmental Health, *University of British Columbia, Canada*

Bert Brunekreef
Professor of Environmental Epidemiology, Institute of Risk Assessment Sciences, *University of Utrecht, the Netherlands*

Mark W. Frampton
Professor Emeritus of Medicine and Environmental Medicine, *University of Rochester Medical Center*

Jana B. Milford
Professor, Department of Mechanical Engineering and Environmental Engineering Program, *University of Colorado–Boulder*

Jennifer L. Peel
Professor of Epidemiology, Colorado School of Public Health and Department of Environmental and Radiological Health Sciences, *Colorado State University*

Roger D. Peng
Professor of Biostatistics, *Johns Hopkins Bloomberg School of Public Health*

Lianne Sheppard
Professor of Biostatistics, School of Public Health, *University of Washington–Seattle*

Publications 2016–2017

Research Report 188
JULY 2016
Adverse Reproductive Health Outcomes and Exposure to Gaseous and Particulate-Matter Air Pollution in Pregnant Women
Jun Wu

Research Report 189
SEPTEMBER 2016
Ambient Air Pollution and Adverse Pregnancy Outcomes in Wuhan, China
Zhengmin Qian

Research Report 190
JANUARY 2017
The Effects of Policy-Driven Air Quality Improvements on Children's Respiratory Health
Frank Gilliland

Special Report
FEBRUARY 2017
State of Global Air 2017: A Special Report on Global Exposure to Air Pollution and Its Disease Burden
Health Effects Institute

Research Report 191
MARCH 2017
Protective Role of Eosinophils and Tumor Necrosis Factor-α after Ozone Inhalation
Allison D. Fryer

Research Report 192, Part 1
JUNE 2017
Multicenter Ozone Study in oldEr Subjects (MOSES): Part 1. Effects of Exposure to Low Concentrations of Ozone on Respiratory and Cardiovascular Outcomes
Mark W. Frampton, John R. Balmes, Philip A. Bromberg, and Paul Stark

Request for Applications 16-1
Walter A. Rosenblith New Investigator Award
Health Effects Institute

Jay Mallin

Walter A. Rosenblith New Investigator Award recipients, from left: Jason Surratt, University of North Carolina–Chapel Hill (2012); Nga Lee (Sally) Ng, Georgia Institute of Technology (2013); Mònica Guxens, Barcelona Institute for Global Health (2016); Kymberly Gowdy, East Carolina University (2015); and Lydia Contreras, University of Texas–Austin (2014).

Request for Applications 17-1
Assessing Adverse Health Effects of Exposure to Traffic-Related Air Pollution, Noise, and Their Interactions with Socio-Economic Status
Health Effects Institute

Request for Applications 17-2
Health Effects of Air Pollution
Health Effects Institute

Spreading the Word

During the last fiscal year HEI made good on its goal of improving the way it communicates science to the public and stakeholders. Besides launching its web-based State of Global Air project in the winter of 2017 (see page 7), the Institute completed the redesign of its main website in August 2016. The site has a fresh new look and dedicated pages for top-priority work, and allows easier navigation and cross-linking of information. It also features an enhanced search function and the ability to share HEI news and studies via social media.

Ongoing Studies and Reports under Review and in Press 2016–2017

ACCOUNTABILITY

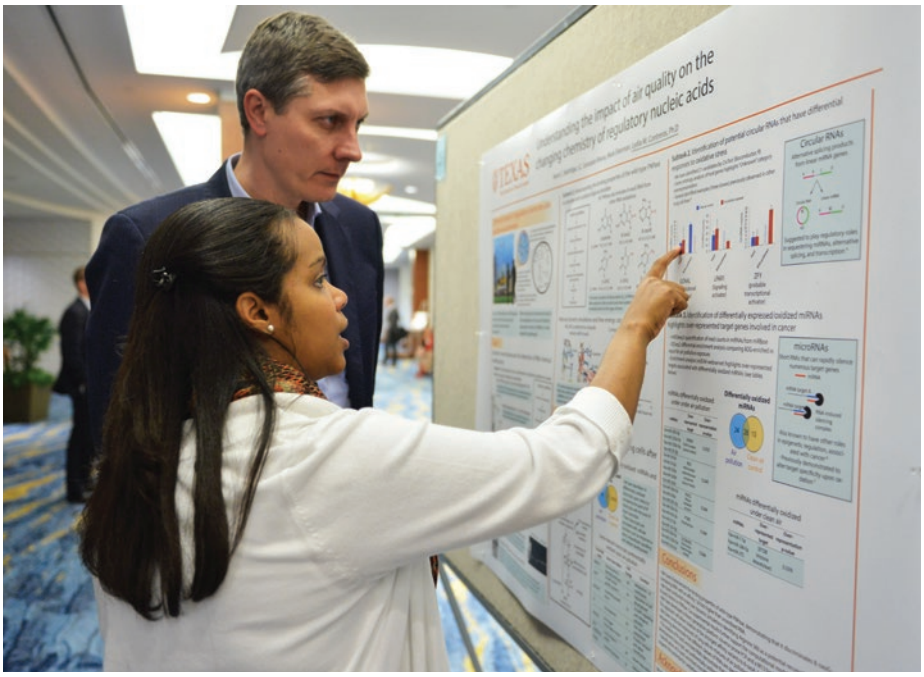
Improvements in air quality and health outcomes among California Medicaid enrollees due to goods movement actions — Phase 2. *Ying-Ying Meng, University of California–Los Angeles*

*Impact of emissions changes on air quality and acute health effects in the Southeast, 1993–2012. *Armistead Russell, Georgia Institute of Technology*

OZONE

Effects of ozone in human volunteers exposed to low levels of ozone in a laboratory, Part 2. *John Balmes, University of California–San Francisco; Philip Bromberg, University of North Carolina–Chapel Hill; Mark Frampton, University of Rochester*

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



Jay Mallin

Lydia Contreras, University of Texas–Austin; and Ivan Rusyn, Texas A&M University and HEI Research Committee.

AIR POLLUTION CONSTITUENTS AND MIXTURES

Epidemiology

*Particulate air pollutants, risk of cognitive disorders, and neuropathology in the elderly. *Jiu-Chiuan Chen, University of Southern California*

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

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. *Michael Brauer, University of British Columbia*

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*

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

Emissions and Exposure Assessment

*The Hong Kong D3D study: a dynamic three-dimensional exposure model for Hong Kong. *Benjamin Barratt, King's College London*

Enhancing models and measurements of traffic-related air pollutants for health studies using Bayesian melding. *Stuart Batterman, University of Michigan*

**Report in the HEI review process as of June 30, 2017*

Jay Mallin

Clint Woods, Association of Air Pollution Control Agencies.

*Use of real-time sensors to assess misclassification and to identify main sources contributing to peak and chronic exposures. *Juana Maria Delgado-Saborit, University of Birmingham*

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

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*

*Developing multipollutant exposure indicators of traffic pollution: the Dorm Room Inhalation to Vehicle Emissions (DRIVE) study. *Jeremy Sarnat, Emory University*

*Evaluation of alternative sensor-based exposure assessment method. *Edmund Seto, University of Washington*

Real-world vehicle emissions characterization for the Shing Mun Tunnel in Hong Kong and Ft. McHenry Tunnel in the U.S. *Xiaoliang Wang, Desert Research Institute*

Mechanisms of Health Effects

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

Air quality by genomics interactions in a cardiovascular disease cohort. *William Kraus, Duke University*

Composition and oxidative properties of particulate matter mixtures: effects of particle phase state, acidity, and transition metals. *Nga Lee (Sally) Ng, Georgia Institute of Technology*

*Understanding the health effects of isoprene-derived particulate matter enhanced by anthropogenic pollutants. *Jason Surratt, University of North Carolina–Chapel Hill*

GLOBAL HEALTH

Burden of disease attributable to major air pollution sources in India. *GBD MAPS Working Group*

Household air pollution and non-communicable disease. *Susan Anenberg, George Washington University and Environmental Health Analytics*

Impact of shipping sources on air quality and burden of disease in Shanghai, Yangtze River Delta. *China Shipping Working Group*

Jay Mallin

Xiaoliang Wang, Desert Research Institute (left); and Haruya Sakai, Japan Automobile Research Institute.

Financial Summary 2016–2017

HEI made significant progress in fiscal year 2017 on initiatives in our Health Effects of Air Pollution program, moving forward with our systematic look at whether there are effects at low levels of exposure, and examining the potential effects of traffic exposure in its broader context. We have also strengthened our Global Burden of Disease from Major Air Pollution Sources (GBD MAPS) project and other international efforts. These activities were made possible by our core sponsors with additional funding from government, industry, and foundations. In addition, we made significant progress in implementing a new Energy Research Program concerning unconventional oil and gas activities, supported by separate funding. Our goal continues to be to apply the maximum part of our resources to fund scientific expenditures.

STATEMENTS OF FINANCIAL POSITION

	June 30	
	2017	**2016**
Assets		
Cash and cash equivalents	$1,074,243	$651,213
Restricted cash	147,390	147,281
Contributions receivable	62,779	287,068
Unbilled incurred costs on grants	2,531,924	1,406,925
Prepaid expenses	52,835	23,931
Office equipment, office furniture and fixtures, and leasehold improvements, net	123,535	66,362
Total assets	**$3,992,706**	**$2,582,780**
Liabilities and Net Assets		
Liabilities:		
Contracted research payables	$935,654	$1,141,897
Accrued contracted research	1,179,300	778,590
Other accounts payable and accruals	36,019	456,819
Line of credit	401,617	—
Total liabilities	**2,552,590**	**2,377,306**
Unrestricted net assets	512,692	205,474
Temporarily restricted net assets	927,424	0
	1,440,116	205,474
Total net assets	**1,440,116**	**205,474**
Total liabilities and net assets	**$3,992,706**	**$2,582,780**

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

STATEMENTS OF ACTIVITIES

	Years Ended June 30	
	2017	2016
Changes in unrestricted net assets:		
Revenues and support:		
EPA grants for the Health Effects of Air Pollution Program	$5,124,999	$5,141,543
Other industry contributions	4,363,502	3,996,982
Other non-federal grant and contract revenue	803,573	370,649
Energy Research Program grant	275,000	225,000
Other revenues	54,957	70,066
Total revenues and support	**10,622,031**	**9,804,240**
Expenses:		
Research programs:		
Research studies	4,368,564	4,188,266
Research planning and study selection	408,956	415,652
Scientific study management	251,971	300,959
Scientific study review	223,964	288,799
Scientific publication and communication	760,489	732,869
	6,013,944	**5,926,545**
Special scientific projects:		
Diesel Epidemiology		140,158
Energy Research	363,441	511,105
Global Health Science	1,074,810	492,063
	1,438,251	**1,143,326**
Total scientific expense	7,452,195	7,069,871
Administration	1,935,194	2,224,435
Total expenses	**9,387,389**	**9,294,306**
Net increase (decrease) in net assets	**1,234,642**	**509,934**
Net assets at beginning of year	**205,474**	**(304,460)**
Net assets at end of year	**$1,440,116**	**$205,474**

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