

Determinants of health: dynamics associated with air pollution globally, in the Americas, and the United States

Marcelo Korc

Unit of Climate Change and
Environmental Determinants of Health (CE)

Session 1.2
Evidence on Determinants of Health with a focus on
Air Pollution



WHAT ARE THE SOURCES OF AIR POLLUTION?

Outdoor air pollution affects urban and rural areas and is caused by multiple factors:



Countries cannot tackle air pollution alone.
It is a global challenge we must all combat together.

CLEAN AIR FOR HEALTH #AirPollution

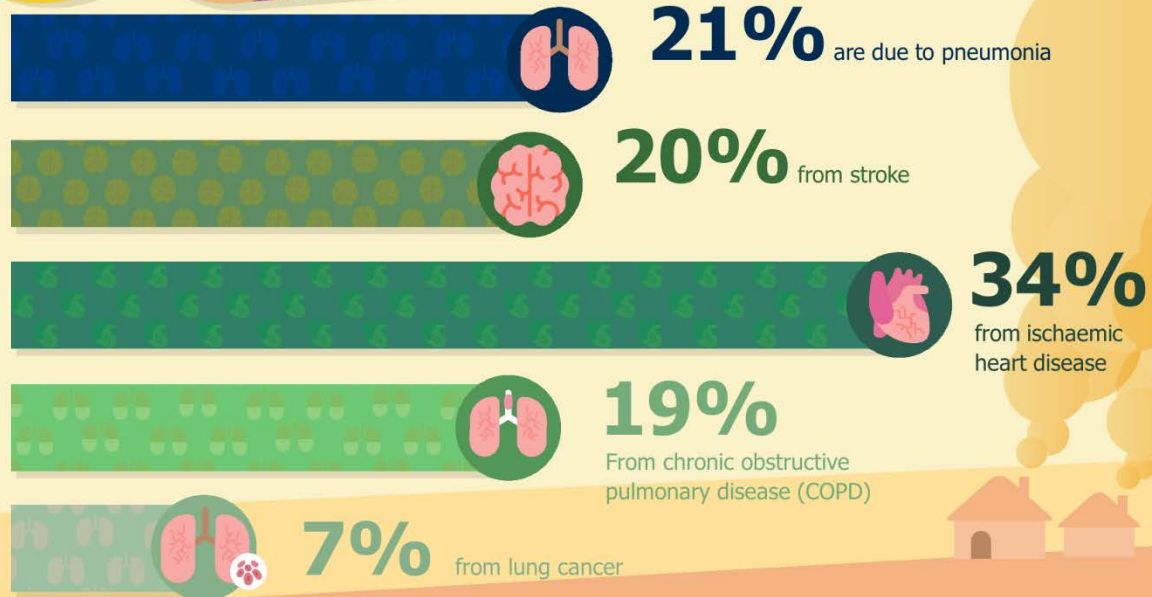


DEATHS LINKED TO OUTDOOR AND HOUSEHOLD AIR POLLUTION



7 million people die prematurely every year from air pollution – both household and outdoor.

Among these deaths:



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How do we estimate the health impact of air pollution?

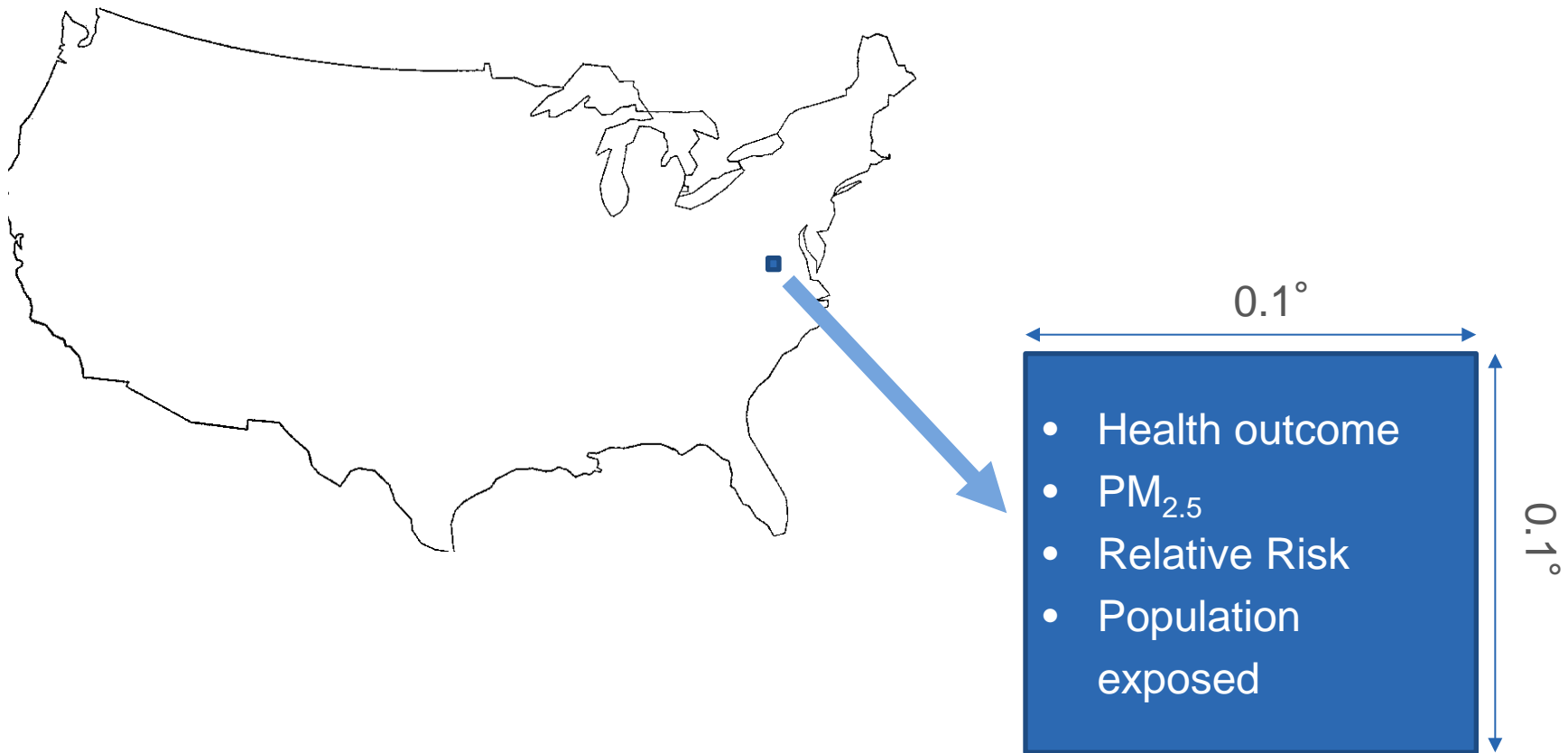
Burden of disease (BD): a measurement to assess the relative importance of a disease, risk, and disability for the entire population.



BD allows decision-makers to compare the effects of different diseases, risks, and disabilities.



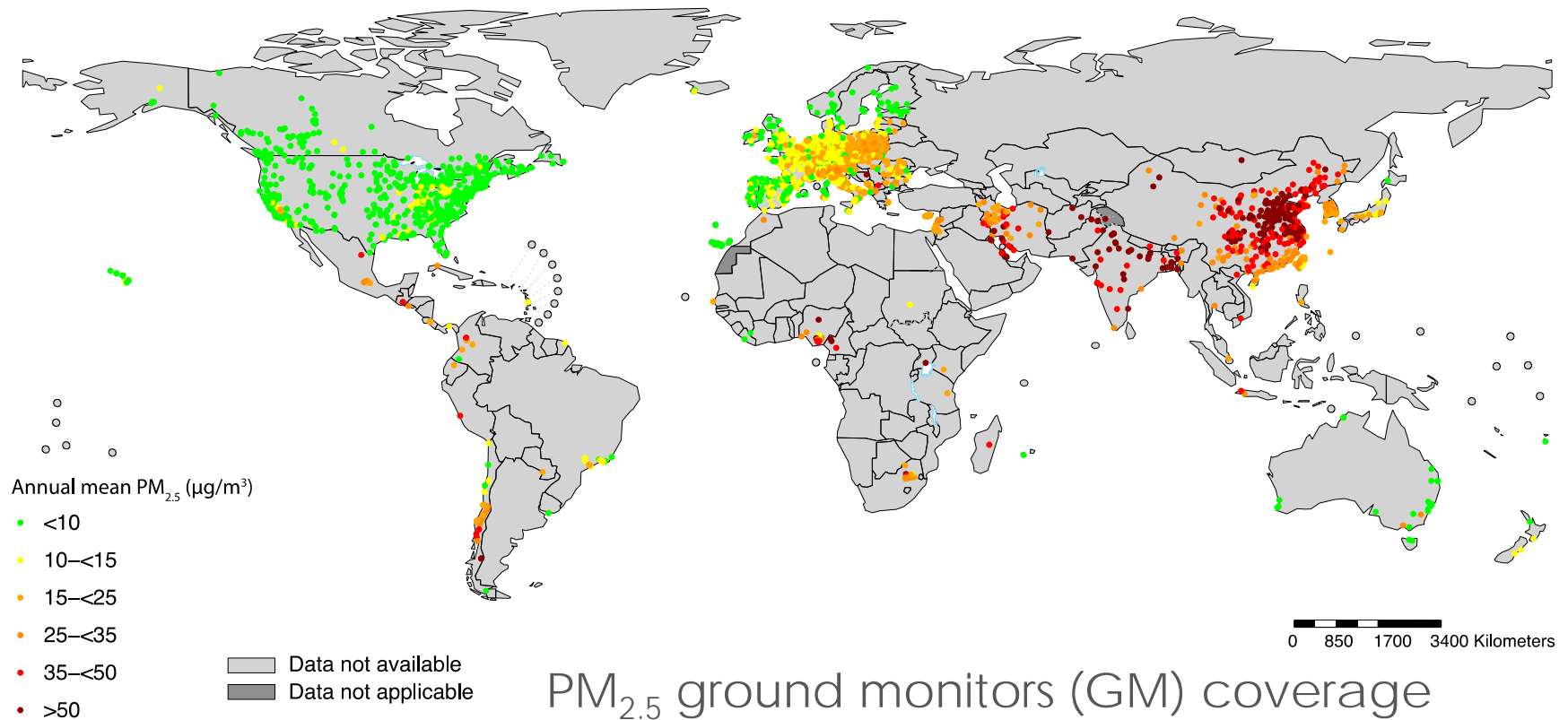
Burden of disease attributable to air pollution



Ambient air quality database

Database coverage for the Americas:

- Number of countries: 20
- Number of cities: 927



PM_{2.5} modelled estimates

Why:

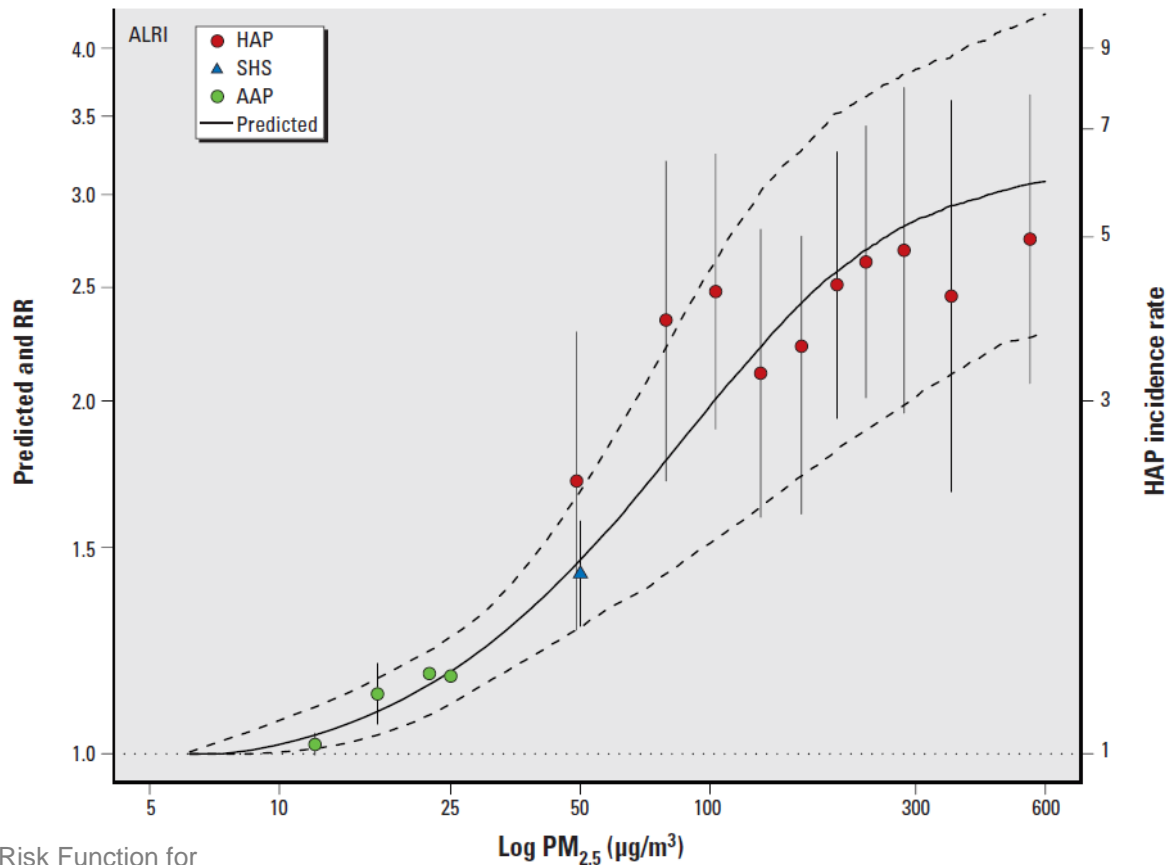
- To cover areas that are not covered by GM measurements.
- To allow the calculation of the exposure, based on population and PM_{2.5} concentration.

How:

- Using the Data Integration Model for Air Quality
 - Satellite remote sensing (Aerosol optical depth) compared with data from more than 9,000 GMs
 - Population
 - Resolution: 0.1° × 0.1° globally (about 11 km × 11 km)



Burden of disease attributable to air pollution



Source:
 Burnett RT, et al. An Integrated Risk Function for
 Estimating the Global Burden of Disease Attributable to
 Ambient Fine Particulate Matter Exposure. *Environmental
 Health Perspectives*. 2014; 122, 4: 397-403.



Global burden of disease attributable to air pollution (2016)

13% of deaths globally attributable to air pollution

| Premature deaths/year | |
|-----------------------|--|
| All causes | 54.7 million (IC 95%, 54.0-55.5 million) |
| Air pollution | 7.04 million (IC 95%, 5.89-8.43 million) |

9% of DALYs globally attributable to air pollution

| DALYs lost/year | |
|-----------------|---|
| All causes | 2,392 million (IC 95%, 2,184-2,631 million) |
| Air pollution | 215 million (IC 95%, 183-252 million) |

Sources: Institute for Health Metrics and Evaluation and World Health Organization

Burden of disease in the Americas attributable to air pollution (2016)

5% of deaths in the Americas attributable to air pollution

| Premature deaths/year | |
|-----------------------|--|
| All causes | 6.70 million (IC 95%, 6.63-6.78 million) |
| Air pollution | 0.32 million (IC 95%, 0.25-0.41 million) |

3% of DALYs in the Americas attributable to air pollution

| DALYs lost/year | |
|-----------------|---|
| All causes | 262.2 million (IC 95%, 233.9-295.7 million) |
| Air pollution | 7.8 million (IC 95%, 6.2-9.8 million) |

Sources: Institute for Health Metrics and Evaluation and World Health Organization

Burden of disease in the US attributable to air pollution (2016)

3% of deaths in the US attributable to air pollution

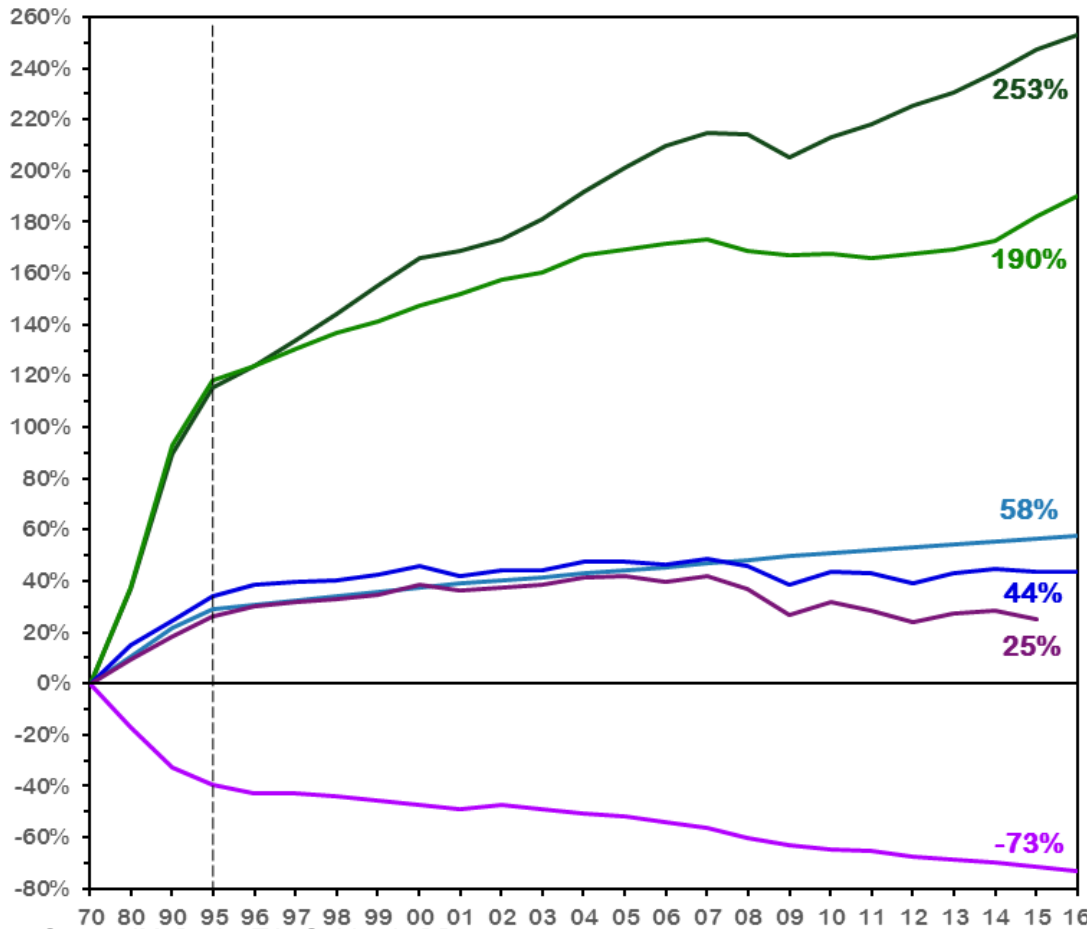
| Premature deaths/year | |
|-----------------------|--|
| All causes | 2.77 million (IC 95%, 2.73-2.82 million) |
| Air pollution | 78 thousand (IC 95%, 55-104 thousand) |

2% of DALYs in the US attributable to air pollution

| DALYs lost/year | |
|-----------------|---|
| All causes | 92.6 million (IC 95%, 81.7-104.7 million) |
| Air pollution | 1.66 million (IC 95%, 1.24-2.15 million) |

Sources: Institute for Health Metrics and Evaluation and World Health Organization

Growth and air pollution in the US



- 
Gross Domestic Product
- 
Vehicles Miles Traveled
- 
Population
- 
Energy Consumption
- 
CO₂ Emissions
- 
Aggregate Emissions
(Six Common Pollutants)

Source: Samet JM, Burke TA, Goldstein BD.

The Trump administration and the environment — heed the science.

N Engl J Med 2017; **376**: 1182–88.

Global challenges to air pollution

- Governance
- Urbanization
- Agriculture/vegetation
- Industrialization
- Energy
- Transportation
- Economic growth
- Housing
- Consumption
- Social inequality



Social inequality and air pollution in the US

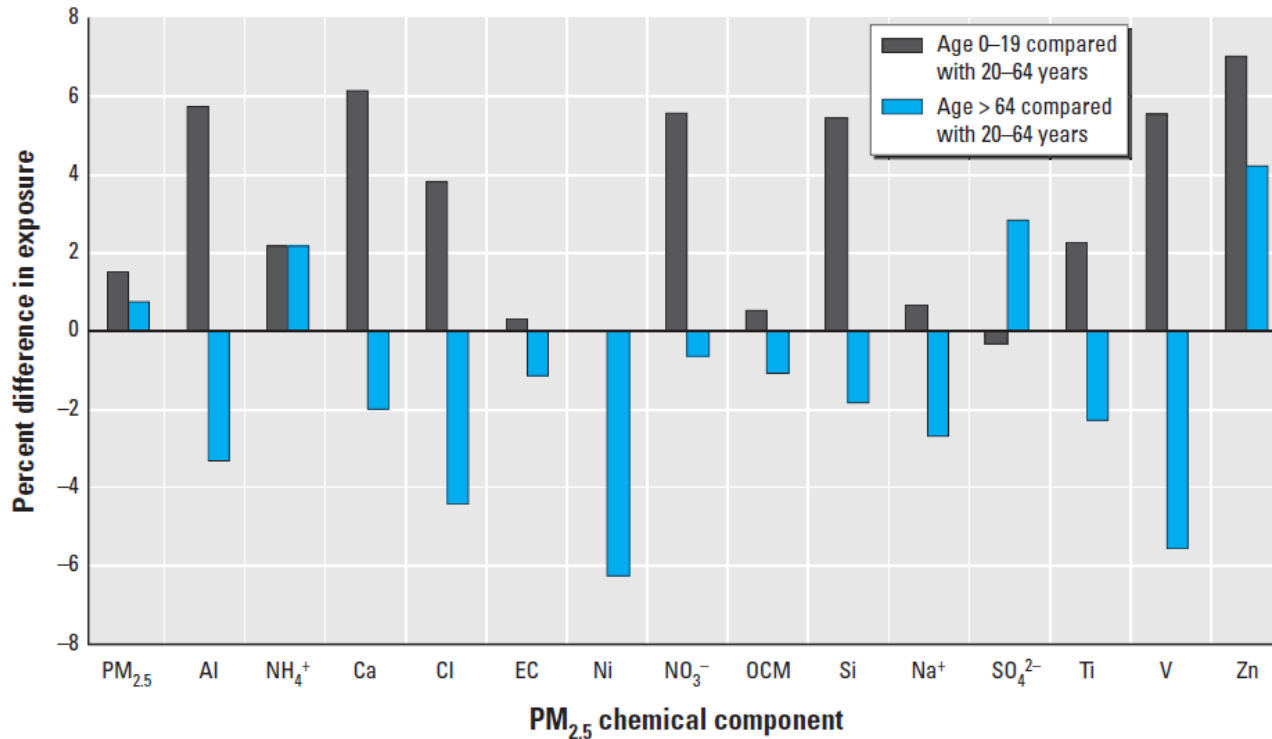


Figure 1. Percentage differences in exposure by age, comparing persons 0–19 or > 64 years of age with those 20–64 years of age.

Source: Bell ML and Ebisu K. Environmental Inequality in Exposures to Airborne Particulate Matter Components in the United States Environmental Health Perspectives. 2012; 120: 12 (1699-1704).



Social inequality and air pollution in the US

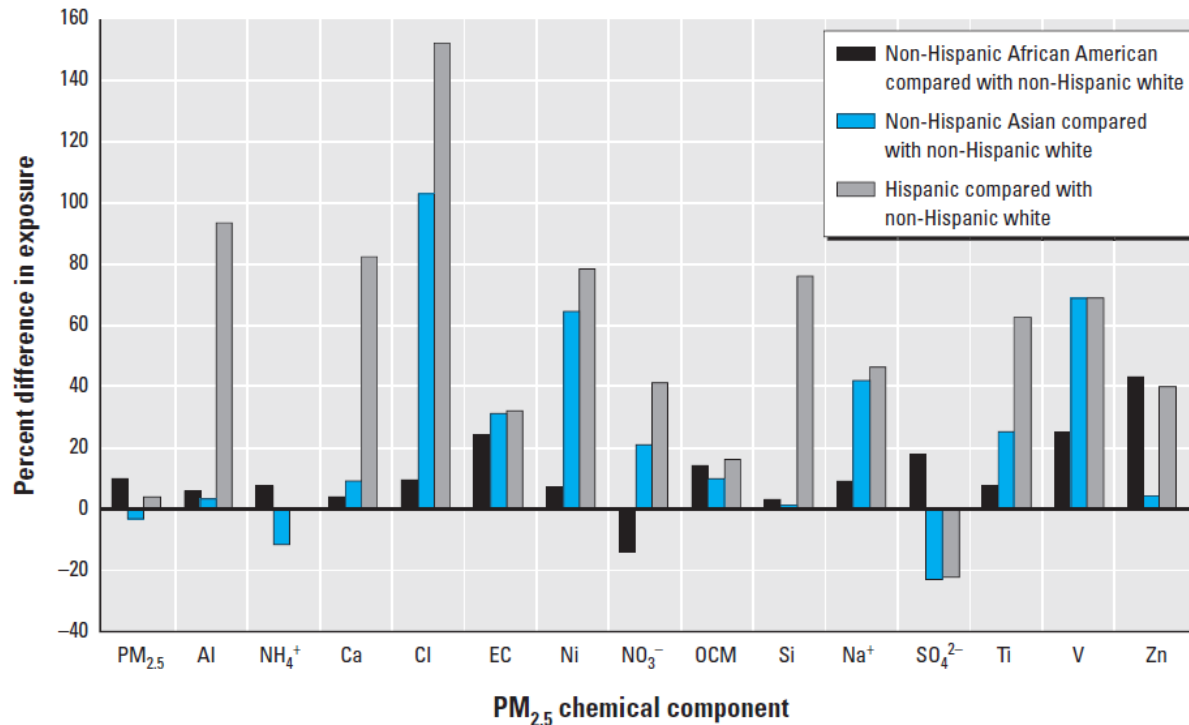


Figure 2. Percentage differences in exposure by race/ethnicity category, comparing non-Hispanic African American and non-Hispanic Asian to non-Hispanic white.

Source: Bell ML and Ebisu K. Environmental Inequality in Exposures to Airborne Particulate Matter Components in the United States Environmental Health Perspectives 2012; 120: 12 (1699-1704).



Social inequality and air pollution in the US

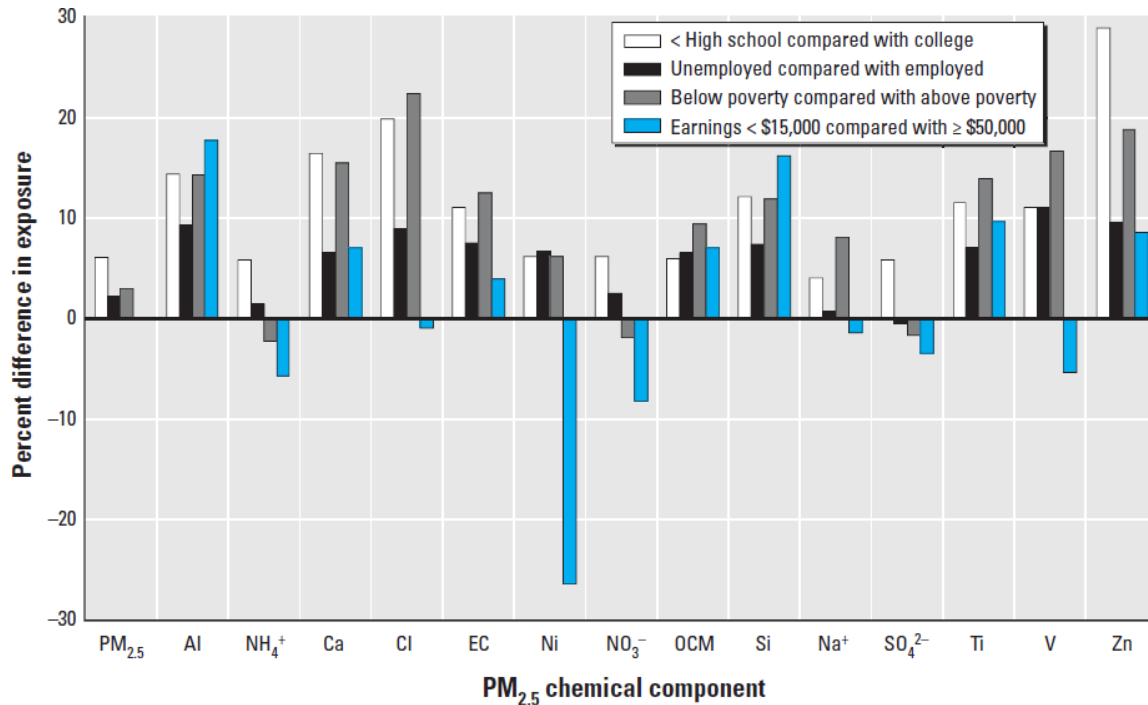


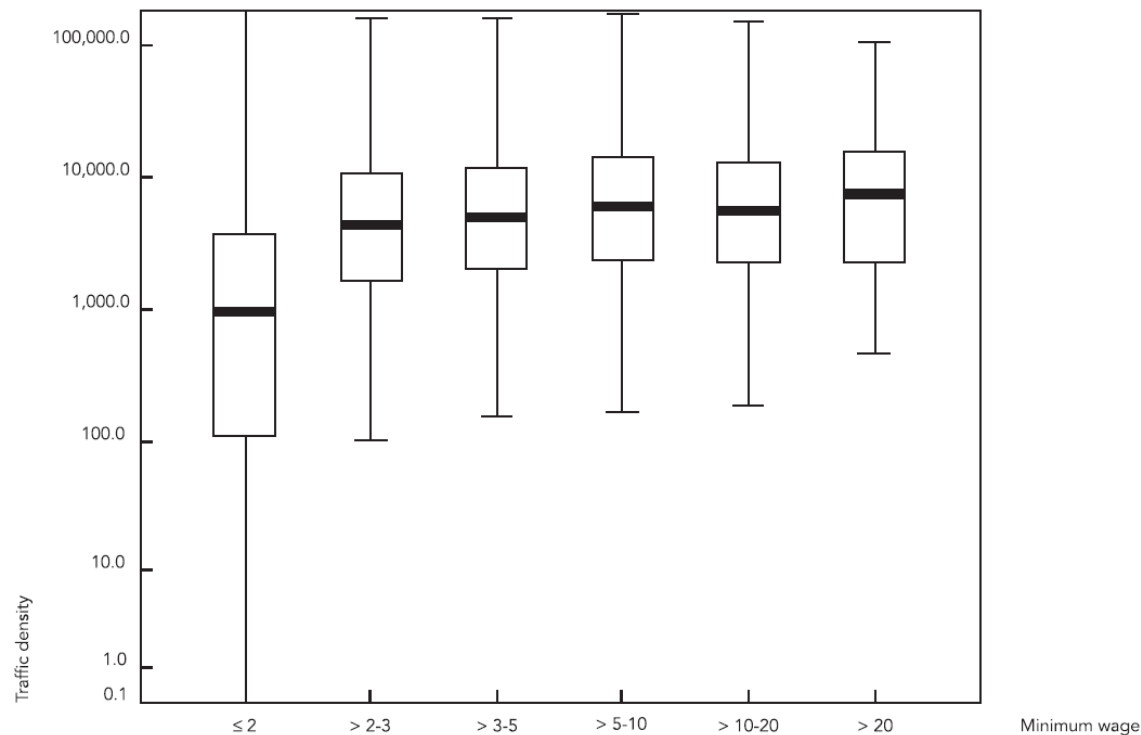
Figure 3. Percentage differences in exposure by category of socioeconomic indicators (education, unemployment, poverty, earnings).

Source: Bell ML and Ebisu K. Environmental Inequality in Exposures to Airborne Particulate Matter Components in the United States Environmental Health Perspectives. 2012; 120: 12 (1699-1704).



Social inequality and air pollution

Traffic density between income groups, by census tract, in the city of São Paulo, Brazil, 2010.



Source: Habermann M., et al. Socioeconomic inequalities and exposure to traffic-related air pollution in the city of São Paulo, Brazil. *Cad. Saúde Pública*, 2014; 30(1):119-125.



Children and air pollution

Children face special risks from air pollution because their lungs are growing and because they are so active and breathe in a great deal of air.

Air pollution affects children before they are born

Air pollution limits lung growth in children



Conclusions

- In 2016, 13% of premature deaths globally were attributable to air pollution, 5% in the Americas and 3% in the US.
- Major challenges include: governance, urbanization, trade, industrialization, energy, transportation, economic growth, gentrification, consumption, and social inequality.
- The relation between social inequalities and air pollution is complex.
- Children face special risks from air pollution. Air pollution can affect children before they are born and limit their lung growth.



Thank you!

