

Air pollution database & attributable mortality



World Health
Organization

Presentation Overview

- Ambient air pollution database
- Ambient air pollution attributable mortality
- Household air pollution attributable mortality



AMBIENT AIR POLLUTION DATABASE



Methodology

- Annual mean concentration of particulate matter (**PM₁₀**, **PM_{2.5}**)
- **Urban** background, residential, commercial and mixed areas ("Hot spots" or industrial areas excluded whenever possible)
- Period covered: **2008-2013**
- Sources:
 - Official national/sub-national reports/websites
 - Regional networks (e.g. Asian Clean Air Initiative, Airbase)
 - Others :(a) UN agencies; (b) Development agencies; and (c) articles from peer reviewed journals.

More info: www.who.int/phe/health_topics/outdoorair/databases/AAP_database_methods_2014.pdf



Ambient air pollution database

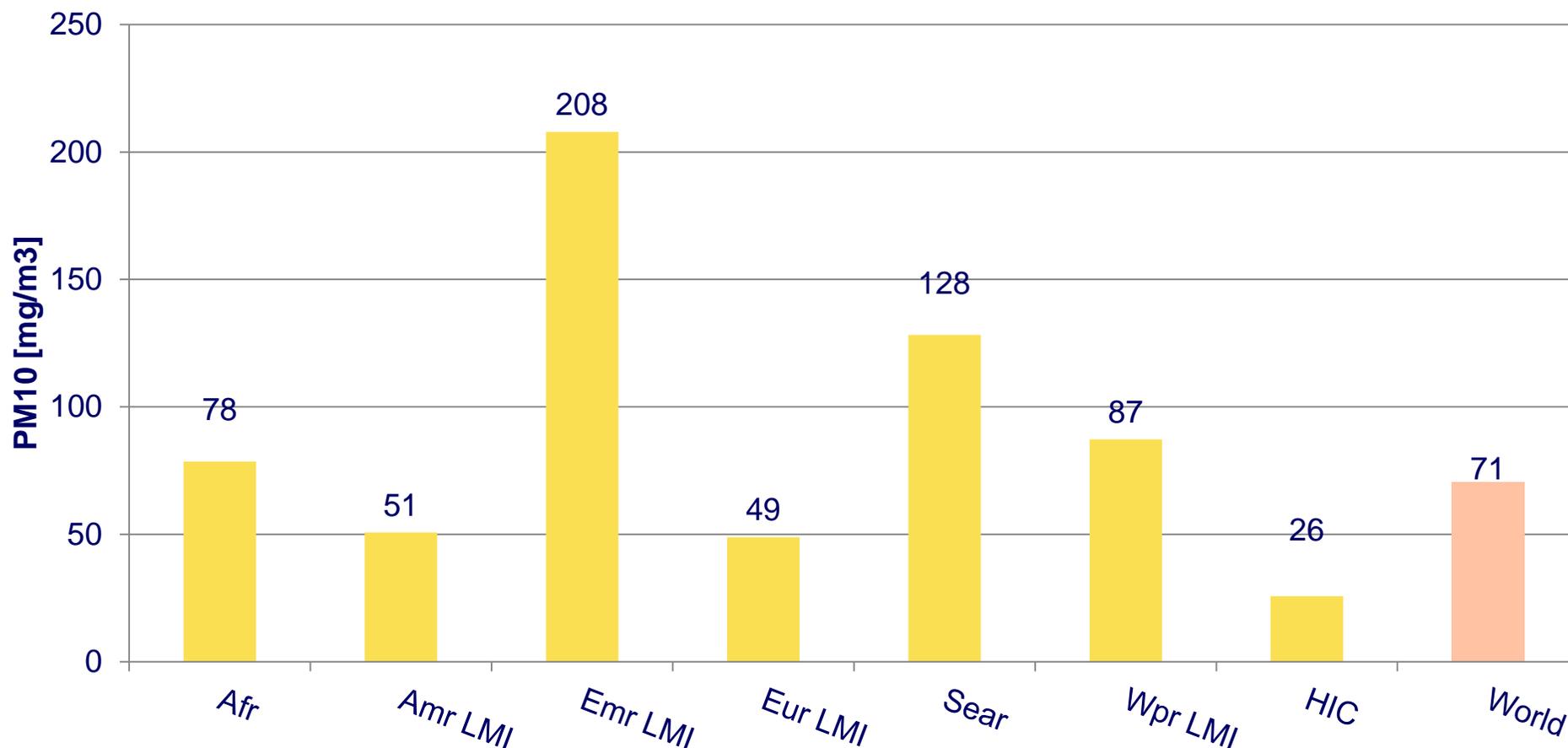
Region	Number of cities	Number of countries	Total number of countries in the region
Africa (Sub-Saharan)	16	6	47
America, LMI	88	13	26
America, HI	535	4	9
Eastern Mediterranean, LMI	14	6	15
Eastern Mediterranean, HI	12	5	6
Europe, LMI	109	8	20
Europe, HI	461	29	33
South-East Asia	167	9	11
Western Pacific, LMI	133	5	21
Western Pacific, HI	93	6	6
World	1 628	91	194

LMI: Low-and middle-income; HI: high-income.



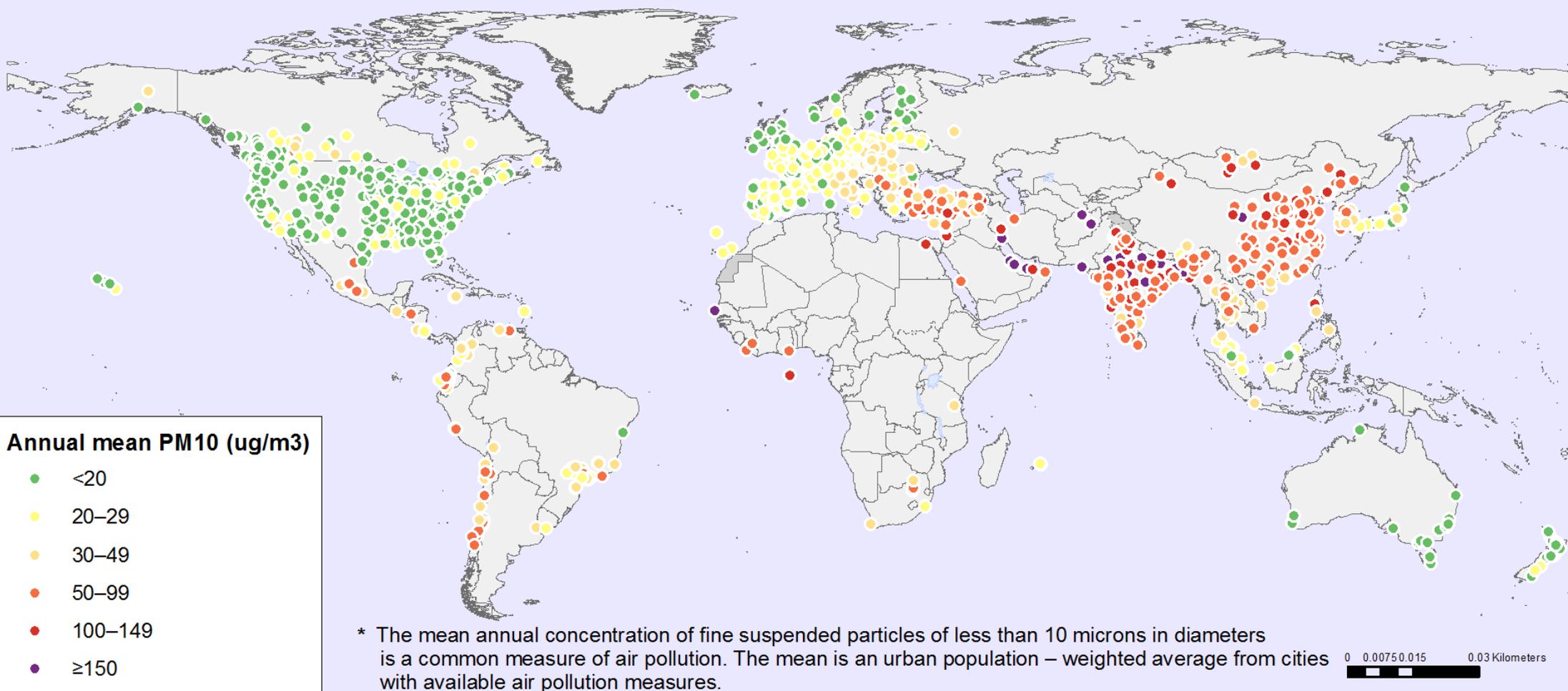
Particulate matter (PM₁₀) levels by region

for the last available year in the period 2008-2012



PM10: Fine particulate matter of 10 microns or less; Afr: Africa; Amr: America; Emr: Eastern Mediterranean; Eur: Europe; Sear: South-East Asia; Wpr: Western Pacific; LMI: Low- and middle-income; HI: high-income. PM10 values are regional urban population-weighted.

Exposure to particulate matter with an aerodynamic diameter of 10 μm or less (PM10) in 1600 urban areas*, 2008–2013



The boundaries and names shown and the designations used on this map do not imply the expression of any opinion whatsoever on the part of the World Health Organization concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries. Dotted and dashed lines on maps represent approximate border lines for which there may not yet be full agreement.

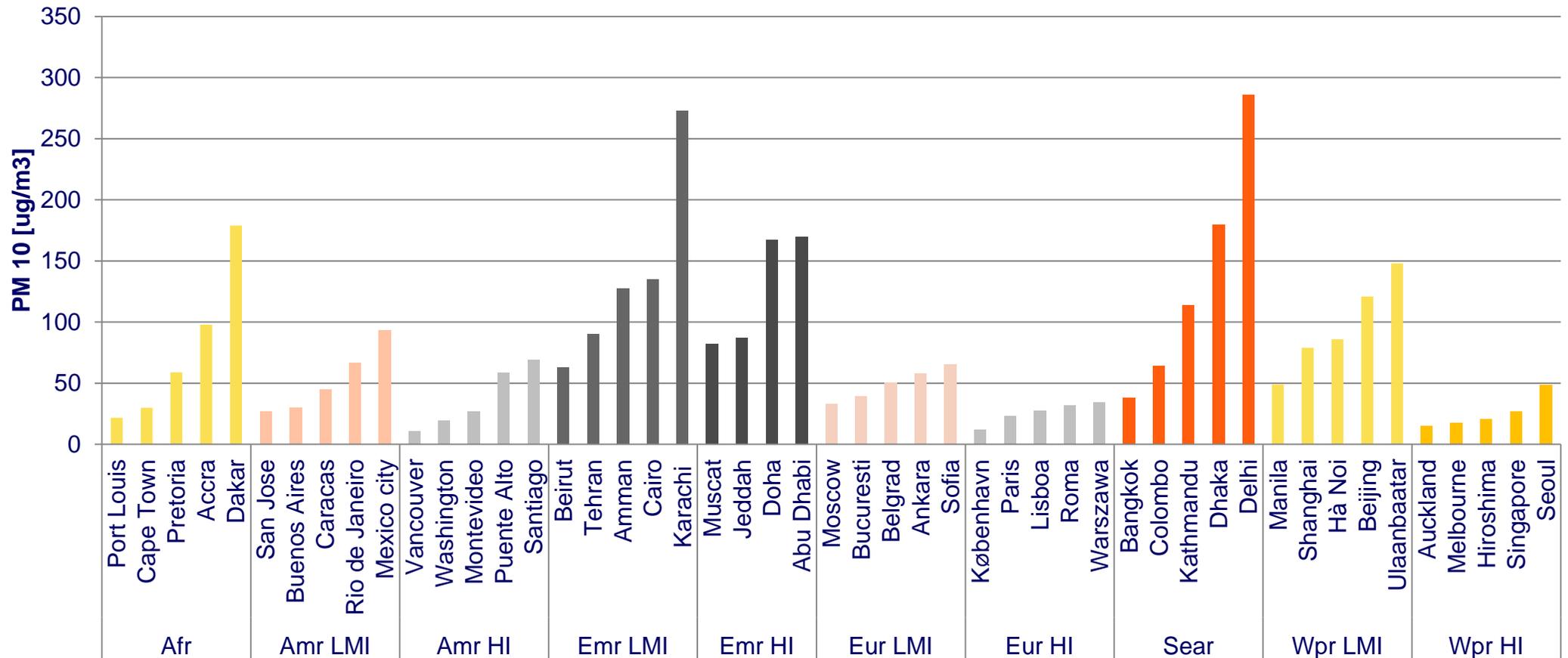
Data Source: World Health Organization
Map Production: Health Statistics and Information Systems (HSI)
World Health Organization



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PM₁₀ levels for selected cities by region

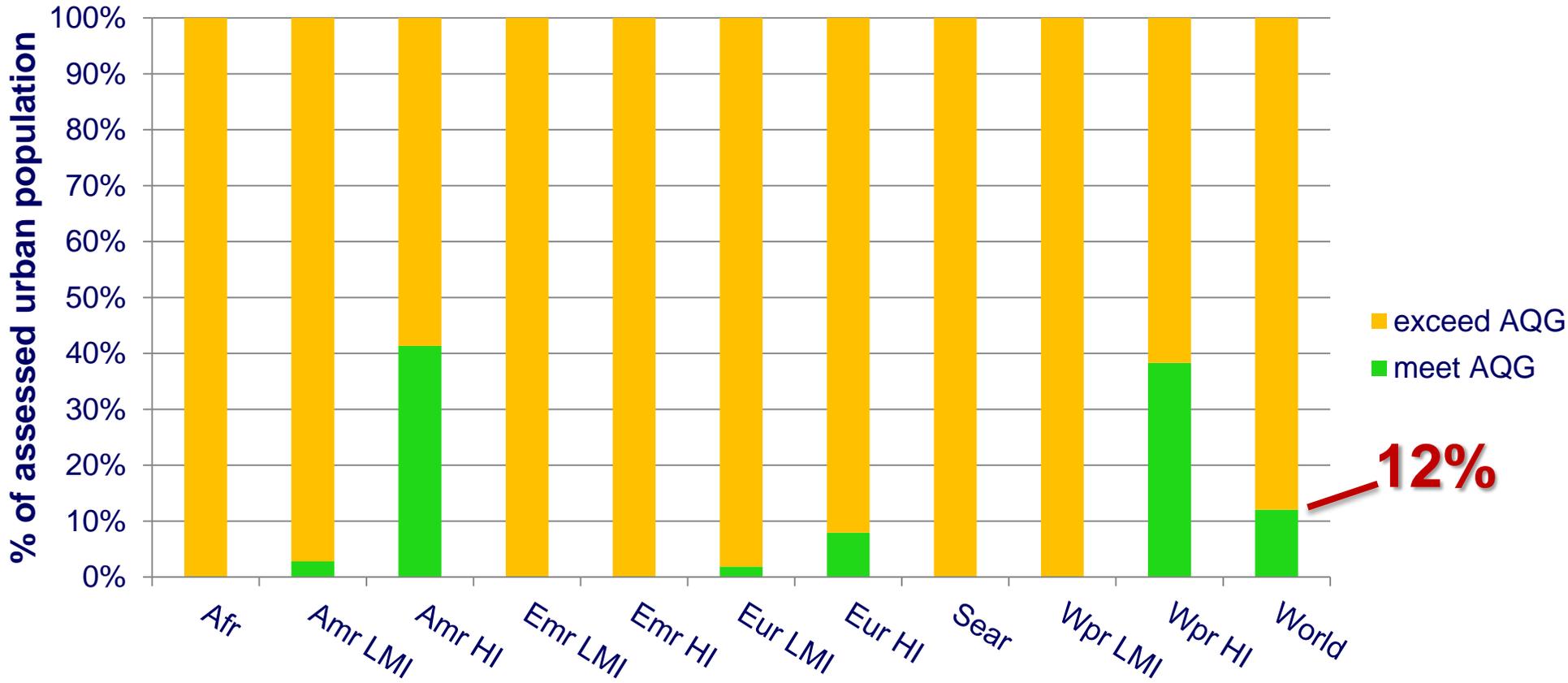
for the last available year in the period 2008-2012



PM₁₀: Fine particulate matter of 10 microns or less; Afr: Africa; Amr: America; Emr: Eastern Mediterranean; Eur: Europe; Sear: South-East Asia; Wpr: Western Pacific; LMI: Low- and middle-income; HI: high-income.



Annual mean PM of the urban population & the WHO Air Quality Guidelines (AQG)



Afr: Africa; Amr: America; Emr: Eastern Mediterranean; Eur: Europe; Sear: South-East Asia; Wpr: Western Pacific; LMI: Low- and middle-income; HI: high-income; AQG: WHO Air Quality Guidelines : Annual mean PM10: 20 µg/m³; Annual mean PM2.5: 10 µg/m³.



Limitations

- Different measurement methods;
- Different temporal coverage (seasonal variability);
- Possible inclusion of data which were not eligible for this database due to insufficient information to ensure compliance;
- Differences in sizes of cities covered: for certain countries, only measurements for larger cities were found, whereas for others also cities with just a few thousand inhabitants were available.
- Heterogeneous quality of measurements;
- Omission of data which are known to exist, but which could not yet be accessed due to language issues or limited accessibility.



MORTALITY ATTRIBUTABLE TO AMBIENT AIR POLLUTION



Methods: Exposure

- Exposure to ambient concentrations of fine particles (PM_{2.5}) at 0.1° × 0.1° spatial resolution
- Model based on
 - Remote sensing
 - Chemical transport model
 - Ground measurements
- Reference :
 - Brauer M et al. Exposure assessment for estimation of the global burden of disease attributable to outdoor air pollution. *Environ Sci Technol*. 2012, 46(2):652-60.



Methods: Disease Burden, 2012

- WHO 2012 Mortality Estimates
- Integrated exposure-risk functions (Burnett et al 2014)

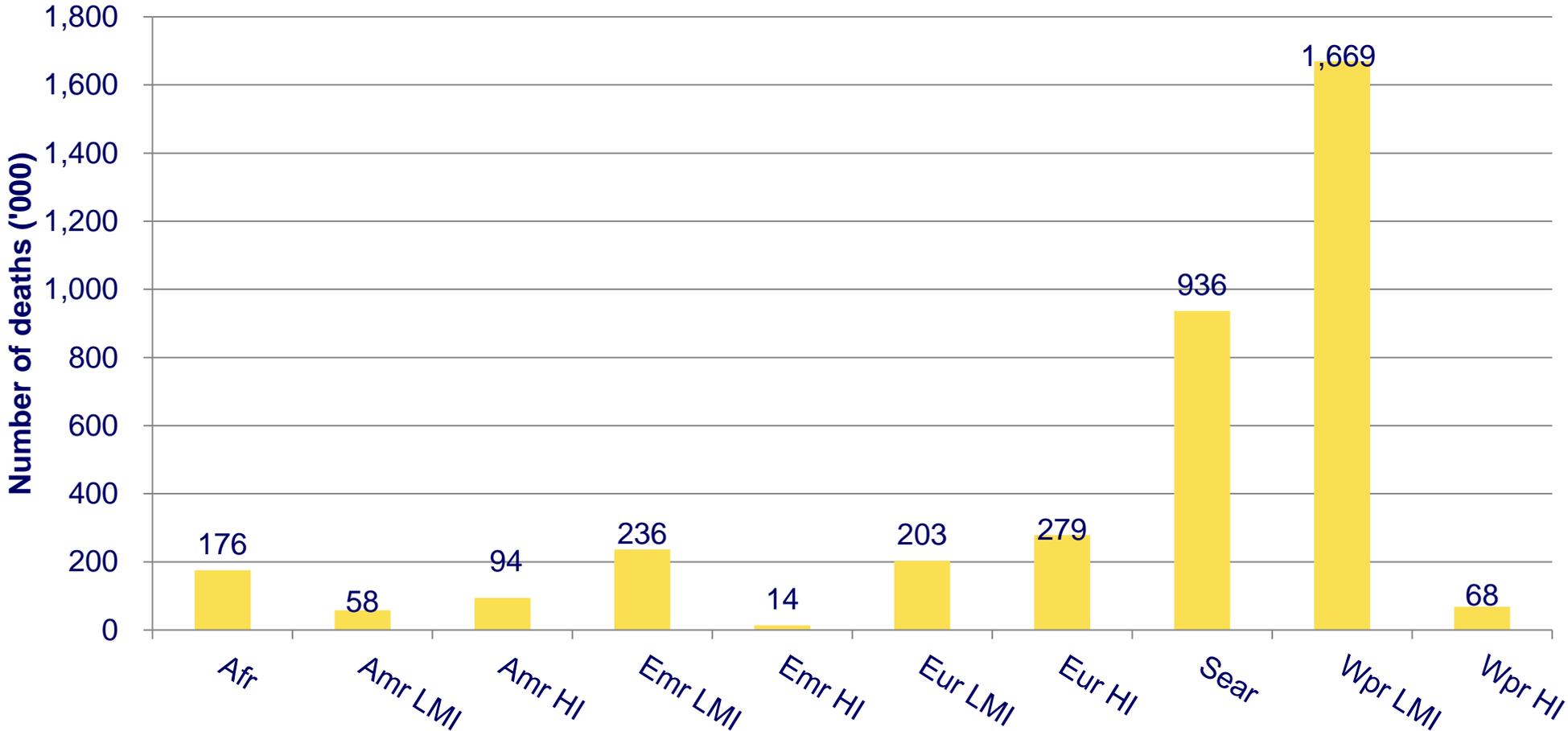
Disease outcomes:

- Acute Lower Respiratory Infections (ALRI);
- Chronic Obstructive Pulmonary Disease (COPD);
- Lung Cancer;
- Ischaemic Heart Disease (IHD)
- Stroke

$$PAF = \frac{\sum_{i=1}^n P_i (RR-1)}{\sum_{i=1}^n P_i (RR-1) + 1}$$

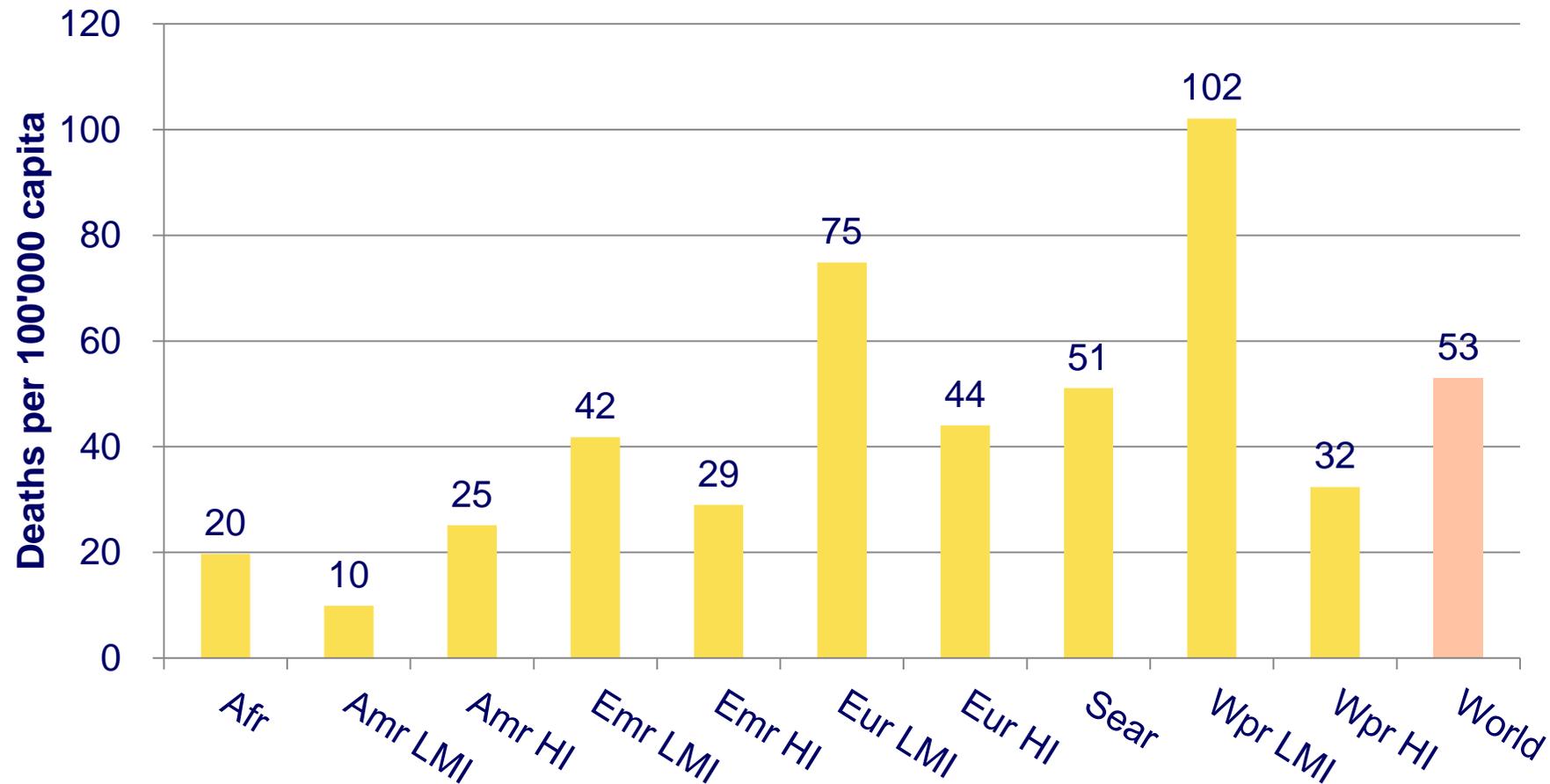
Burnett R et al. Environmental Health Perspectives, 2014, Vol. 22:4.

Results: Total deaths attributable to AAP in 2012 by region

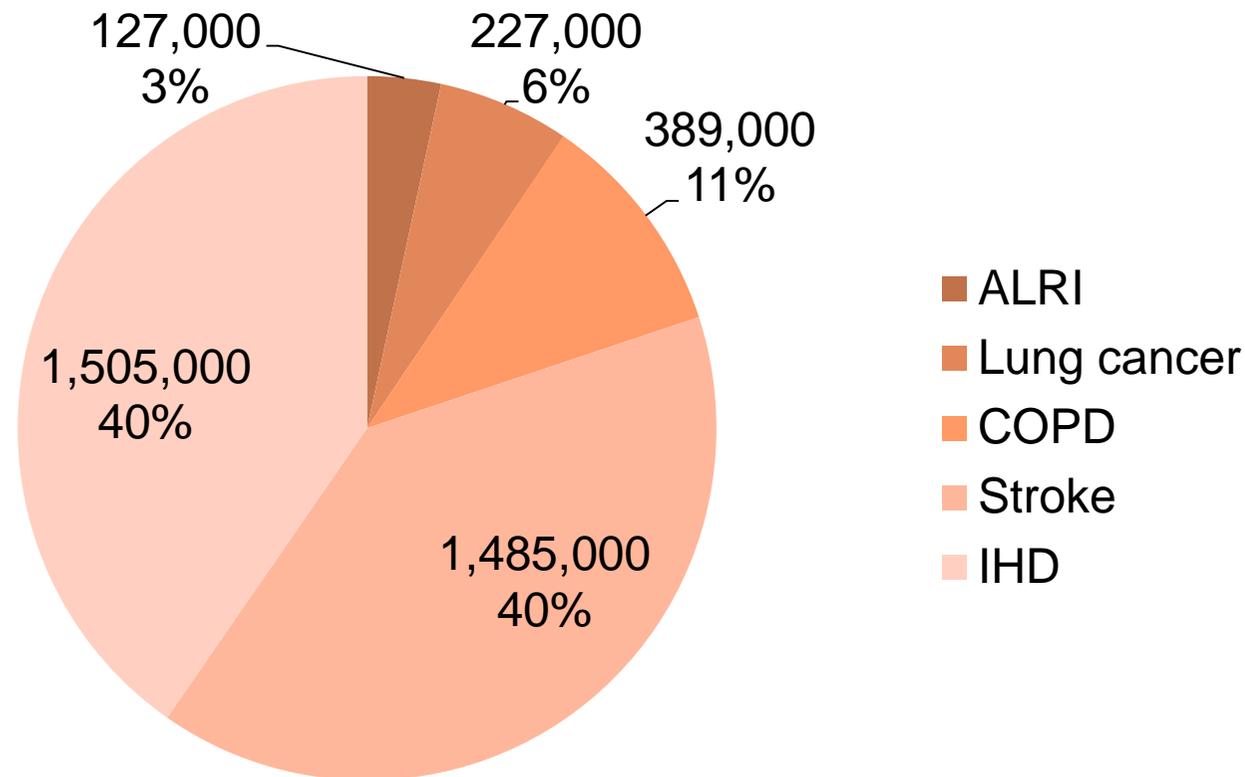


World: 3.7 million deaths

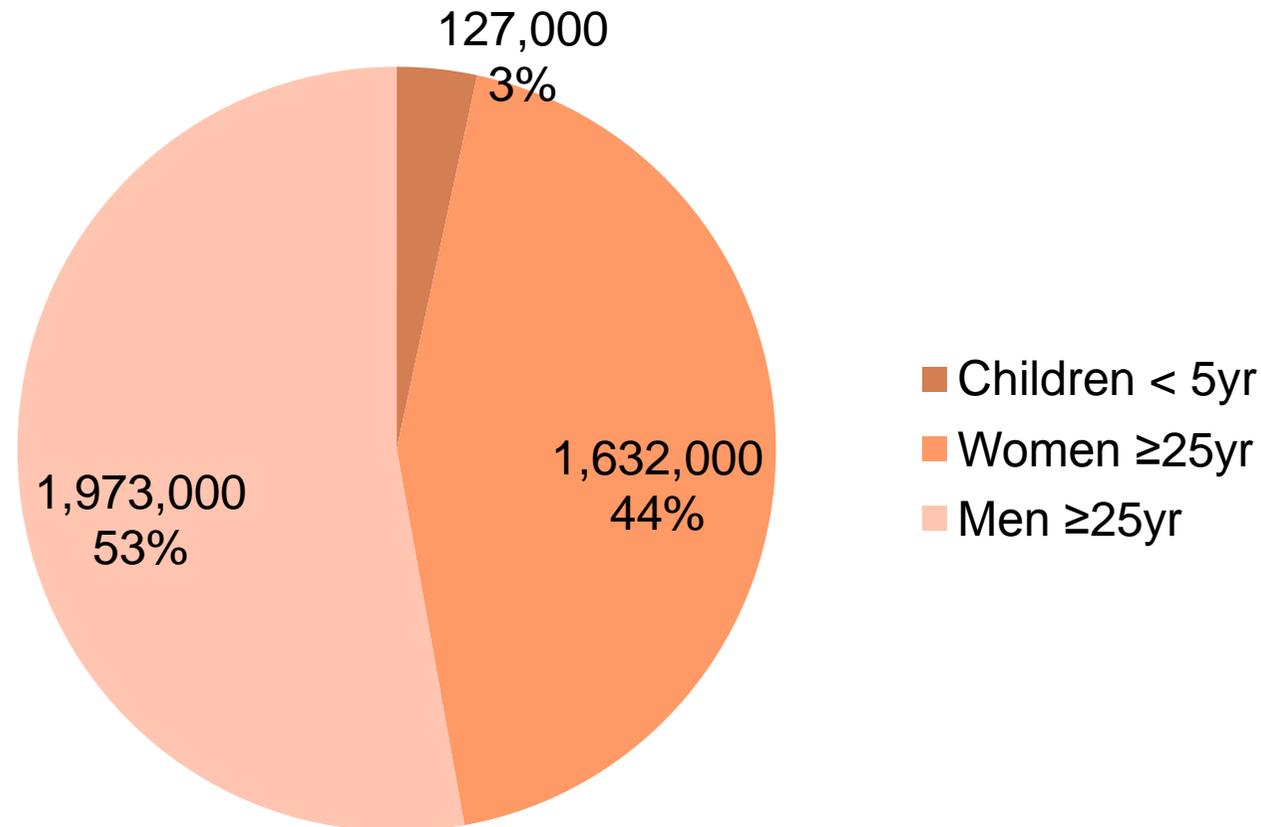
Results: Deaths per capita attributable to AAP in 2012, by region



Results: Deaths attributable to AAP in 2012, by disease



Results: Deaths attributable to AAP in 2012, by age and sex

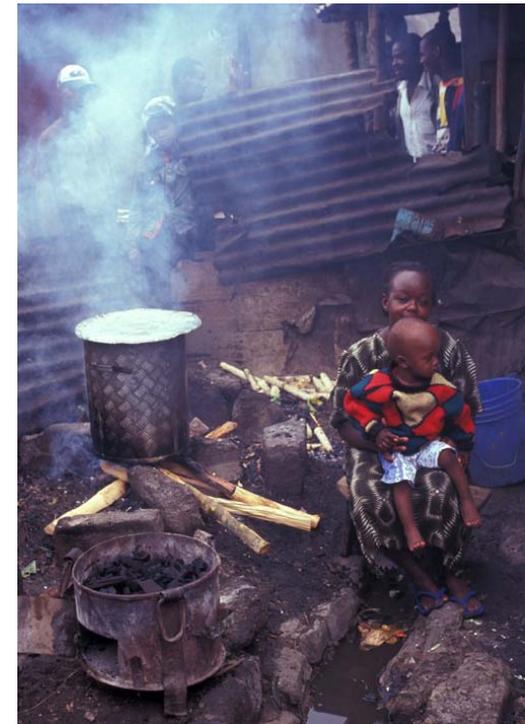


MORTALITY ATTRIBUTABLE TO HOUSEHOLD AIR POLLUTION



Methods: Exposure, 2012

- Proxy for exposure is Household Primary Solid Fuel Use
- Data from
 - 711 National Surveys
 - 157 Countries
 - 99% of all LMIC
- Non-parametric Multi-Level Statistical Model



Methods: Disease Burden, 2012

- WHO 2012 Mortality Estimates
- Integrated exposure-risk functions & meta-analysis

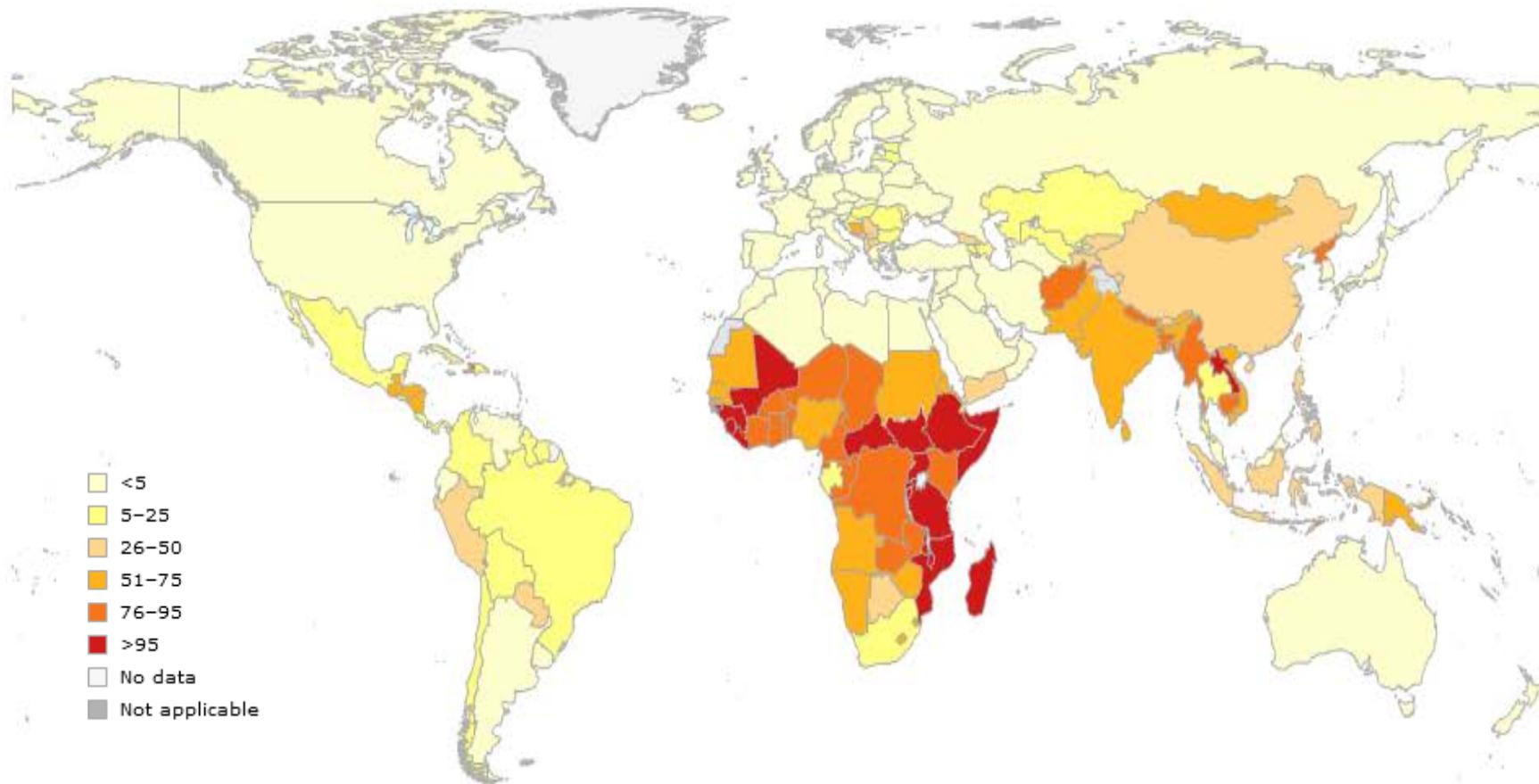
Disease outcomes:

- Acute Lower Respiratory Infections (ALRI);
- Chronic Obstructive Pulmonary Disease (COPD);
- Lung Cancer (**Biomass** + Coal);
- **Ischaemic Heart Disease (IHD)**
- **Stroke**

$$PAF = \frac{P_e(RR-1)}{P_e(RR-1)+1}$$

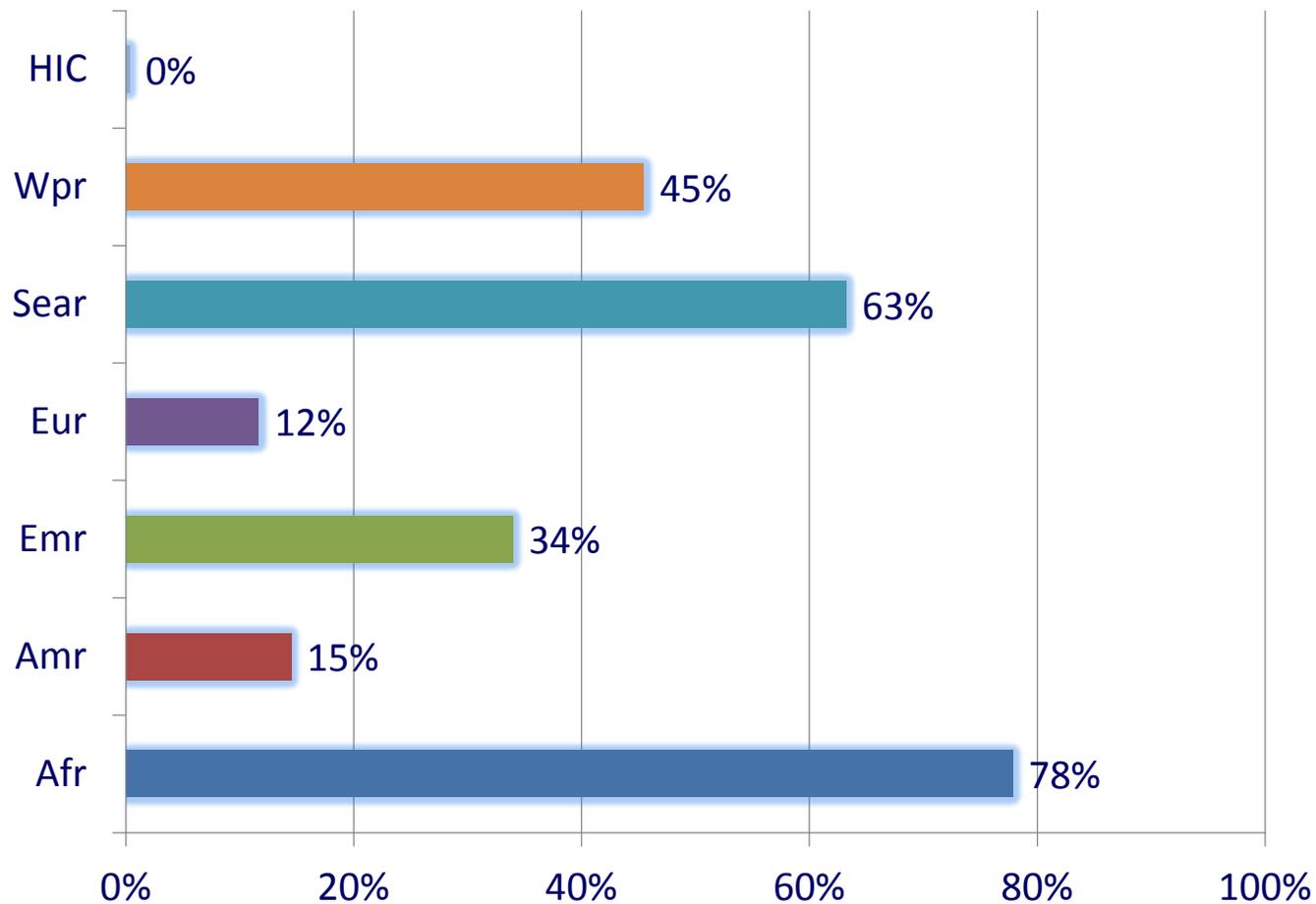
Disease	RR (95% CI) women	RR (95% CI) men
ALRI	2.9 (2.0-3.8) for children	
COPD	2.3 (1.7- 3.1)	1.9 (1.2- 3.1)
Lung cancer	2.3 (1.5-2.8)	1.9 (1.4-2.3)
IHD	(1.4-2.2)	(1.4-2.2)
Stroke	(1.4-2.4)	(1.3-2.4)

Results: HAP Exposure, 2012



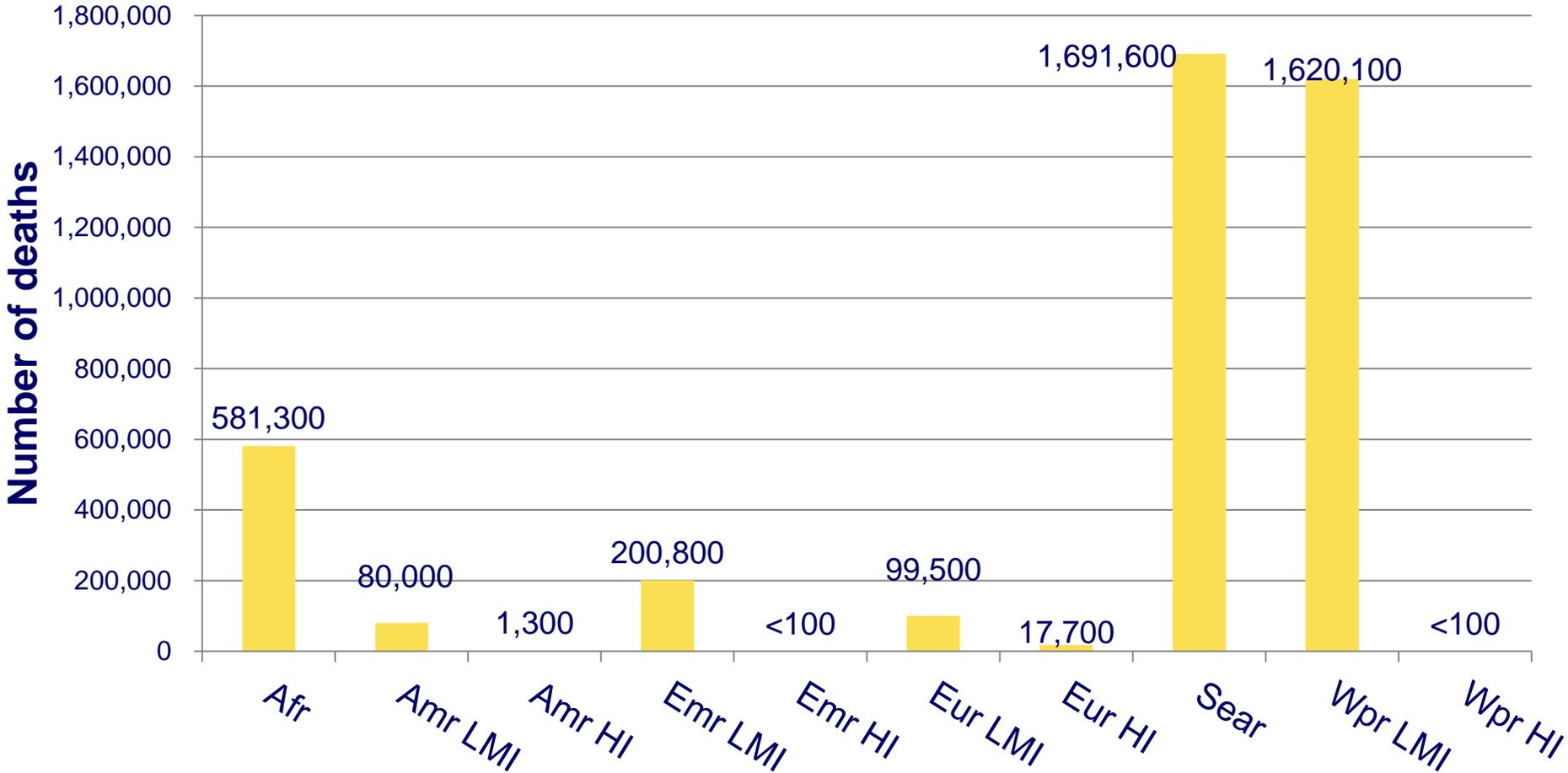
Results: HAP Exposure, 2012

Population Primarily Cooking with Solid Fuels



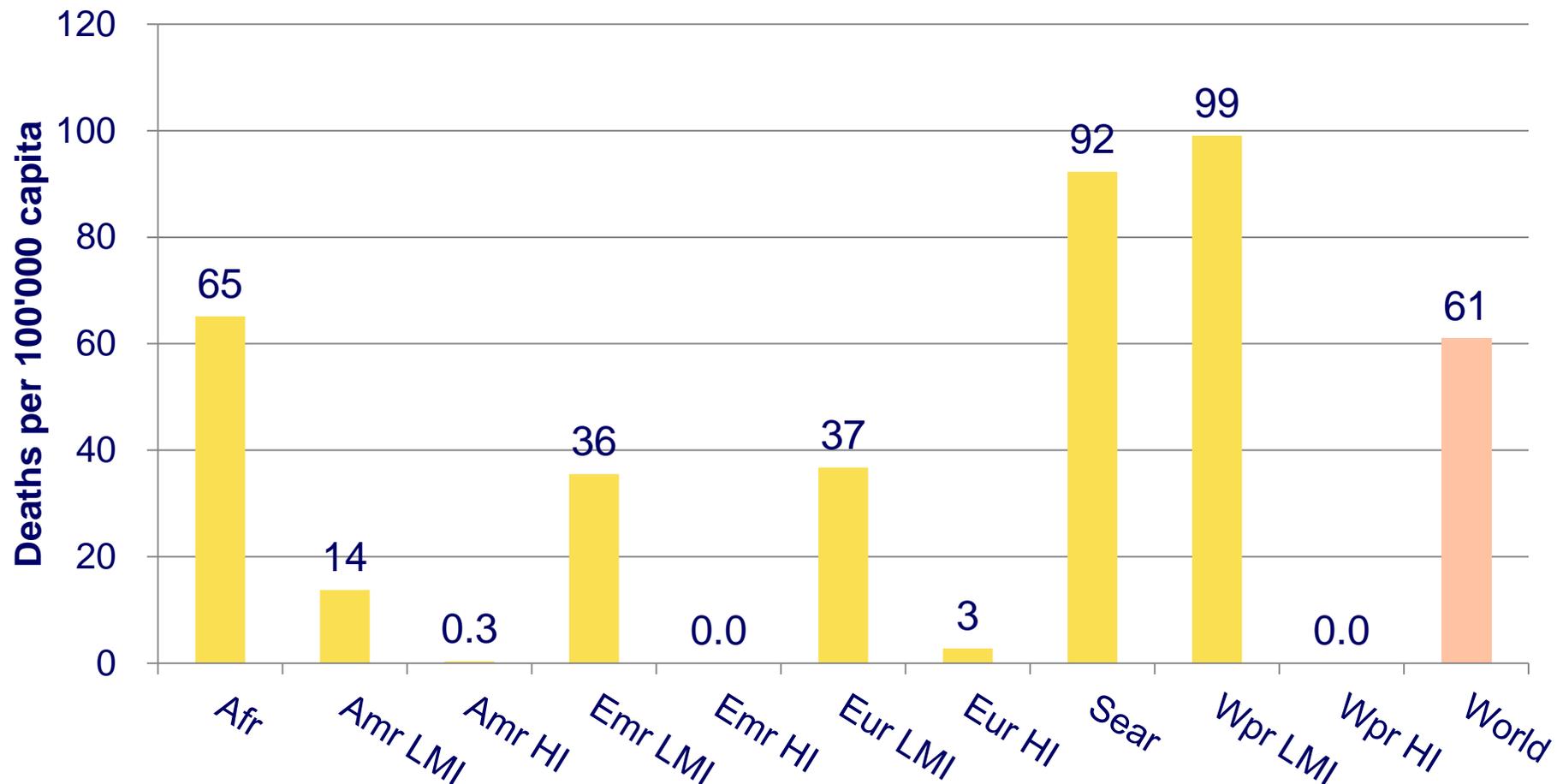
- 4.3 billion people exposed or...
- 42% of the global population

Results: Total deaths attributable to HAP in 2012 by region

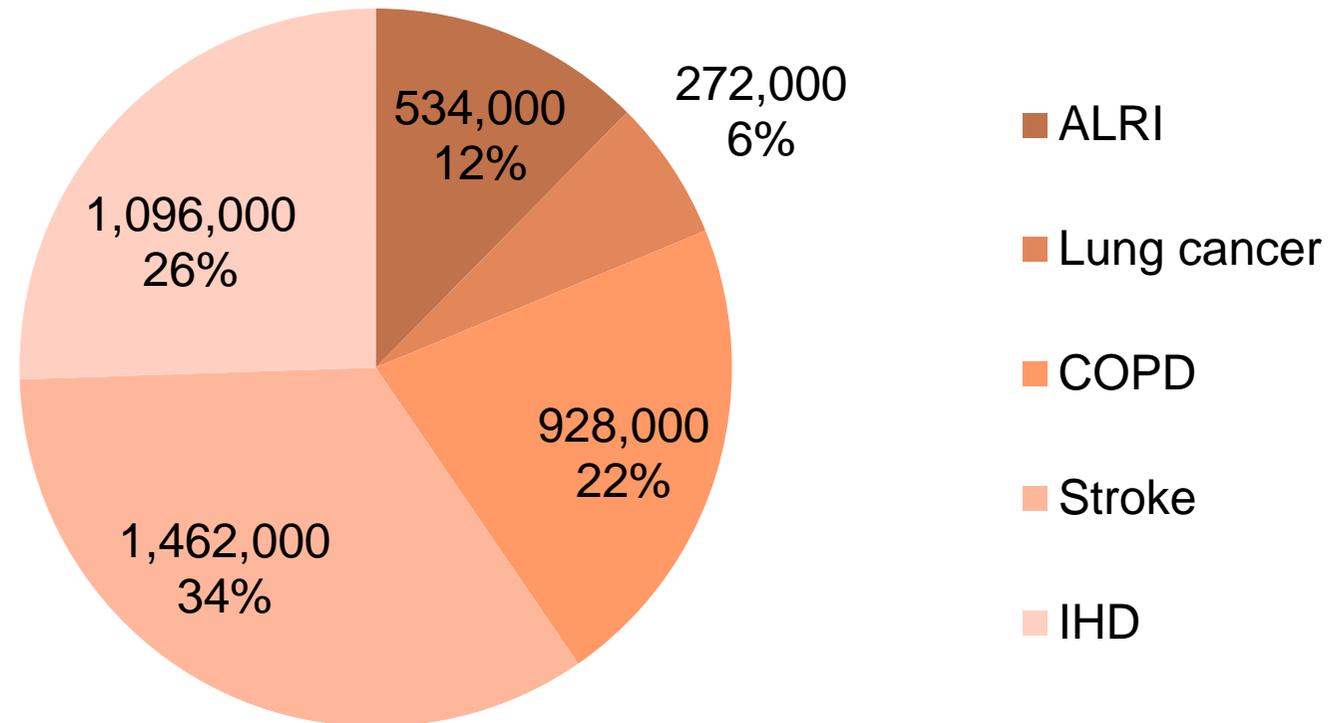


World: 4.3 million deaths

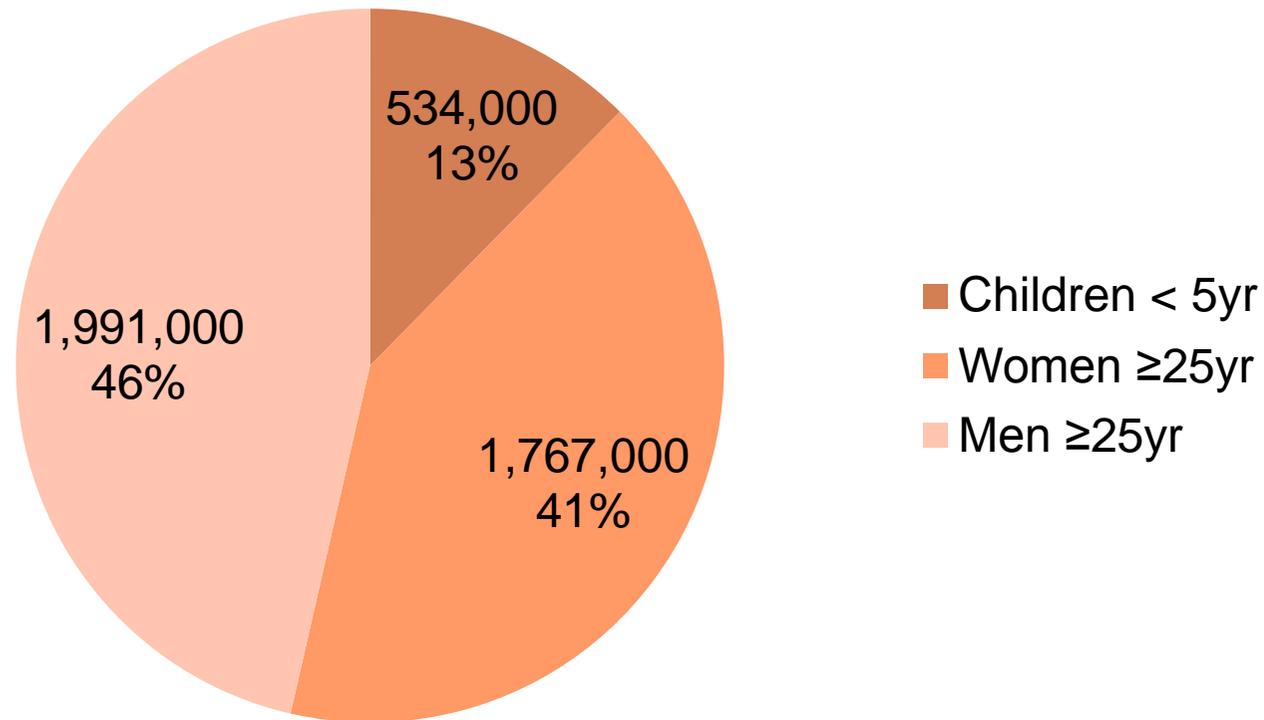
Results: Deaths per capita attributable to HAP in 2012, by region



Results: Deaths attributable to HAP in 2012, by disease



Results: Deaths attributable to HAP in 2012, by age and sex



Links

- Ambient air pollution database:

www.who.int/phe/health_topics/outdoorair/databases/cities

- Air pollution attributable mortality:

www.who.int/phe/health_topics/outdoorair/databases

www.who.int/gho/phe/outdoor_air_pollution

www.who.int/gho/phe/indoor_air_pollution



Thank you!

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