Beyond mortality numbers: communicating health burden for public policy

Katy Walker

Air pollution and Health: Recent Advances to Inform the European Green Deal

Brussels, January 22, 2020

A primary role of public health science is to identify the important factors that affect health, where we can intervene cost effectively to modify or reduce risk, and to track our progress.

Source: Adapted from the Global Burden of Disease project

A comparative risk assessment: Global Burden of Disease Study

- 195 countries
- 84 behavioral, environmental and occupational, and metabolic risks
- 476 risk-outcome pairs that met criteria for probable evidence of causation.
- Updated annually; complete trends back to 1990

- **Air pollution:** $PM_{2.5}$, Ozone, Household air pollution
- 6 health outcomes in 2017
- Deaths, DALYs, YLDs, and rates

IHME Measuring what matters | UBC | TEXAS The University of Texas at Austin

(HEI collaborates to present GBD Air pollution results.)

GBD 2017 Risk Factor Collaborators *The Lancet* **2018**

Burden assessment has played a critical role in identifying air pollution as an important risk factor

- Different methodological approaches have led to varied estimates of the “absolute” burden of air pollution.
- As scientific evidence is evolving, scientific agreement on approaches is converging in many, though not all areas. This creates opportunities and challenges…

BUT

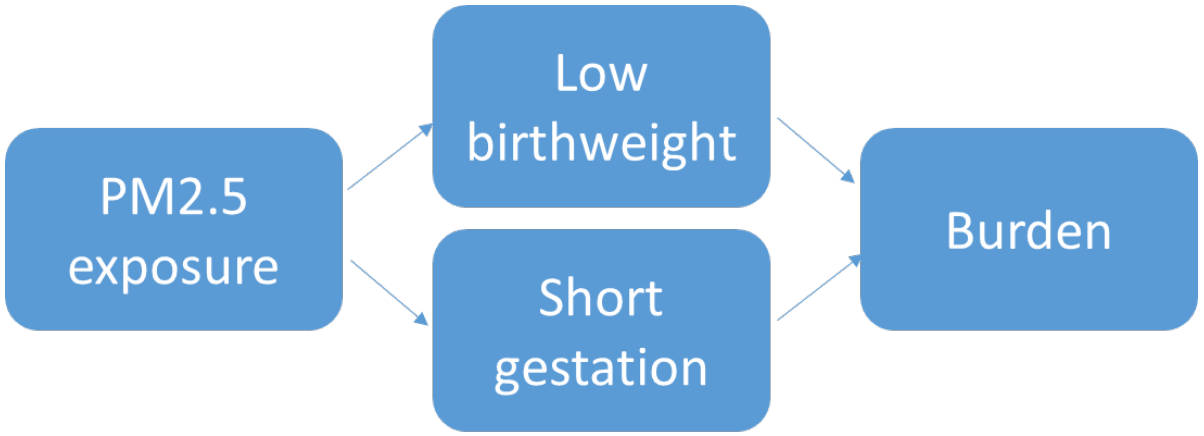
- No one is saying the health burden attributable to air pollution is small!

Some estimates of the burden attributable to air pollution will likely increase with addition of new adverse health outcomes

For example, GBD 2019 is evaluating whether some portion of the burden **low birthweight** and **pre-term birth** may be attributable to $PM_{2.5}$, that is:

- Mortality
- Years lived with disability for neonatal preterm birth
- Estimated burden is specific to ages 0-6 days and 7-27 days

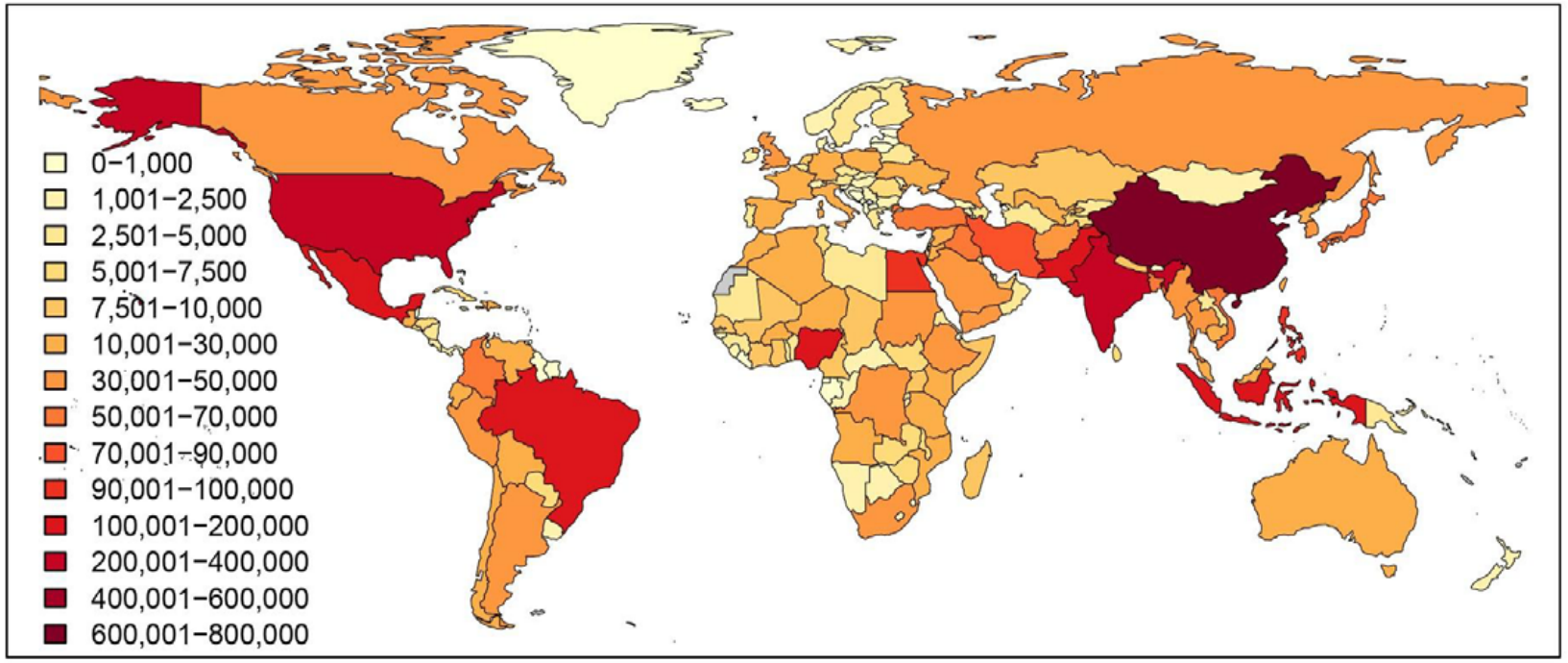
Mediation analysis



Source: M. Brauer

In 2020, GBD will consider additional pollutants (NO_2) as well as new outcomes (pediatric asthma incidence)

4 million (95% UI 1.8-5.2) incident asthma cases attributable to NO_2 in 2015

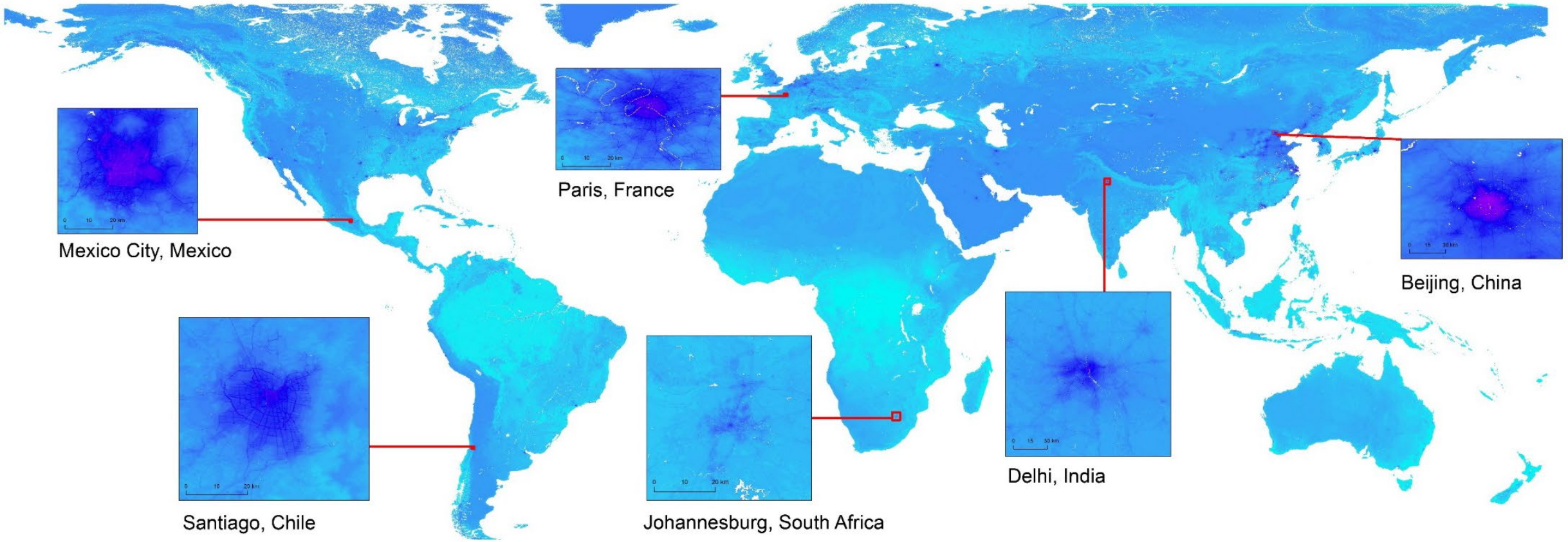


- GBD evidence scoring for concentration-response relationship
- Generate globally gridded surface NO_2 concentrations (Sat, LUR), high resolution (100m),
- Globally gridded, urban, and national burdens of NO_2 on pediatric asthma incidence.

HEI supported.

Achakulwisut P, Brauer M, Hystad P, Anenberg SC. Global, national, and urban burdens of paediatric asthma incidence attributable to ambient NO2 pollution: estimates from global datasets. Lancet Planetary Health
DOI: (10.1016/S2542-5196(19)30046-4)

Increasingly, exposure studies are focused on finer scales to understand who is most affected: e.g. high resolution (100m) NO_2 model



IHME GBD

Larkin A, Geddes J, Martin RV, Xiao Q, Liu Y, Marshall JD, Brauer M, Hystad P. A Global Land Use Regression Model for Nitrogen Dioxide Air Pollution. Environmental Science & Technology. 2017

Back to Bert's point: the value of relative comparisons

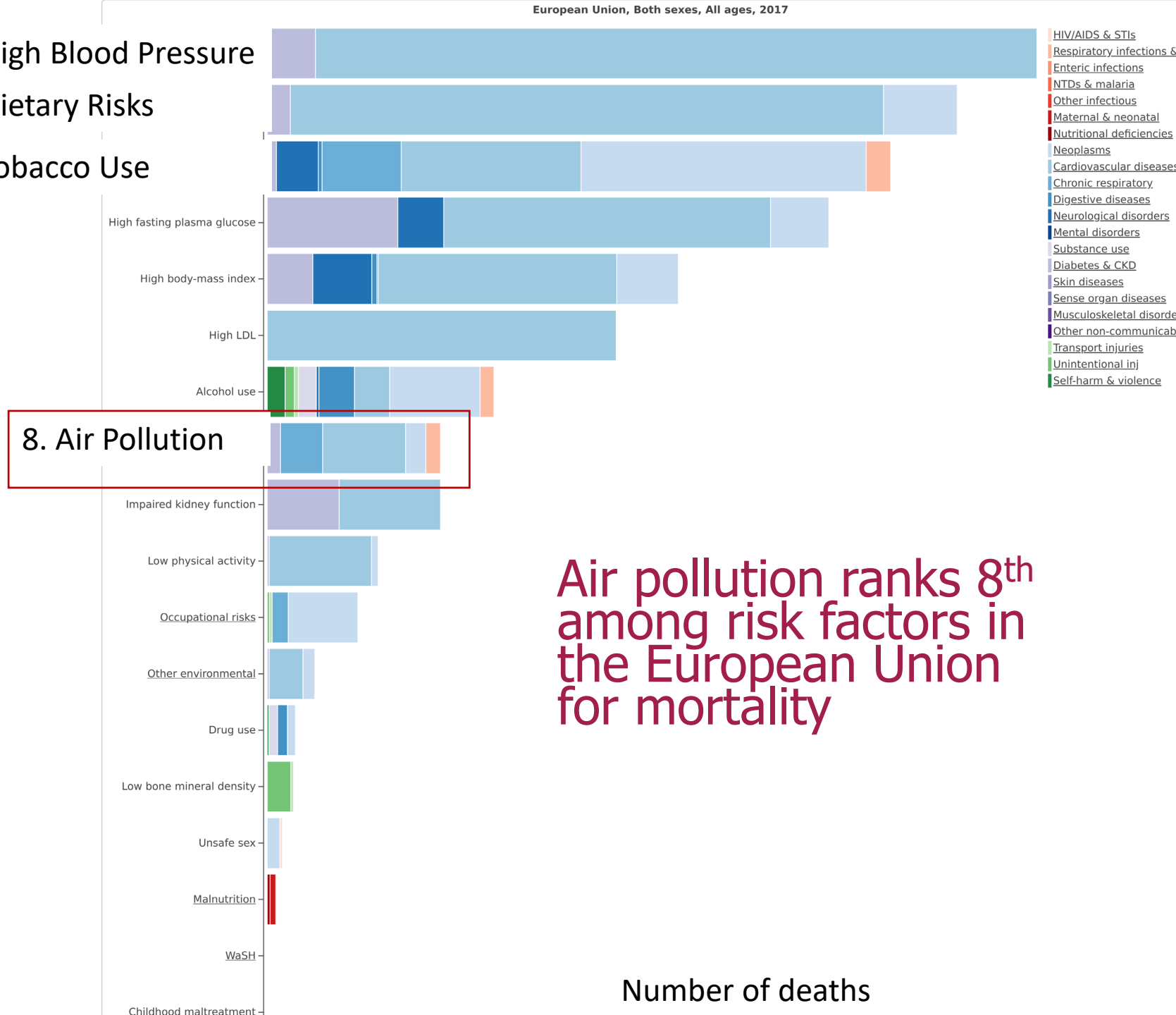
"The N of attributable premature deaths are comparable across different risk factors – as long as they are being calculated the same way"

- How can we set priorities?
- Where can we intervene effectively to modify or reduce risk?

HEI

Relative rankings put risk factors in perspective

- Ranks highest in Malta, Cyprus -**7th**
- Ranks lowest in Finland – **12th**
- Compares with **5th** ranking globally
- Top risk factors vary from country to country

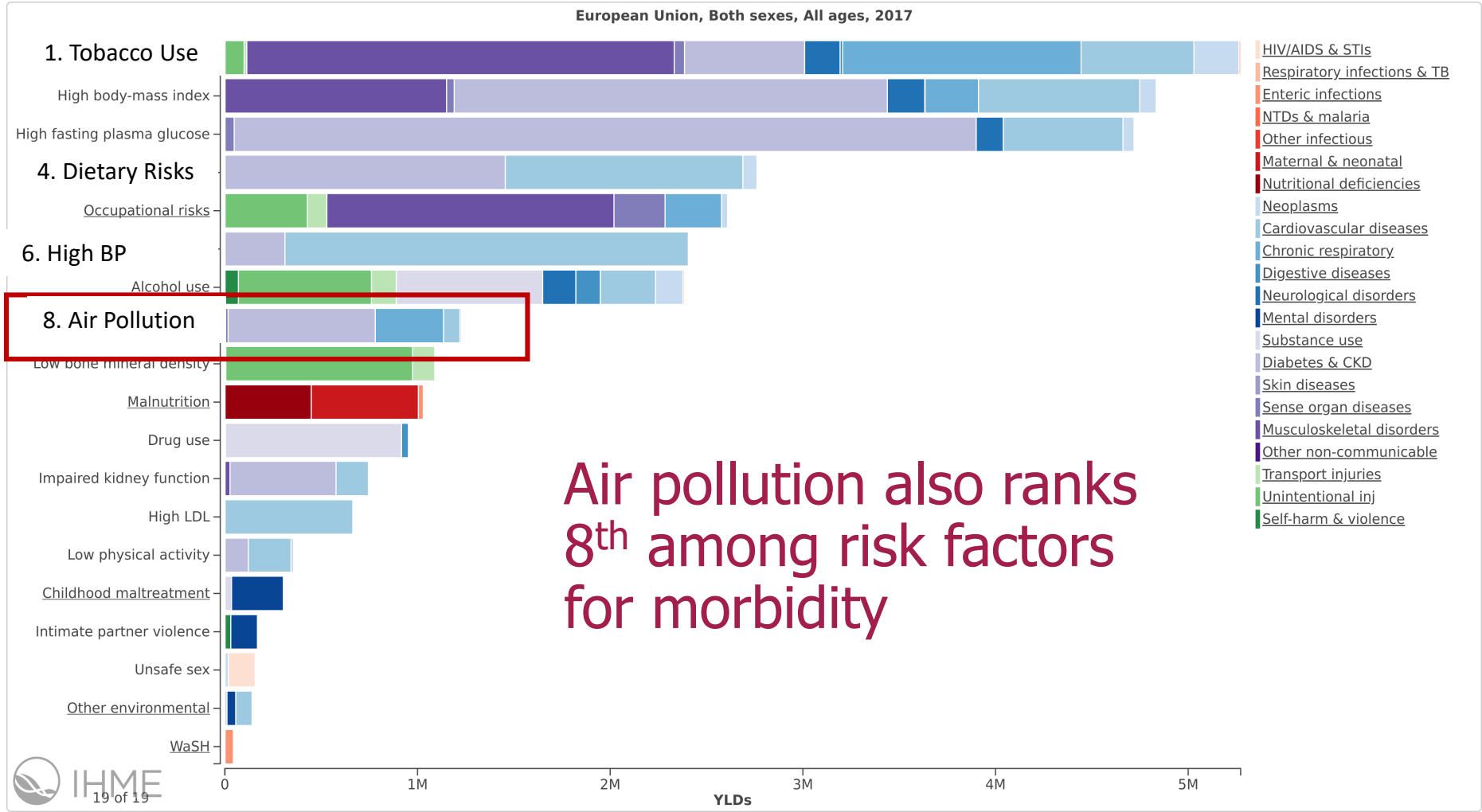


Air pollution ranks 8th among risk factors in the European Union for mortality

Number of deaths

Relative rankings put risk factors in perspective

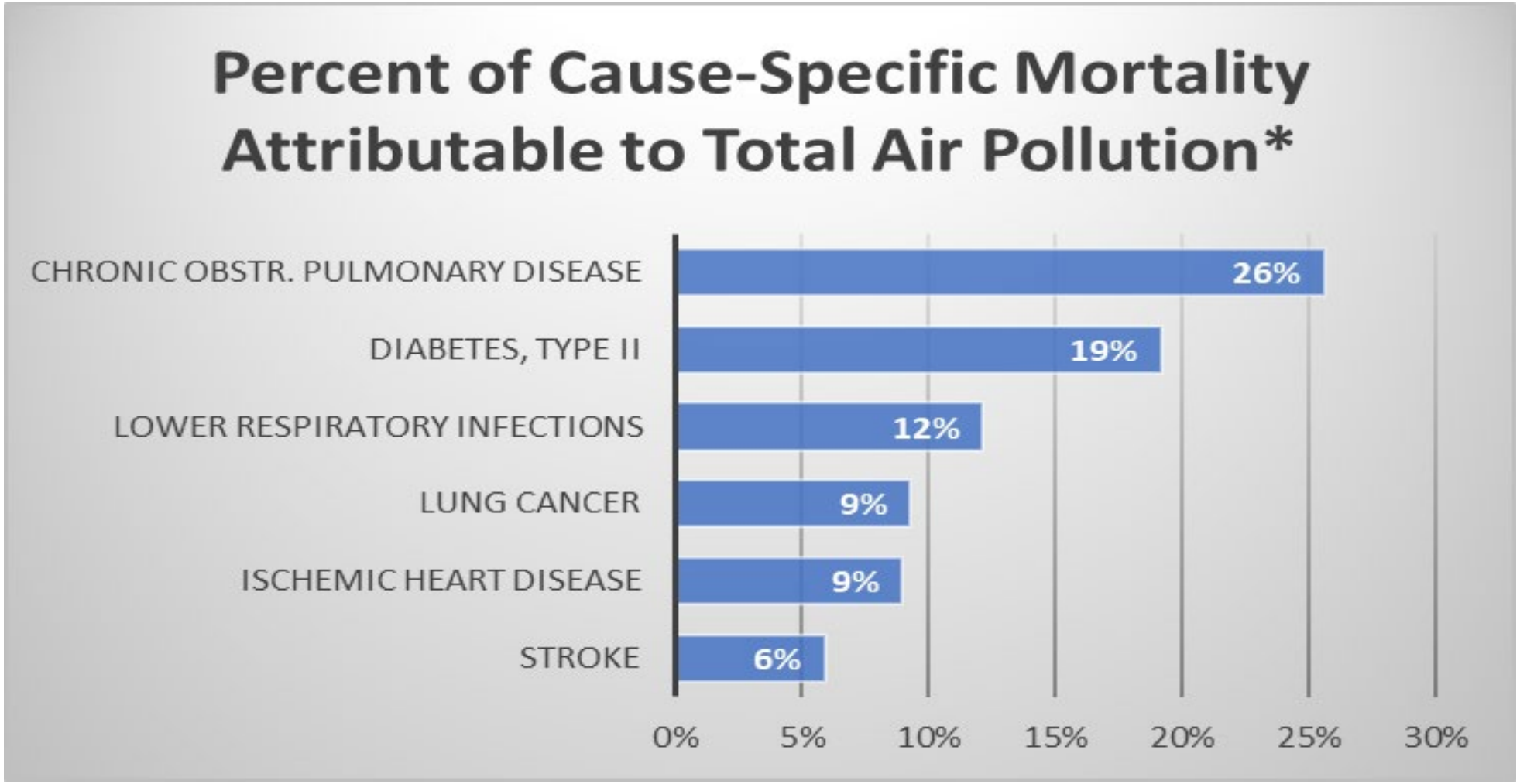
- Top Risk factor rankings change
- Diabetes, respiratory disease and CVD now predominant



Air pollution also ranks 8th among risk factors for morbidity

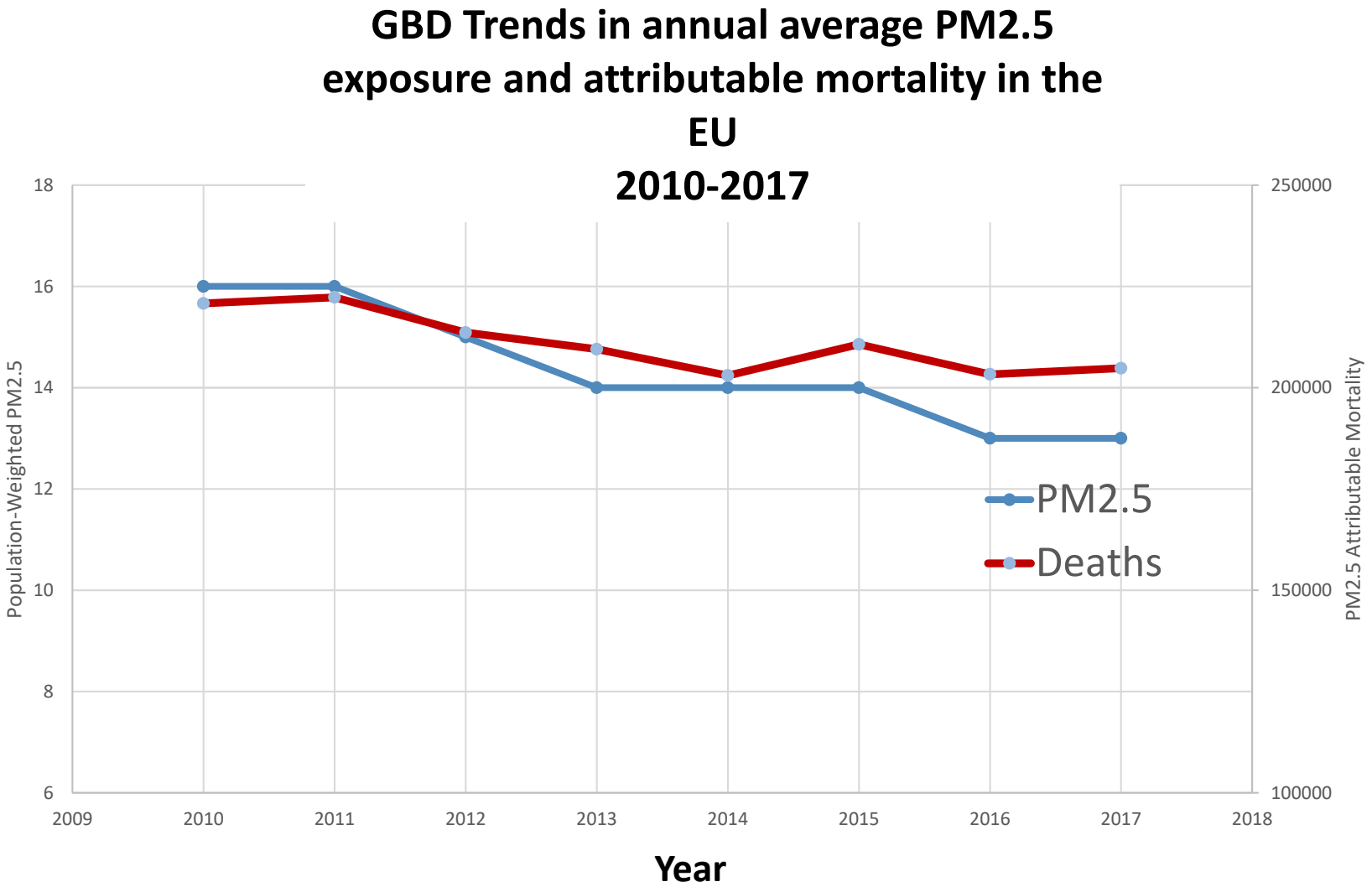
Years lived with disability

How much of cause-specific burden is attributable to air pollution in the EU?



* Total air pollution (PM2.5, Ozone, Household AP) Source:GBD Compare, 2017

What are the trends over time?



And what's driving them?

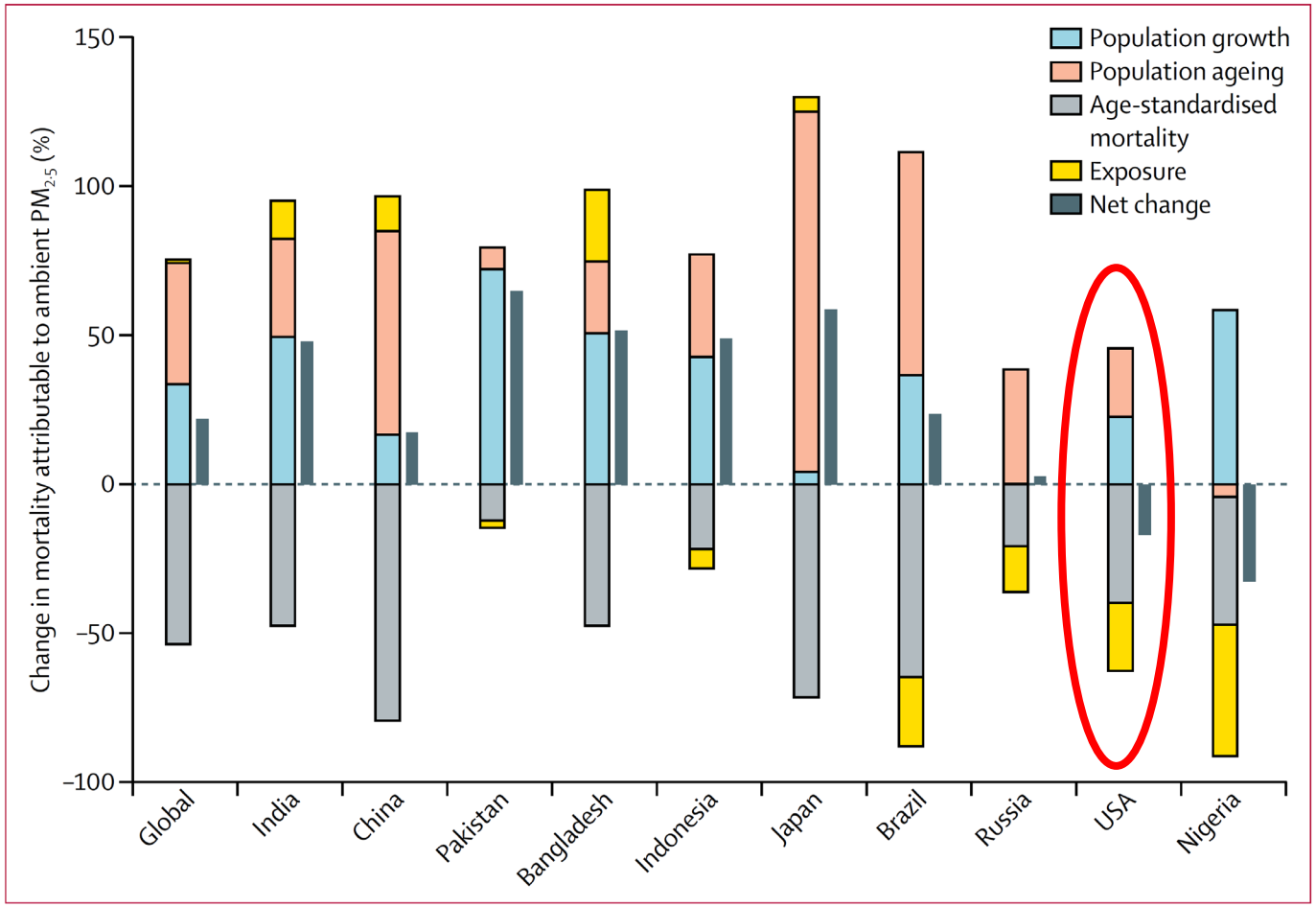


Figure 6: **Changes in mortality attributable to ambient particulate matter pollution according to population-level determinants by country from 1990 to 2015**
$PM_{2.5}$=particle mass with aerodynamic diameter less than 2·5 μm.

Cohen et al. (2017)

Decomposition analysis is possible:

- Changes in $PM_{2.5}$ attributable mortality are not driven solely by changes in exposure.
- Population growth and aging are key.

What is air pollution's predicted impact on life expectancy relative to other risk factors?

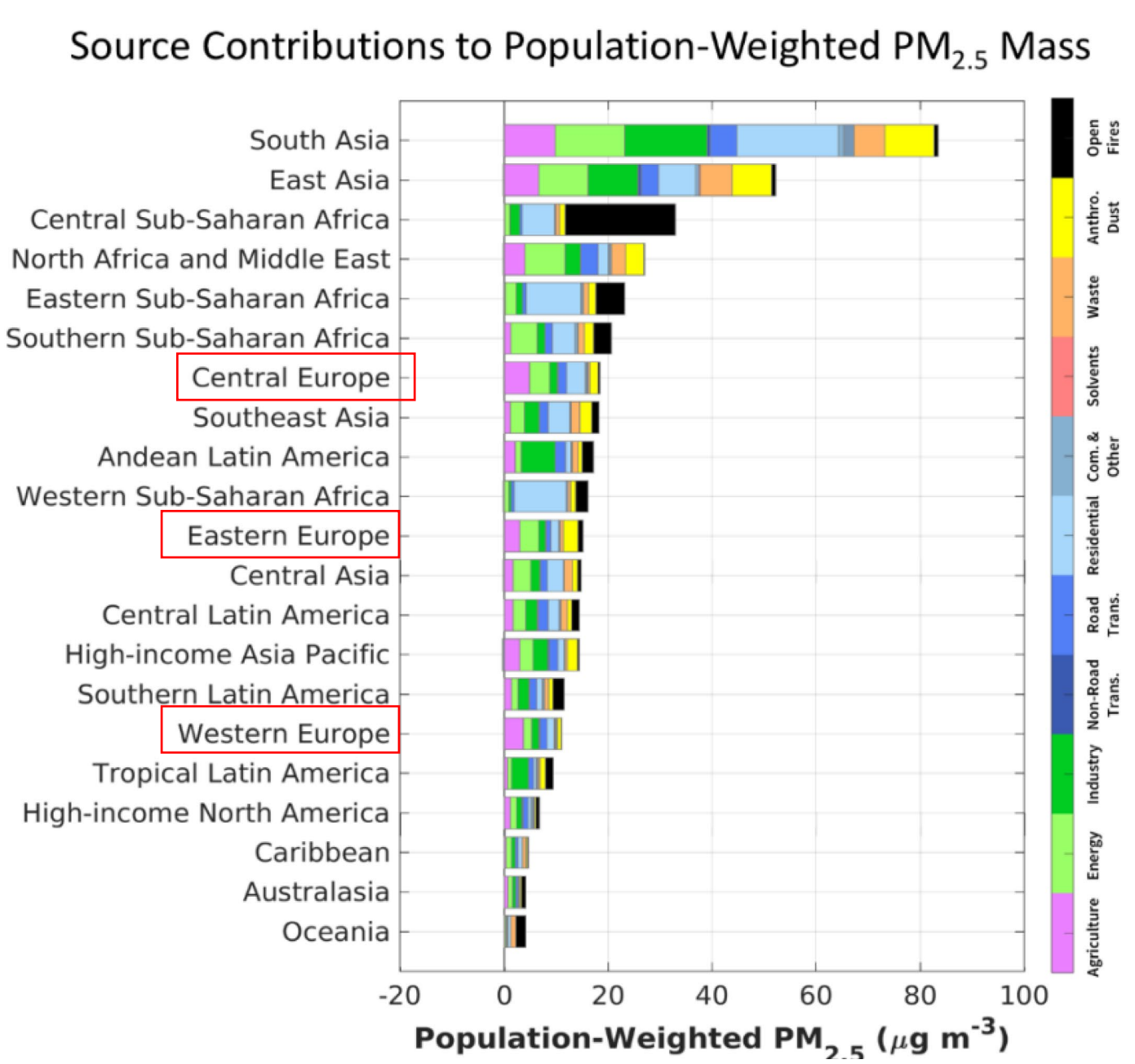
State of Global Air 2019

- Epidemiologic studies like Texel/Brussels do offer direct observation of LE changes.
- Comparative health impact analysis of LE allows perspective on multiple risk factors, multiple geographic scales.

Adapted from Apte et al. 2018, based on GBD 2016

Finding solutions: sources, fuels and their impacts on exposure and burden

- Global Burden of Disease-Major Air Pollution Sources – a global platform
- Links to health and climate policies



Summary of key points

1) Despite their differences, health burden analyses have played a critical role in identifying air pollution's overall contribution.

2) However, current estimates may understate total burden and will continue to change as evidence on additional pollutants and health outcome mounts.

3) When underlying methods are comparable, relative comparisons of different metrics are useful for communicating the roles of multiple factors that drive burden, for identifying priorities for interventions, and for understanding trends over time.

4) Understanding of sources and fuels, their relative contribution to exposure and burden are key inputs to cost-effectiveness analysis of policy alternatives. Provide links to climate.

Thank-you!

Acknowledgments:

Mike Brauer/UBC, IHME

Susan Anenberg/GWU

Pallavi Pant/HEI