Trusted Science for Air Quality Decisions in the Developed and Developing World

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Health Effects Institute

Haagen-Smit Clean Air Awards
Sacramento, California
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The Health Effects Institute
Trusted Science – Cleaner Air – Better Health
www.healtheffects.org

• Independent Non-profit Research Institute since 1980
• Balanced Core Support
  • US EPA and the worldwide motor vehicle Industry
  • Also partnerships with WHO, ADB, EU, US DOE, other industries, foundations
• Independent Board and Expert Science Committees
  • Board agreed to by EPA Administrator and core industry sponsors
  • Research Committee selects all research competitively
  • Separate Review Committee intensively peer reviews all results
• Full Transparency
  • All Results – positive and negative – published
  • Work to make all data accessible to others
• Does not take policy positions
• Impact: Widely cited by US EPA, EU, ARB, IARC, China, India, others
HEI Science
All available at www.healtheffects.org

• **Targeted Research and Reanalysis**
  - Over 350 Studies on a wide variety of air pollutants: PM, ozone, diesel, air toxics, others
  - Exposure, Toxicology, Epidemiology

• **Rapid Scientific Review**
  - E.g. The Health Effects of Exposure to Traffic

• **Global Health**
  - North America, Europe
  - Developing Asia

• **NEW Energy Research program**
  - Potential Exposures and effects from unconventional oil and gas development
HEI Strategic Plan 2015 – 2020

Addressing the Challenges of Multi-pollutant Science

Estimating the Effects of Exposure to Low Levels of Air Pollution

• Three new studies funded after intense competition:
  o Large Populations in the US, Canada and Europe; administrative and traditional cohorts
  o Satellite data and ground level exposure measurements; high quality exposure assessment models at high spatial resolutions
  o Development of new statistical methods
  o Investigator teams with prior experience of productive collaborations

• Detailed HEI Oversight
New HEI studies assessing health effects of low levels of air pollution

Geographical areas

PI: Michael Brauer, U British Columbia
6 million

PI: Francesca Domenici, Harvard
56 million

PI: Bert Brunekreef, Utrecht
25 million

First important results to be published in New England Journal of Medicine next week
Main Features of the Study:

- 3 Centers: UCSF, UNC, Rochester
- 87 healthy, older volunteers exposed to near ambient levels of ozone (0.07 and 0.12 ppm) or clean air while exercising
- Highly standardized protocol and SOPs
- Endpoints studied:
  - Cardiac function (including autonomic balance)
  - Vascular effects (inflammation, endothelial function, prothrombotic changes)
  - Lung function and inflammation

First results to be published next week….

- Plans underway for providing access to data
Ozone Caused no Changes in Heart Rate Variability (5-minute averages) or other CVD endpoints in the healthy adults...
Ozone Did Attenuate the Increase in FEV₁ and FVC with exercise
HEI Strategic Plan 2015 - 2020:
Testing The Impact of Air Quality Actions through Accountability Research

- Regulatory action
- Emissions
  - Atmospheric transport, chemical transformation, and deposition
  - Compliance, effectiveness
- Ambient air quality
  - Human time-activity in relation to indoor and outdoor air quality; uptake, deposition, clearance, retention
- Exposure/dose
  - Susceptibility factors; mechanisms of damage and repair, health outcomes
- Human health
  - Improved actions

Arrows indicate the flow of influence and causality between the various factors.
After substantial numbers of vehicle, fuels, and other actions, air quality improved (Gilliland et al 2017)
Cleaner Air and Improved Lung Health

- Tracked growth in Lung Function in 3 population “cohorts” (2,100 children total) in Southern California 1994 – 2011
  - Checked each year from Age 12 to 17

- Reported improvement in lung function and reduction in symptoms in most recent cohort
  - Who grew up 2007 – 2011 in cleaner air

- Still some questions about other differences among the 3 cohorts (e.g. more Hispanics in the latest one)

- But overall strong relationship of improved air quality with health
HEI Strategic Plan 2015-2020: Global Health

• HEI’s Key Global Initiatives:
  
  • The **Global Burden of Disease**
    • The *Gold Standard* for Public Health Assessments of Air Pollution and other risk factors
  
  • **GBD MAPS**: Source-Specific national and provincial results and targeted analyses

  • **The State of Global Air**
  
    • Our new annual report and interactive website of the latest exposure and health data
    • Tracking progress and setbacks in every country
The Global Burden of Disease (GBD)

- A systematic scientific effort to quantify the magnitude of health loss from disease and injuries in 195 countries around the world from 1990 to 2015
  - E.g. cardiovascular disease, respiratory disease, HIV-AIDS, cancer, road traffic injuries and

- Risks factors associated with those diseases
  - E.g. smoking, diet, high blood pressure, air pollution, overweight

- Organized by the Institute for Health Metrics and Evaluation (IHME), U Wash.

- HEI leadership for outdoor air pollution

- Now updated each year
  - with future attention to a wider range of health effects (e.g. asthma, low birth weight)

GBD 2015
Premature Deaths: Air Pollution among top-ranked global risk factors

Outdoor PM contributed to 4.2 million premature deaths

Figure 1. Global ranking of risk factors for total deaths from all causes for all ages and sexes in 2015.

Explore the rankings further at the IHME/GBD Compare site.
GBD MAPS: Understanding Source Specific Impacts

- Source-specific impacts best inform, drive climate and air pollution control measures

- GBD MAPS: Global Burden of Disease from Major Air Pollution Sources

- Initiative to understand source-specific impacts (e.g. coal, transport)
  - **China, India** in a global context
  - Using GBD methods, data
  - At national, provincial levels

- In partnership with leading Chinese, Indian partners (Tsinghua, IIT-B, Others)

**China results published August 2016; India in Fall 2017**
### Source sector contributions to mean population-weighted ambient PM$_{2.5}$ and PM$_{2.5}$ - attributable deaths in China, 2013.

<table>
<thead>
<tr>
<th>Subsector</th>
<th>Mean PM$_{2.5}$</th>
<th>Deaths</th>
</tr>
</thead>
<tbody>
<tr>
<td>All Ambient PM2.5</td>
<td>54.3</td>
<td>916,000</td>
</tr>
<tr>
<td>Total Coal</td>
<td>21.9</td>
<td>366,000</td>
</tr>
<tr>
<td>Powerplant Coal</td>
<td>5.2</td>
<td>86,500</td>
</tr>
<tr>
<td>Industrial Coal</td>
<td>9.4</td>
<td>155,500</td>
</tr>
<tr>
<td>Non Coal Industrial</td>
<td>5.6</td>
<td>95,000</td>
</tr>
<tr>
<td>Domestic Coal</td>
<td>2.4</td>
<td>41,000</td>
</tr>
<tr>
<td>Domestic Biomass</td>
<td>8.0</td>
<td>136,500</td>
</tr>
<tr>
<td>Traffic</td>
<td>8.2</td>
<td>137,500</td>
</tr>
<tr>
<td>Open Burning</td>
<td>4.1</td>
<td>70,000</td>
</tr>
</tbody>
</table>
LOOKING AHEAD:
Chinese mortality from most sources of ambient PM$_{2.5}$ will grow dramatically by 2030 without substantial new controls.
Coming Soon: GBD MAPS India

GBD MAPS will assess 2015 Sources, and project Historic Case and Modest and Advanced Control scenarios for all sources through 2050.

Industrial and energy sector of growing importance in years ahead

Preliminary: Report in Fall 2017 (Source: IIT Bombay)
The State of Global Air: How Clean is the Air You Breathe?

- A NEW Annual Report and Web Site from HEI highlighting:
  - The levels and health burdens of air pollution in every country
  - A “report” and extensive interactive web site for government officials, NGOs, scientists and citizens
  - Annual in-depth looks as well at:
    - How do the different estimates of health burden – GBD, WHO, IEA, World Bank – compare?
    - Household Air Pollution Burdens and Trends
  - First Report February 2017
State of Global Air 2017:
India “catching up” to China in air pollution exposure, burden...
Extensive Global, Indian and Chinese Coverage

The foul air we breathe

A new international report has drawn attention to the deadly pollutants that pervade the air that people breathe in India and China. The State of Global Air -2017 study, conducted jointly by the Health Effects Institute and the Institute for Health Metrics and Evaluation, quantifies further what has been reported for some time now: that the concentration of tiny particulate matter, with a diameter of 2.5 micrometers or less, is killing millions every year. This is known as PM2.5, and it causes terrible illness and premature death. The health burden of air pollution is now twice as high as it was a decade ago, and the report notes that the number of premature deaths attributable to air pollution has increased by about 30% in the last 15 years.

The report points out that while India is the world’s biggest emitter of carbon dioxide, it is China that has the highest number of air pollution deaths. In 2015, the US-based health research center estimated that China had 1.5 million premature deaths due to air pollution, while India had 1.1 million. The numbers are only set to rise in the future.

The report also highlights the significance of particulate matter in air pollution. Particles less than 10 micrometers in diameter are particularly dangerous, as they can penetrate deep into the lungs and cause serious health problems. The report calls for urgent action to reduce air pollution and protect public health.
State of Global Air 2017, on the air...

Source: Reuters
HEI State of Global Air
-- Active Online Engagement on Six Continents--
Science for Air Quality Decisions in the Developed and Developing World

• HEI: A targeted Strategic Plan to Answer the Most Policy-Relevant Questions
  • Low levels of exposure in North America, Europe
  • High levels – and sources – in developing Asia
• Rigorous Science and intensive peer review
• Communication, communication, communication...
  • To technical and policy audiences
  • In English, Chinese, Hindi, German, and more….
• Results:

  Trusted Science ➔ Cleaner Air ➔ Better Health
Thank You

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