What We Have Learned about Effects on Health at Low Levels of Exposure: Evidence from the United States, Canada, and Europe

Bob O'Keefe Health Effects Institute

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Trusted Science • Cleaner Air • Better Health

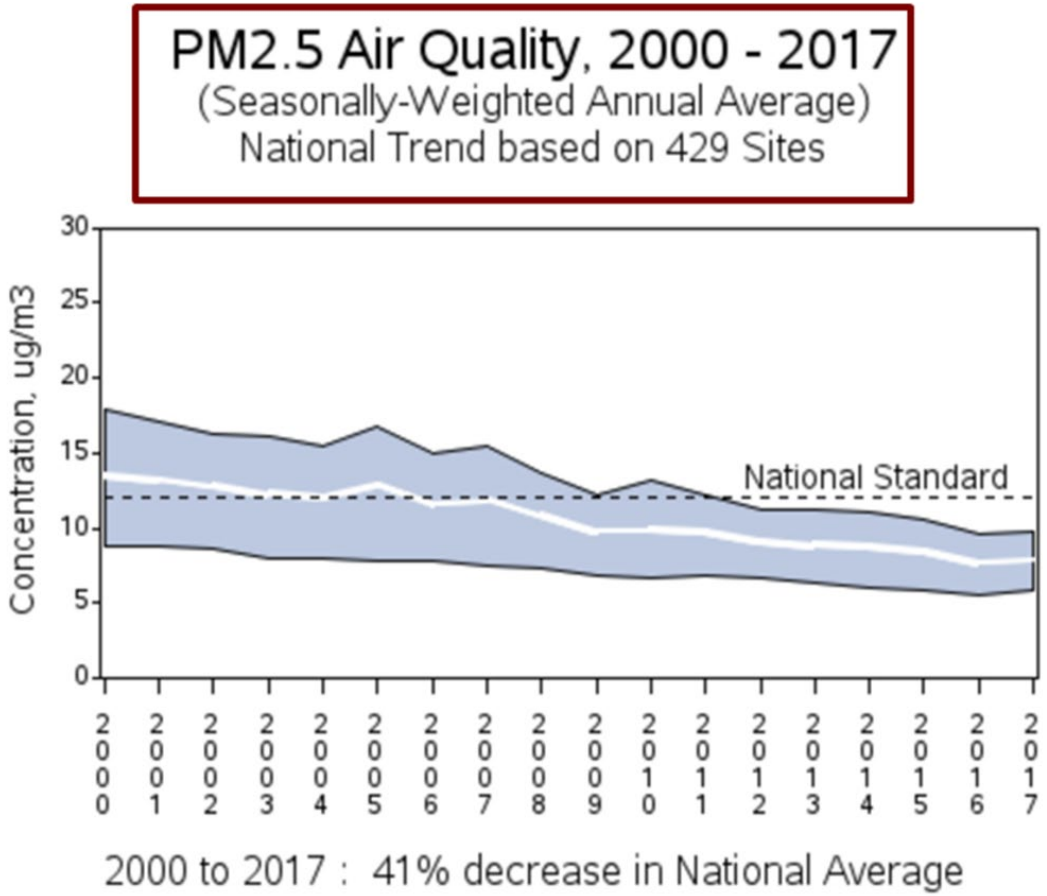
OVERALL OBJECTIVES OF RFA 14-3

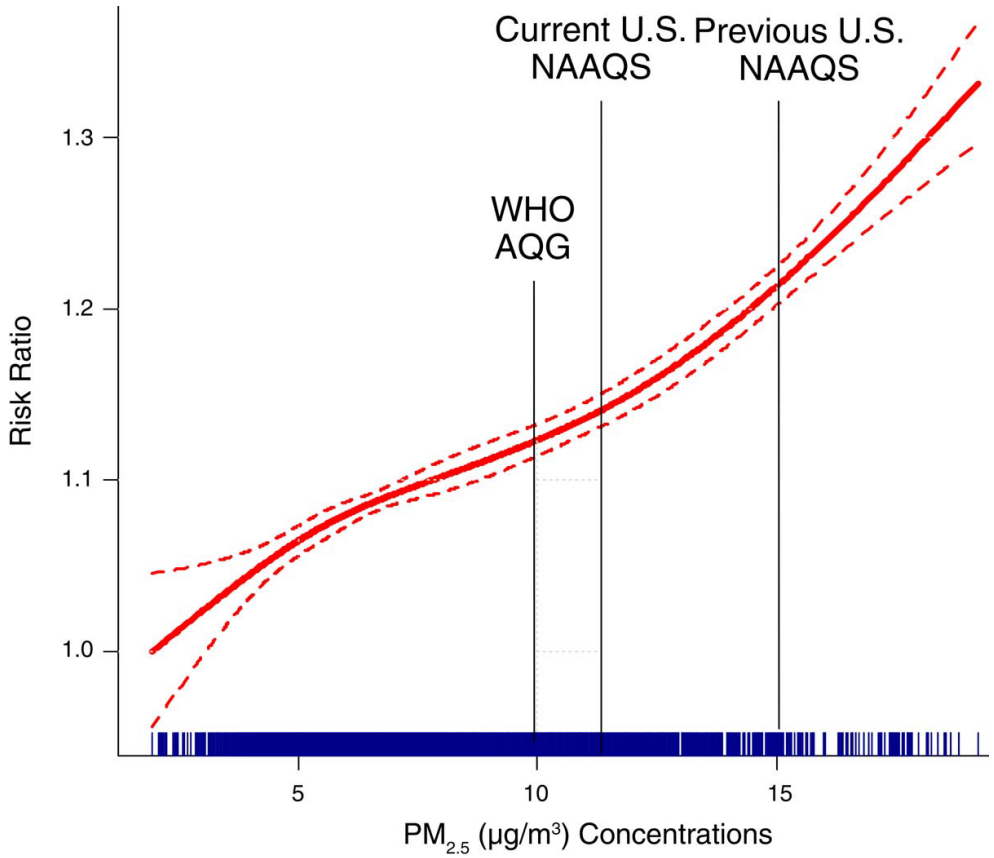
Studies to:

- Assess health effects of exposure to low levels of ambient air pollution on all-cause and cause-specific mortality and morbidity
- Exposure-response function(s) for $PM_{2.5}$ and other pollutants at low levels
- Develop statistical and other methodologies
  - New/improved exposure surfaces and estimates

Motivation for HEI's Low Exposure Studies Program

Declines in Air Pollution yet effects observed at low Levels





Shape of the concentration–response function for mortality associated with fine particulate matter in a Canadian Cohort. (Courtesy R. Burnett)

What are the Policy-relevant Questions These Studies Seek to Help Answer?

- *A Better understanding of Concentration-Response relationships*:
  - Helps understand the shape of the relationship at very low and very high levels
    - E.g., is there a threshold, and at what level?
  - Helps to assess whether a particular exposure may cause a specific effect, and
  - Estimates the public health burdens from an exposure
- *Provides a basis to Inform at least two important policy questions*:
  1. At what level should we set ambient air quality standards?
  2. To what level of exposure should we estimate health impacts?

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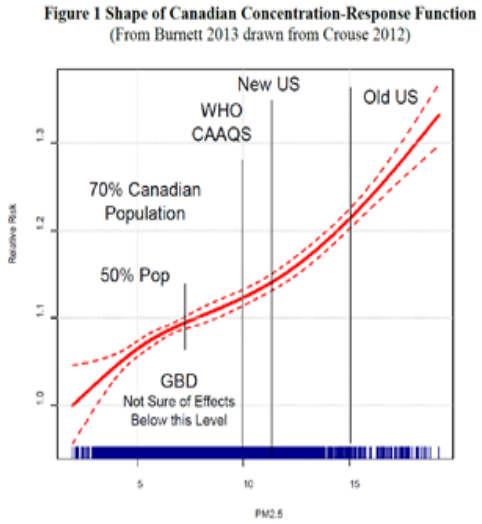
These Studies, When Completed and Reviewed, are Expected to Contribute Significantly by:

- Harnessing exceptionally large data sets to estimate exposure at the lowest levels;
- Considering potential confounders to the maximum extent possible;
- Applying a range of analytic approaches to test sensitivity to model selection – and possible causal inference

Estimating the Effects of Exposure to Low Levels of Air Pollution

Three studies, selected competitively, and have common and unique features:

- Populations with millions in the US, Canada, and Europe; and both administrative and traditional cohorts

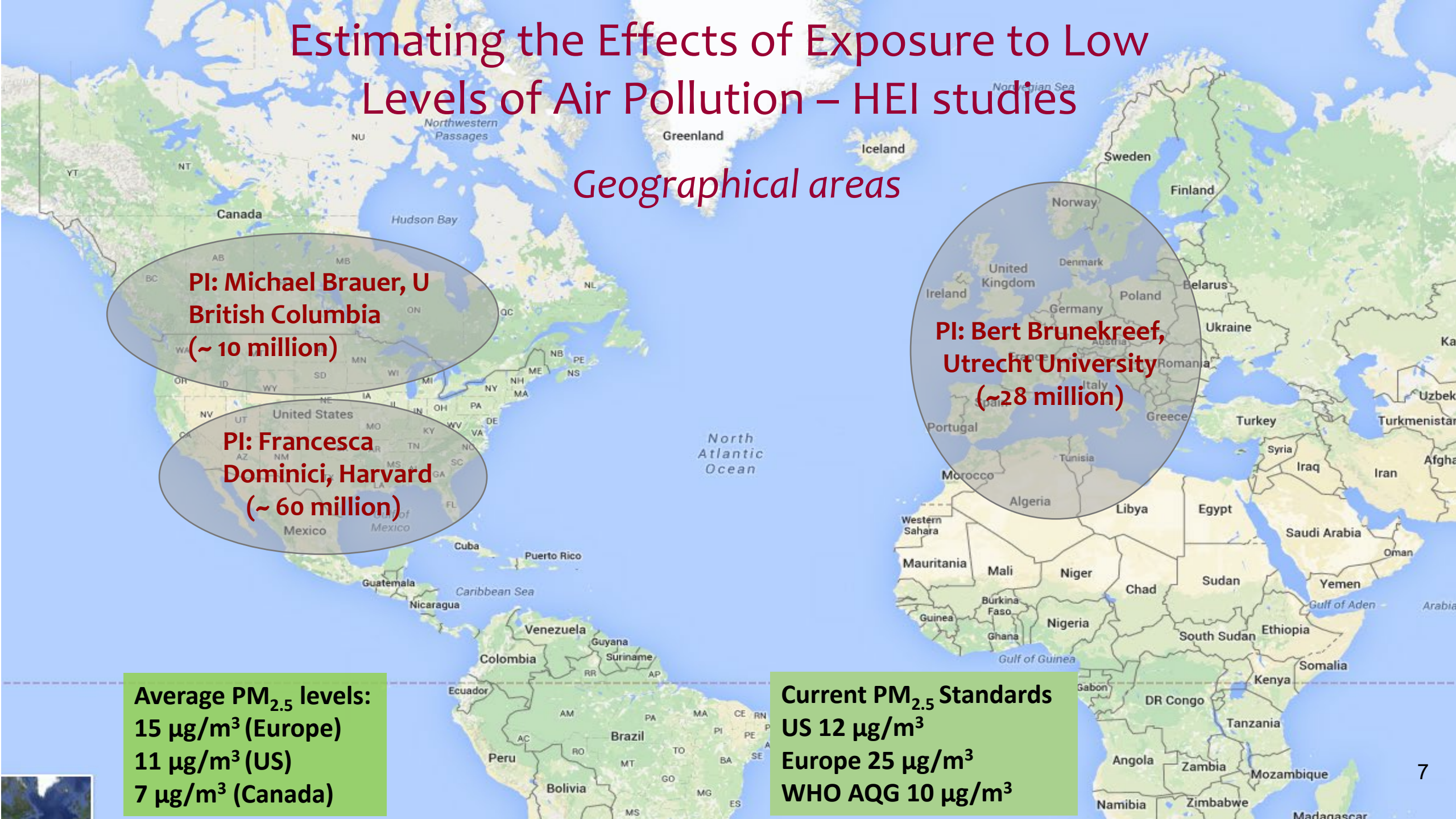


- Satellite data and ground level exposure measurements; and high-quality exposure assessment models at high spatial resolutions

- Development and application of novel statistical methods

Estimating the Effects of Exposure to Low Levels of Air Pollution – HEI studies

Geographical areas



Average $PM_{2.5}$ levels:
15 µg/m³ (Europe)
11 µg/m³ (US)
7 µg/m³ (Canada)

Current $PM_{2.5}$ Standards
US 12 µg/m³
Europe 25 µg/m³
WHO AQG 10 µg/m³

Ensuring the highest quality from the studies

- Detailed and continuing HEI oversight:
  - ***Oversight Committee***, chaired by Jon Samet (Colorado School of Public Health)
    - Bi-Annual Progress reports, webinars, meetings and workshops, QA/QC audits
  - ***Low Exposure Review Panel***, Chaired by Sverre Vedal, University of Washington
    - Detailed Peer Review, Commentary for Each Study
- ***Results today include –***
  - ***Initial findings for US and Canada that were published, after review, in November 2019***
  - ***Final comprehensive results currently in peer review and will be published with commentaries later this year***
- Because of the rich datasets, HEI is now funding additional individual and joint analyses to further test the results, including:
  - Harmonized analyses across all three populations
  - Additional causal analyses
  - Probing of relationships of multiple pollutants, shape and covariates

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THANK YOU

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