# Global and Regional estimates of the Burden Due to Ambient Air Pollution: results from GBD 2013

**1ST AFRICA/MIDDLE-EAST EXPERT MEETING AND WORKSHOP ON THE HEALTH IMPACT OF AIRBORNE DUST**

**November 3, 2013**

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**Health Effects Institute**

**on behalf of the Global Burden of Disease Collaboration**

# The Global Burden of Disease (GBD) 2013

- **Systematic effort to quantify the magnitude of health loss from over 200 disease and injuries in 188 countries around the world from 1990 to 2013 with subnational estimates for China (provincial-level), Mexico and UK**

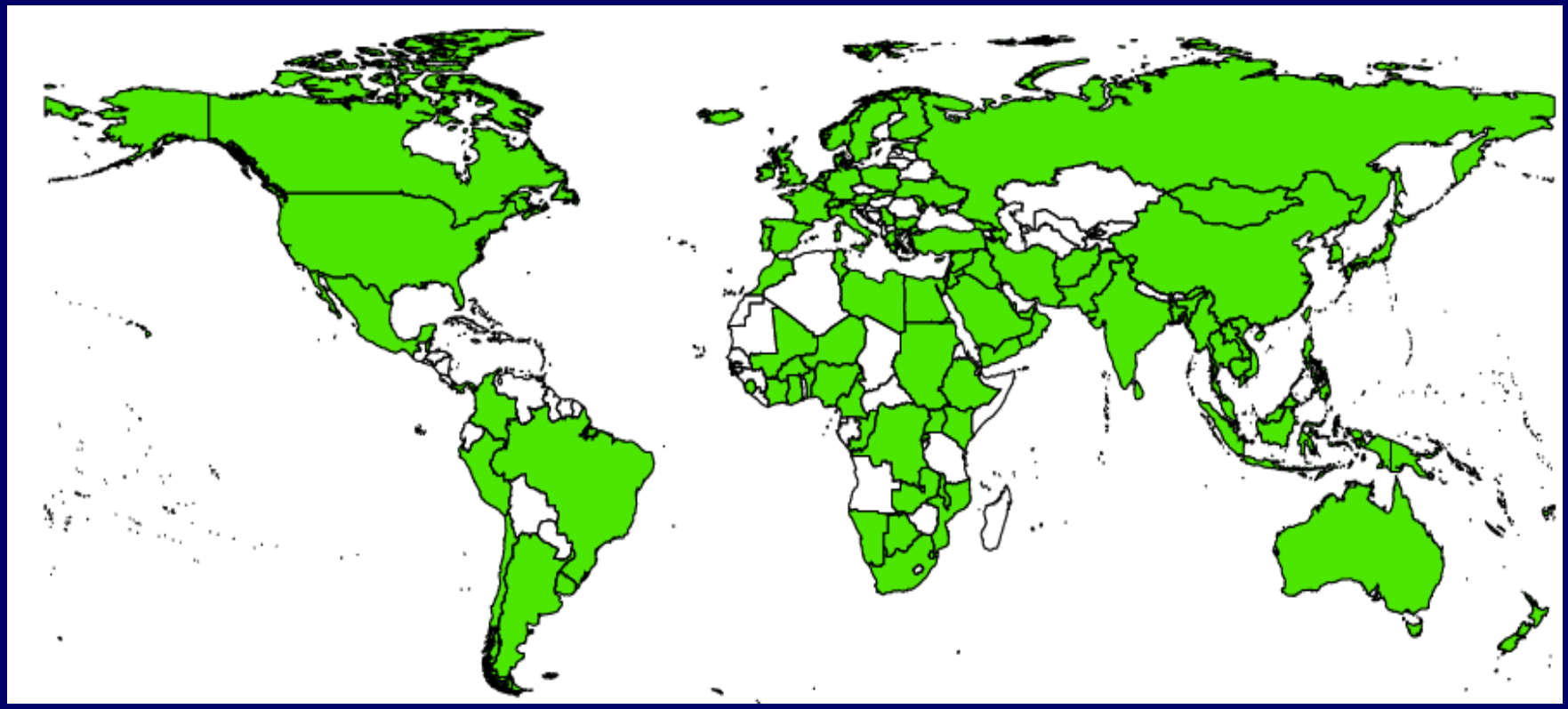
- **Burden measured as "Disability Adjusted Life Years" (DALYs) – lost years of healthy life-and Deaths in a given year**

- **Estimates burden of disease due to 78 risk factors, e.g. smoking, diet, high blood pressure, overweight, ambient and household air pollution**

- **Major GBD 2013 results for Mortality, Healthy Life Expectancy and Years Lived with Disability , and Risk Factor burden published in *The Lancet* 2014-2015**

- **Data and results publically available at: http://vizhub.healthdata.org/gbd-compare/**

# GBD collaborative measurement model



**Over 1,000 collaborators from 108 countries**

# Global Life-Expectancy and Healthy-Years-of-Life-Lost 2013

Global, regional, a
(DALYs) for 306 di
expectancy (HALE
the epidemiologic

GBD 2013 DALYs and HALE Collaborators*

Summary

Background The Global Burden of I
using a coherent measurement fr
comparisons of health loss over tim
summary measures such as disabi
comparative assessments of broad
also be used to quantify the compo

Methods We used the published G
(YLLs), and years lived with disabi
for 188 countries. We calculated
uncertainty in age-specific death r
for 306 causes for each country as
We quantified patterns of the ep
which we constructed from incom
and mean age of the population.
decompose variance related to the

Findings Worldwide, from 1990 to
(65·0–65·6) in 1990 to 71·5 years
(54·5–59·1) to 62·3 years (59·7–
100 000 people fell by 26·7% (24·
DALY numbers, crude rates, and
communicable diseases, global D
standardised DALY rates declined
most specific non-communicable
food-borne trematodes, and leish
causes of DALYs were ischaemic
neck pain, and road injuries. Soci
and over time for diarrhoea, lower
neonatal disorders; nutritional d
musculoskeletal disorders; and ot
than 10% of the variance in DALY
urogenital, blood, and endocrin
Predictably, increased sociodemog
declines in YLLs and increases i
substance use disorders. In most
HALE. Leading causes of DALYs a

Interpretation Global health is in
crude rates have remained relativ
health systems. The notion of an
structured change in disease bur
associated with sociodemographi
DALYs and HALE to appropriately

Funding Bill & Melinda Gates Fou

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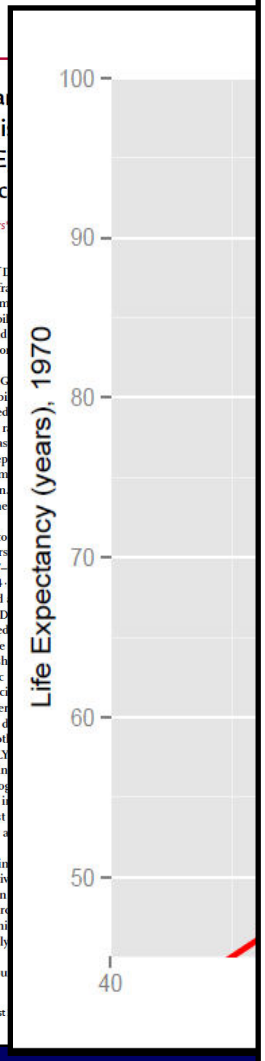
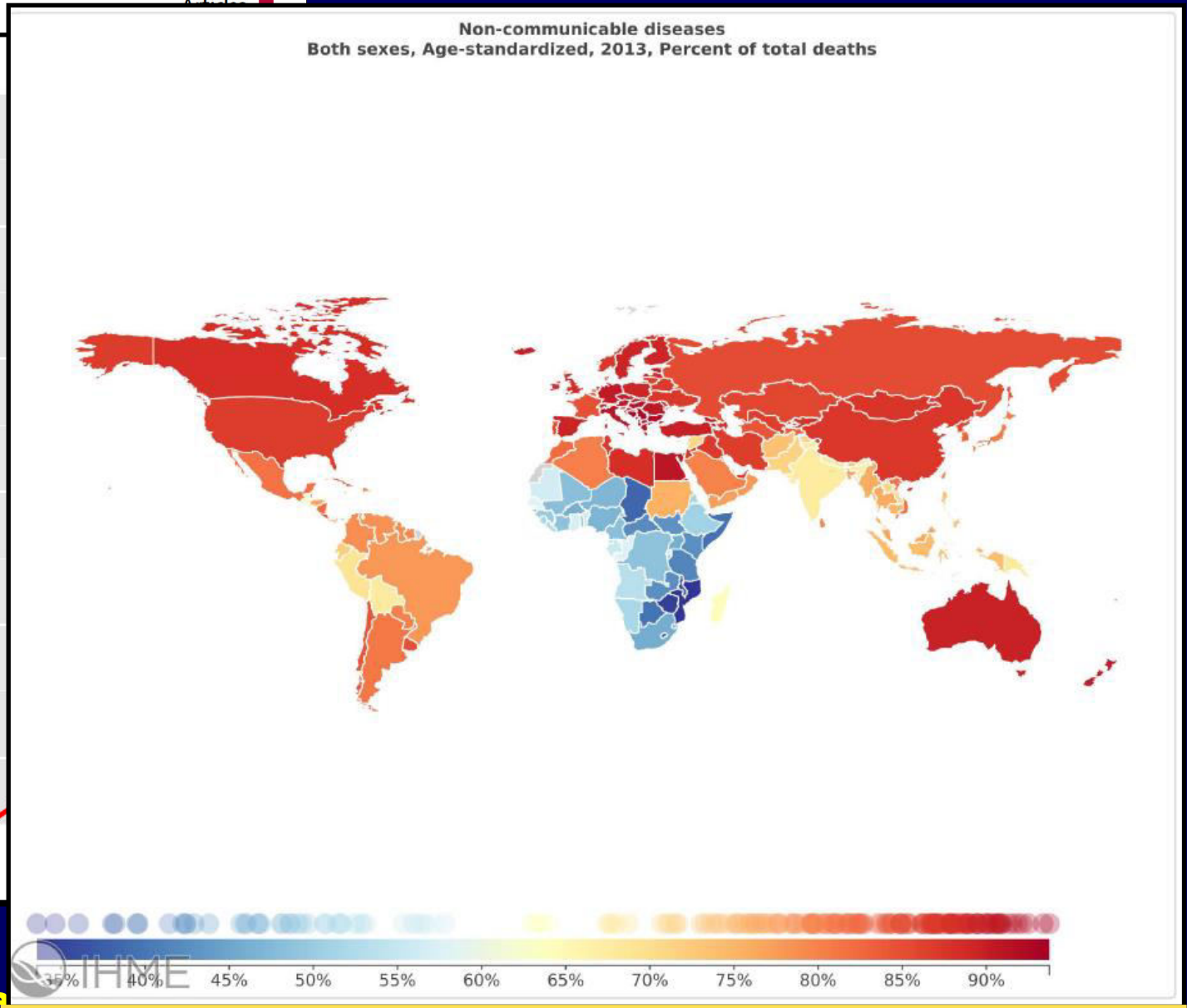
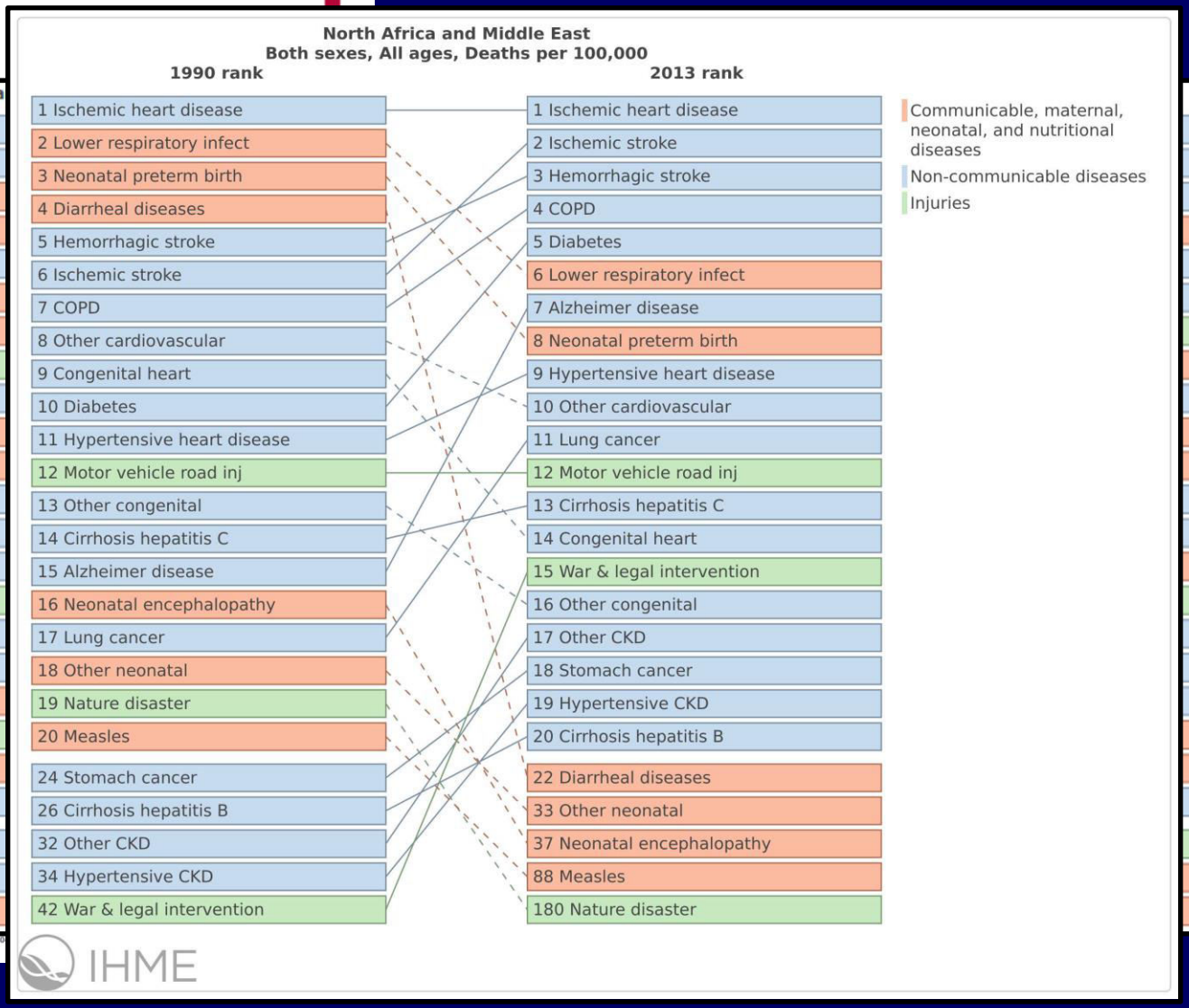



GBD 2013 DALYs a

Institute for Health Metrics and Evaluation (IHME). GBD Compare. Seattle, WA: IHME, University of Was hington, 2015. Available from http://vizhub.healthdata.org/gbd -compare . (Accessed 10/29/15)

# Leading Global and North African/Middle Eastern Causes of Death 1990-2013

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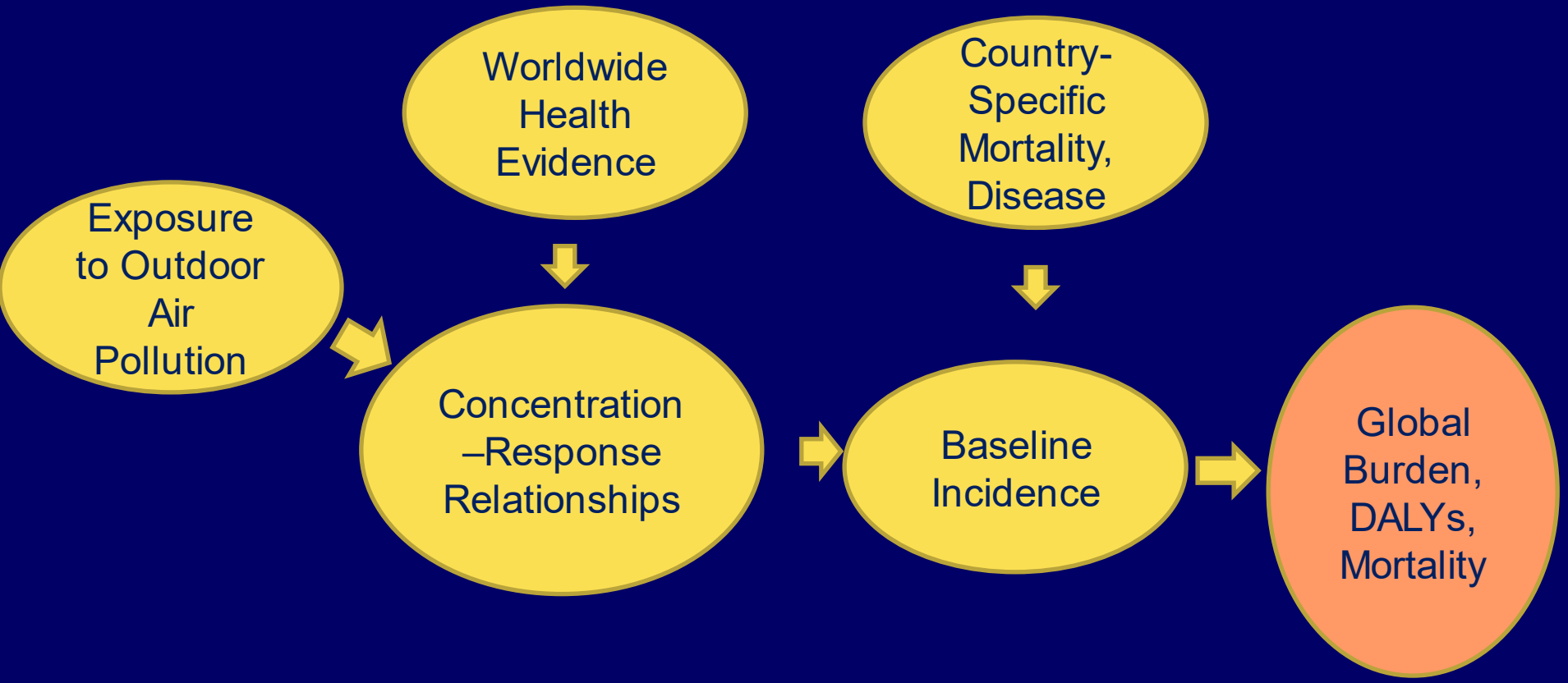
# Estimating the Global Burden of Disease due to Ambient Air Pollution

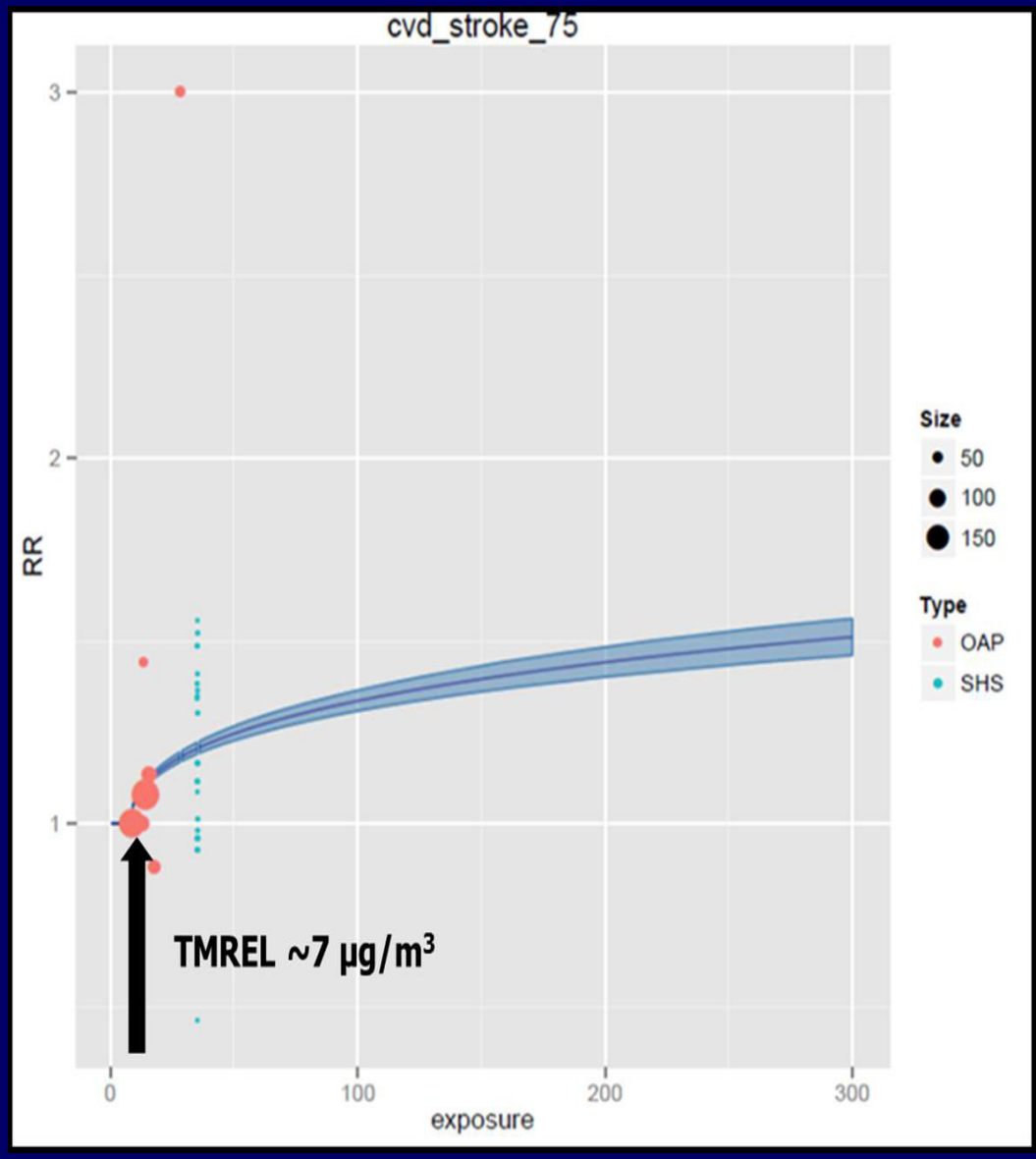


# A Mortality Risk Model for the Global Burden of Ambient $PM_{2.5}$

- Nearly all epidemiologic studies of long-term exposure to $PM_{2.5}$ and mortality from chronic disease have been conducted in the US and Western Europe at $PM_{2.5}$ 5µg/$m^3$ to 30µg/$m^3$
- Need new models to estimate risk over the entire global range up with annual average $PM_{2.5}$ greater than 100 µg/$m^3$in East and South Asia and other regions
- Estimate risk across the full global range of $PM_{2.5}$ concentrations by integrating epidemiologic evidence on risk of mortality from major sources of exposure to $PM_{2.5}$
    - active smoking
    - second-hand smoke
    - household burning of solid fuels
    - ambient $PM_{2.5}$
- Key assumption: risk is a function of $PM_{2.5}$ inhaled dose regardless of PM source

# GBD 2013 IER Risk Models

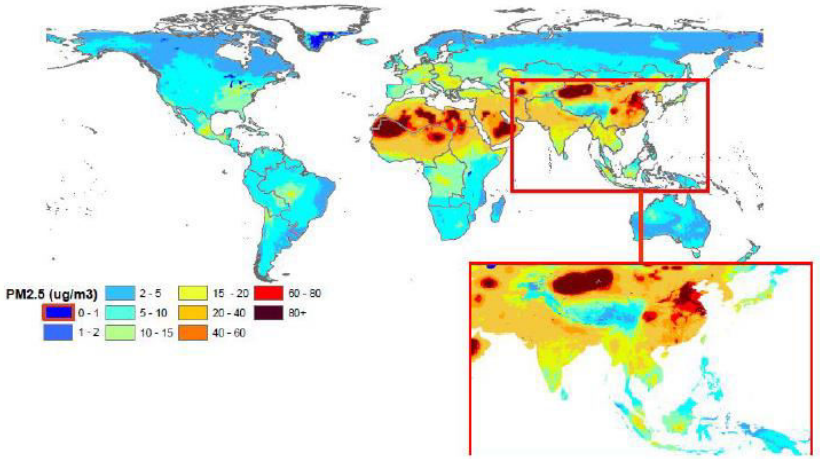
- Risk models for IHD, stroke, lung cancer, and COPD mortality in adults include 13 epidemiologic studies of ambient $PM_{2.5}$ air pollution
- CVD risk models are nonlinear, with a steep increase in risk at low exposures and flattening out at higher exposures. Lung cancer risk models are more nearly linear
- Counterfactual level (TMREL) ~7 µg/m$^3$ - based on evidence from multiple large epidemiologic studies
- Uncertainty in risk model parameters, estimated using Bayesian methods, contributes to total uncertainty in air pollution burden estimates along with uncertainty in estimated exposure and baseline mortality rates



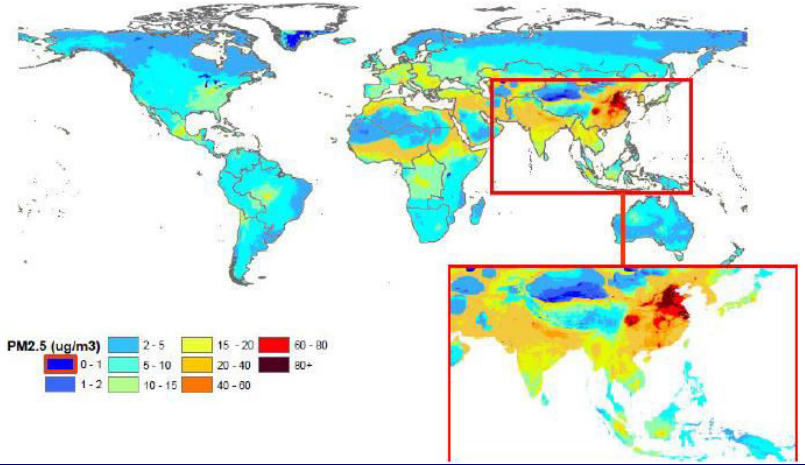
# GBD 2010
# Regional dust sensitivity analysis (Lim et al. *The Lancet* 2012)

- Sensitivity analysis with an alternative theoretical-minimum-risk exposure distribution that included the effect of regional dust particulate matter. Dusty grid cells were identified as those with an ambient air concentration of $PM_{2.5}$ of 36 µg/m³ or more and where the dust fraction from the TM5 chemical transport model was 50% or more
- Global burden (DALYs) decreased by 2% but larger reductions in NA/MER
- Not repeated for GBD 2013

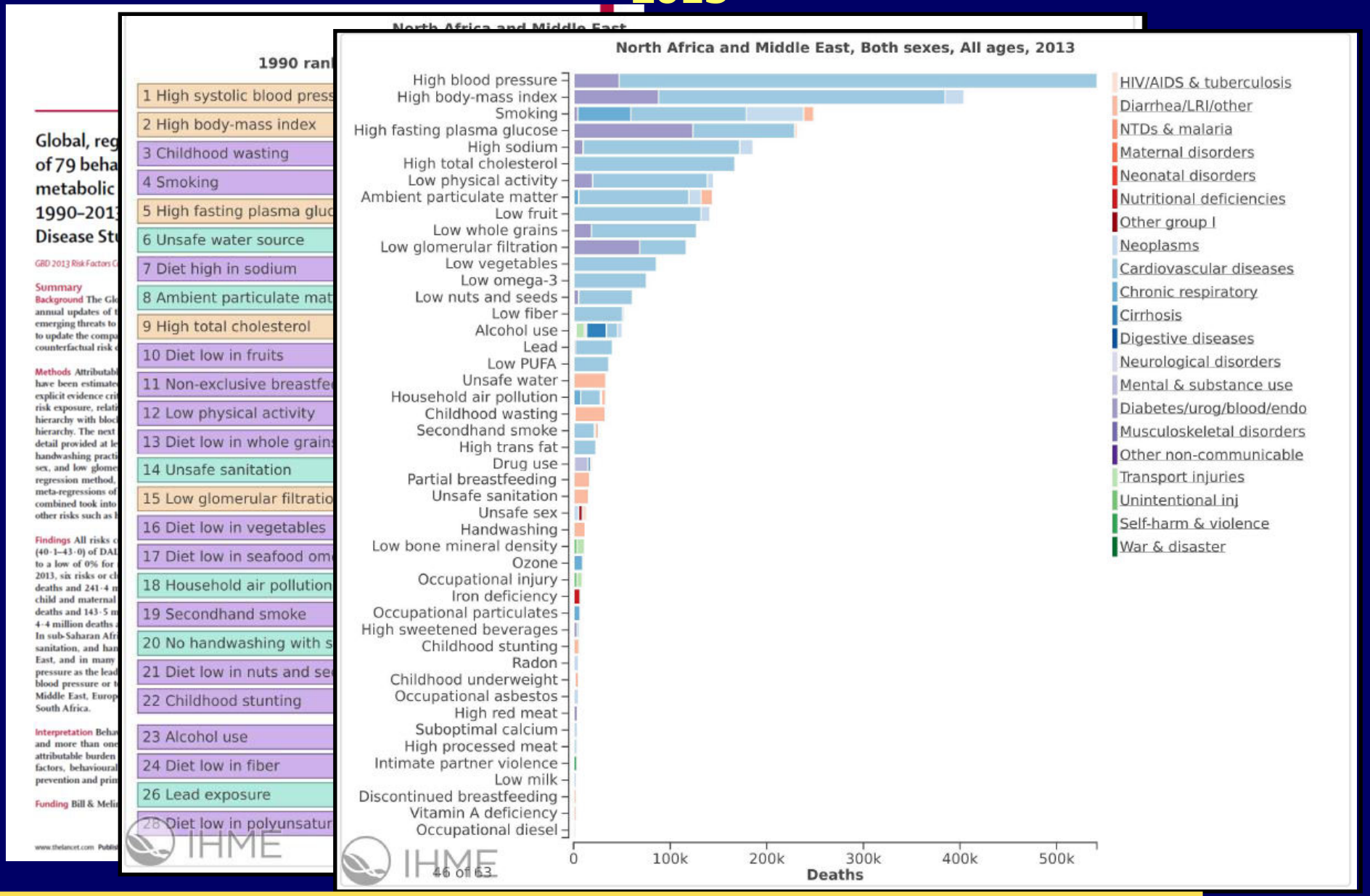
Estimated 2005 annual average $PM_{2.5}$ concentrations (µg/m³)




Estimated 2005 annual average $PM_{2.5}$ concentrations (µg/m³) – No Dust



# Global and North African/Middle Eastern Mortality Risk Factors 1990-2013

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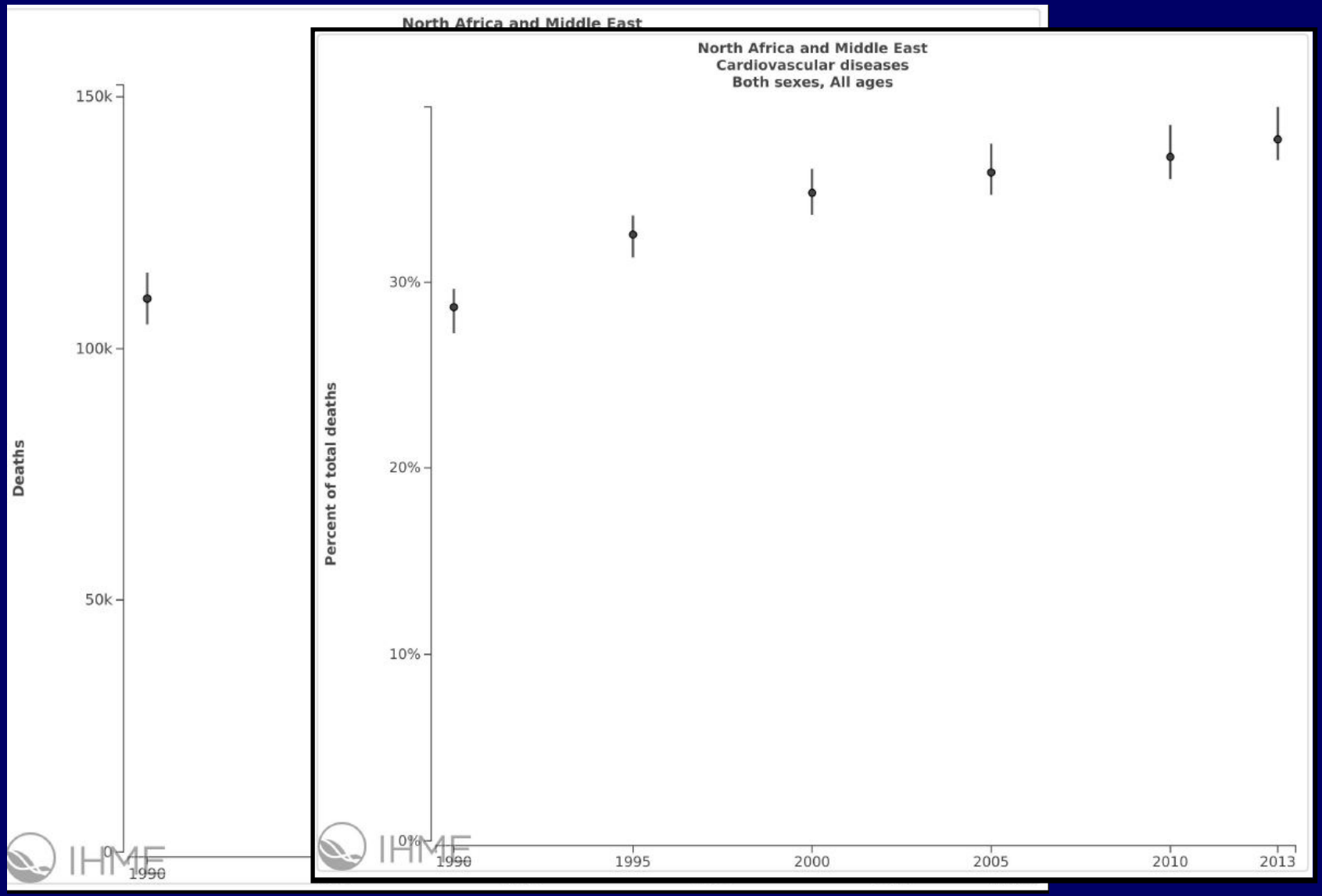
# Increasing Burden of Disease 1990-2013

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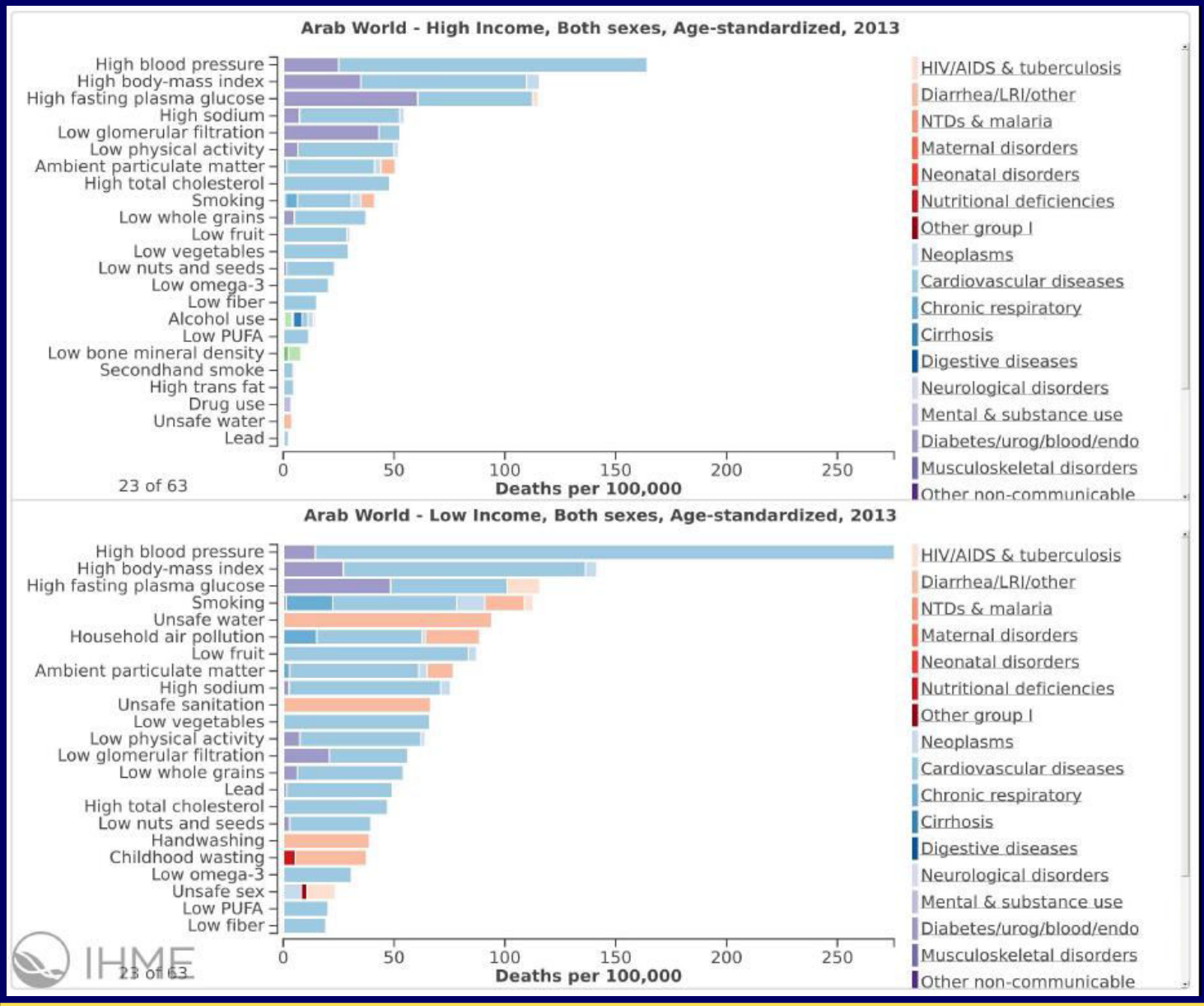
# Top Mortality Risk Factors in 2013 by National Income in the Arab World

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# Summary

- Cardiovascular disease and other diseases affected by air pollution are among the top causes of mortality and lost years of healthy life in the region

- $PM_{2.5}$ air pollution is an important source of disease burden in the region and its importance has increased in the last two decades, driven by both increasing levels of exposure and cardiovascular disease

- Populations of low-income Arab countries have almost twice the age-adjusted rate of mortality due to $PM_{2.5}$ exposure than high-income Arab countries, and household air pollution contributes significantly to burden in low-income Arab countries

# Thank You!

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**For more information on the GBD Collaboration contact:**

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**Institute for Health Metrics and Evaluation**

***http://www.healthdata.org/gbd***