HEI Releases Initial Results of Studies Assessing Low-Exposure Effects

In November, HEI published Phase 1 reports from two in its trio of ongoing studies evaluating the extent to which air pollution at low levels of exposure may have consequences for public health. These major reports are based on research conducted by two teams of investigators, using U.S. and Canadian data. Results from the third study in this program — focused on Europe — are forthcoming.

Levels of most ambient air pollutants have declined significantly in the United States and many Western countries over several decades. Recent epidemiological studies, however, have suggested an association between exposure to low levels of ambient air pollution — even below the U.S. National Ambient Air Quality Standards (NAAQS) — and adverse health effects. In view of the importance of such findings, HEI in 2014 issued a request for applications seeking research to investigate this question further. HEI funded three studies under this program, each using state-of-the-art exposure methods and very large populations, based in the United States, Canada, and Europe.

The low-exposure-level studies are scheduled to be completed in mid-2020. In 2018, in order to inform the U.S. Environmental Protection Agency reviews of the NAAQS for fine particles and ozone, HEI requested Phase 1 reports from the U.S. and Canadian investigators, and appointed the Low-Exposure Epidemiology Studies Review Panel to review their results and write commentaries.

U.S. Cohort Study
As presented in Research Report 200, Assessing Adverse Health Effects of Long-Term Exposure to Low Levels of Ambient Air Pollution, Francesca Dominici and her colleagues at Harvard University used Medicare data for...
61 million Americans, ages 65 and older and enrolled between 2000 and 2012. They used both cohort and case–crossover designs to analyze the long- and short-term associations between exposure to PM$_{2.5}$ and ozone and all-cause mortality. By combining air monitoring, satellite, transport modeling output, and other data, the investigators developed hybrid models for the continental United States to estimate fine particle and ozone levels at 1 km $\times$ 1 km grids.

For both long- and short-term exposures, Dominici and her team report associations between nonaccidental all-cause mortality and PM$_{2.5}$ and ozone at concentrations at and below the NAAQS (12 µg/m$^3$ PM$_{2.5}$ and 70 ppb ozone); these associations were robust to most adjustments for potential confounding by lifestyle and behavioral factors for which data were available. Various sensitivity analyses also did not substantially change the findings of association.

**Canadian Cohort Study**

*Research Report 203, Mortality–Air Pollution Associations in Low-Exposure Environments (MAPLE)*, presents the findings of Mike Brauer at the University of British Columbia and his colleagues, who used a cohort of approximately 9 million Canadians, based on census data. They combined satellite data, ground-level measurements, atmospheric modeling data, and land-use covariates to estimate PM$_{2.5}$ exposures at a fine resolution across North America from 1981–2016.

Brauer and colleagues report associations between nonaccidental mortality and PM$_{2.5}$ concentrations at and below the annual U.S. ambient air quality standard of 12 µg/m$^3$. These associations were robust to most adjustments for potential confounding by lifestyle and behavioral factors, and by exposure to nitrogen dioxide, although effects of ozone exposures on the main PM$_{2.5}$ results need further exploration.

**Need for Further Analysis**

In its independent review, the Review Panel concluded that both studies have conducted extensive and innovative sets of initial analyses in these very large air pollution and health data sets; in addition, both studies add to the growing body of epidemiological evidence regarding associations between air pollution and health effects at low ambient air pollution concentrations, and advance the science considerably. However, the Panel also noted several uncertainties in each of the studies, and it awaits the extensive further analyses underway before reaching full conclusions on the air pollution and public health implications of this important research.

Research Reports 200 and 203 are available for downloading, free of charge, at www.healtheffects.org. For more information, contact Eleanne van Vliet, evanvliet@healtheffects.org.

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**Upcoming Joint Meeting in Brussels to Inform EU Air Quality Policies**

To help inform air quality decisions in the European Union, HEI, the World Health Organization, the International Society for Environmental Epidemiology, and the European Respiratory Society plan to hold a joint meeting on January 21–22, 2020 in Brussels, Belgium (see draft agenda). The event, also supported by the European Commission, will update a similar workshop that HEI helped organize in Brussels during the European Union’s “Year of Air” (2013). After the workshop, a briefing on research results will be presented to the European Parliament.

For more information, contact jboogaard@healtheffects.org. To request attending the meeting, contact roberta.sadauskaite@ersnet.org. (Note that space may be limited.)
Michael Jerrett, an internationally recognized expert in geographic information science for exposure assessment and spatial epidemiology, recently joined the HEI Review Committee. He is a full professor and the chair of the Department of Environmental Health Sciences, as well as director of the Center for Occupational and Environmental Health, at the Fielding School of Public Health, University of California, Los Angeles.

Jerrett earned his Ph.D in geography from the University of Toronto. Over the past 23 years, he has researched how to characterize population exposures to air pollution, how to determine the social distribution of these exposures among different groups (e.g., low vs. high income), and how to assess the health effects from environmental exposures. He has worked extensively on how the built environment affects exposures and health, particularly the role of parks and open spaces on physical activity promotion and obesity prevention.

Jerrett has published some of the most widely cited papers in the fields of exposure assessment and environmental epidemiology in leading journals, including *The New England Journal of Medicine*, *The Lancet*, *Proceedings of the National Academy of Sciences of the United States of America*, and *Nature*.

In 2009, the National Academy of Sciences appointed Jerrett to the Committee on Human and Environmental Exposure Science in the 21st Century, which issued its report, *Exposure Science in the 21st Century: A Vision and a Strategy*, in 2012. He also served on the National Academy of Sciences Standing Committee on Geographical Sciences from 2016 to 2019. [HEI]

![Michael Jerrett](image)

**HEI Update**

**Fall 2019**

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**Communicating the Science**

**Epidemiological Insights**

In August, HEI staff attended the 31st annual conference of the International Society for Environmental Epidemiology (ISEE 2019) in Utrecht, the Netherlands. HEI had a strong presence in discussions of the history and future of environmental epidemiology.

Hanna Boogaard of HEI and Francesco Forastiere (King’s College London, UK and HEI Panel on the Health Effects of Long-Term Exposure to Traffic-Related Air Pollution) organized a symposium on new health research on low-level ambient air pollution. HEI President Dan Greenbaum spoke on the implications of such research for future risk–benefit assessments and regulations.

Manolis Kogevinas of ISGlobal and Kristie Ebi, University of Washington.

HEI Consulting Scientist Aaron Cohen and Jon Samet of the Colorado School of Public Health organized a symposium on issues and challenges of estimating the global risk and burden of particulate air pollution exposure. HEI’s State of Global Air team distributed materials in the exhibition hall promoting its data-rich website at [www.stateofglobalair.org](http://www.stateofglobalair.org).

HEI staff highlighted other activities in the poster session. Boogaard and Allison Patton presented posters on the protocol and early results of paper screening in HEI’s ongoing systematic literature review on the health effects of long-term exposure to traffic-related air pollution. Anna Rosofsky presented a poster on HEI-Energy’s review of the epidemiology literature on human health effects associated with unconventional oil and gas development.

**Diesel Emissions and Ultrafines**

HEI Director of Science Rashid Shaikh and President Dan Greenbaum communicated HEI’s latest findings at several events this fall.

In September, Greenbaum presented “The Future is Urban: What Will That Mean for Transportation?” at the Commercial Vehicle Engineering Conference, sponsored by SAE International in Indianapolis, Indiana. For the large number of heavy-duty vehicle and emissions engineers in attendance, he highlighted significant trends that are shaping the future of urban air quality.

In early October, Shaikh was the keynote speaker at a conference organized by the Mining Diesel Emissions Council in Toronto. Since the late 1990s, the Council has provided a global forum to disseminate research on how to control diesel engine emissions. Shaikh summarized HEI’s studies on emissions from modern diesel engines that strongly support such controls.

Later in October, Shaikh addressed the National Association of Clean Air Agencies’ fall membership meeting in Washington, D.C. He described scientific evidence on the potential health impact of ambient ultrafine particles and summarized findings of the 2013 HEI report on ultrafines, results of a recent review for the German Umweltbundesamt, and other evidence. [HEI]

From left, Manolis Kogevinas, David Savitz, Bob O’Keefe, and Kristie Ebi at the ISEE conference.

In a workshop on “Developing Credible Research Partnerships with Industry,” HEI Vice President Robert O’Keefe presented on HEI’s success and continuing challenges in engaging industry and its regulators in research to advance science and public health. HEI Research Committee Chair David Savitz, Brown University, led the discussion; also presenting were Ruth E. Shaw, Cameographics, Layout and Composition
HEI’s Panel on the Health Effects of Long-Term Exposure to Traffic-Related Air Pollution met with HEI staff in Boston on October 30–31 to apply its systematic approach to search the epidemiological literature on long-term exposure to traffic-related air pollution and selected health outcomes, assess study quality, summarize results, and reach conclusions about the body of evidence, as reflected in its protocol (www.healtheffects.org/system/files/TrafficReviewProtocol.pdf). The protocol has been largely based on standards set by the Cochrane Collaboration, the World Health Organization, and the National Institute of Environmental Health Sciences.

The Panel was appointed in 2018 by HEI’s Board of Directors following the publication of HEI’s well-cited 2010 critical review. HEI expects to publish the Panel’s findings as a Special Report in Fall 2021. Further information is available online at www.healtheffects.org/air-pollution/systematic-literature-review-traffic-related-air-pollution, or contact Hanna Boogaard at HEI, jboogaard@healtheffects.org.