New results on risk of mortality associated with exposure to low concentrations of ambient air pollution in a cohort of 68.5 million older Americans

Health Effects Institute
February 16, 2022

The webinar will begin shortly.

If you experience any logistical difficulties, please contact us using the “Chat” box or by email: Rshavers@healtheffects.org

Please put your questions in the Q&A box.
Why Study the Health Effects of Low Levels of Air Pollution?

HEI Webinar, February 16, 2022

Dan L Crouse, Health Effects Institute
Why Study the Health Effects of Low Levels of Ambient Air Pollution?

Levels of ambient air pollution have decreased over the past few decades in North America & other developed regions.

In the 2010s, several studies reported associations between health outcomes and air pollution at levels below current air quality standards.

Limited evidence, especially about exposure-response functions at the low end of the exposure curve.

Critical questions to answer for risk assessment and regulation:
- At what level should ambient air quality standards be set?
- To what level of exposure should we estimate health impacts (and benefits of a reduction)?
The systematic review included studies up to October 2018.
Growing body of evidence, including studies in other geographic regions

All-cause mortality and long-term exposure to low level air pollution in the ‘45 and up study’ cohort, Sydney, Australia, 2006–2015


Environment International 126 (2019) 762–770

Long-term residential exposure to PM$_{2.5}$ constituents and mortality in a Danish cohort

Ulla Arthur Hvidtfeldt, Camilla Geels, Mette Sørensen, Matthias Ketzel, Jibran Khan, Anne Tjønneland, Jørgen Brandt, Ole Raaschou-Nielsen.

Environment International 133 (2019) 105268

Particulate air pollution from different sources and mortality in 7.5 million adults — The Dutch Environmental Longitudinal Study (DUELS)\


Science of the Total Environment 705 (2020) 135778

Examining the Shape of the Association between Low Levels of Fine Particulate Matter and Mortality across Three Cycles of the Canadian Census Health and Environment Cohort

Amenda J. Puppin, Tsara Christidis, Laurie L. Pinault, Dan L. Crouse, Jeffrey R. Brook, Anders Eriksson, Perry Hystad, Chi Li, Randall V. Martin, Jun Meng, Scott Weichenthal, Aaron van Donkelaar, Michael Tjeleken, Michael Buerkle, and Richard F. Burnett.

Environmental Health Perspectives 127(10) October 2019

Long term exposure to air pollution, mortality and morbidity in New Zealand: Cohort study

Simon Hales, June Atkinson, Jayne Metcalfe, Gerda Kusche, Alistair Woodward.

Science of the Total Environment 881 (2021) 149560

Research Open Access

Low concentrations of fine particle air pollution and mortality in the Canadian Community Health Survey cohort

Tanya Christidis, Anders C. Erickson, Amanda J. Pappin, Daniel L. Crouse, Lauren L. Finault, Scott A. Weichenthal, Jeffrey R. Brook, Aaron van Donkelaar, Perry Hystad, Randall V. Martin, Michael Tjeleken, Richard T. Burnett and Michael Buerkle.

Environmental Health 2019 18:88
https://doi.org/10.1186/s12940-019-0581-y

RESEARCH
Overall objectives of RFA 14-3

• Assess the health effects of long-term exposure to low levels of ambient air pollution (all-cause and cause-specific mortality and morbidity).

• Investigate exposure-response functions for PM$_{2.5}$ and other pollutants at low levels.

• Develop statistical and other methods.
Key features of the three studies

• Very large populations, with millions in the US, Canada, and Europe; administrative and traditional cohorts.

• High-quality exposure assessment models, using data from satellites, ground level monitors, other sources, and modeling.

• Development and application of novel statistical methods.
Estimating the Effects of Exposure to Low Levels of Air Pollution – HEI studies

Geographical areas

PI: Michael Brauer, U British Columbia (~ 8 million)

PI: Francesca Dominici, Harvard (~ 60 million)

PI: Bert Brunekreef, Utrecht University (~ 28 million)

Average PM$_{2.5}$ levels:
15 µg/m$^3$ (Europe)
11 µg/m$^3$ (US)
7 µg/m$^3$ (Canada)
Bert Brunekreef

Richard Atkinson (University of London, UK)
Marie-Christine Boutron-Ruault (French Institute of Health and Medical Research)
Kees de Hoogh, Danielle Vienneau (Swiss Tropical and Public Health Institute)
Francesco Forastiere (King’s College London)
John Gulliver (Imperial College, UK)
Ole Hertel (University of Aarhus, Denmark)
Gerard Hoek, Maciej Strak (Utrecht University, Netherlands)
Barbara Hoffmann (University of Düsseldorf, Germany)
Nicole Janssen (National Institute of Public Health and the Environment)
Klea Katsouyanni (University of Athens, Greece)
Goran Pershagen (Karolinska Institute, Sweden)
Annette Peters (Helmholtz Zentrum, Germany)
Ole Raaschou-Nielsen (Danish Cancer Society)
Per Schwarze (Norwegian Institute of Public Health)
Gudrun Weinmayr (University of Ulm, Germany)
Ensuring the Highest Quality from the Studies

Detailed oversight
- Oversight Committee
  • Bi-annual progress reports
  • Annual requests for contract renewal
  • Webinars and presentations at HEI Annual Conference
- QA/QC audits

Intensive Review of Final Reports
- Formed special independent Panel to review the reports and prepare Commentaries

The European Final Report was published in September 2021 and the Canadian Final Report will be published in spring 2022.

Joint analyses are ongoing among the 3 teams.
Mortality and Morbidity Effects of Long-Term Exposure to Low-Level PM$_{2.5}$, BC, NO$_2$, and O$_3$: An Analysis of European Cohorts in the ELAPSE Project by Bert Brunekreef and Colleagues

- Developed new exposure models for all of Europe for PM$_{2.5}$, BC, NO$_2$, and O$_3$.
- Used data from 11 European countries to analyze (a) pooled cohort of 15 well-characterized cohorts and (b) 7 administrative cohorts.
- Both approaches reported PM$_{2.5}$, BC, and NO$_2$ exposures significantly associated with natural-cause, cardiovascular, respiratory, and lung cancer mortality.
- Found increased risks for natural-cause mortality at even the lowest observed concentrations for PM$_{2.5}$, BC, and NO$_2$.


Published September 2021
For today....

The American study was published last month.

- Cohort of 68.5 million older Americans
- Annual exposures to PM$_{2.5}$, NO$_2$, O$_3$
- 3 causal inference approaches, 2 traditional regression approaches
THANK YOU!

Check out our website www.healtheffects.org