

## Burden of disease from the joint effects of household and ambient Air pollution for 2016

v2 May 2018

### Summary of results

Globally, 7 million deaths were attributable to the joint effects of household (HAP) and ambient air pollution (AAP) in 2016. About 94% of these deaths occur in low and middle-income (LMI) countries. The South East Asian and Western Pacific regions bear most of the burden with 2.4 and 2.2 million deaths, respectively. About 980 000 deaths occur in Africa, 475 000 in the Eastern Mediterranean region, 348 000 in Europe and 233 000 in the Americas. The remaining deaths occur in high-income countries of Europe (208 000), Americas (96 000), Western Pacific (83 000), and Eastern Mediterranean (18 000) (Figure 1).

Regional crude and age-standardized<sup>1</sup> death rates are shown in Figures 2 and 3. Both are available at country level in the WHO Global Health Observatory<sup>2</sup>. The mortality rate due to the joint effects of household and ambient air pollution serves as an indicator (SDG indicator 3.9.1) to monitor the environmental health target of the Sustainable Development Goal 3<sup>3</sup> (SDG) on health. WHO is the custodial agency for this and two other air pollution and health related indicators<sup>4</sup>. Death breakdown by disease and by sex are shown in Figures 4 and 5.

Country estimates of deaths, disability-adjusted life years (DALYs), years of life lost (YLD) are provided by disease and sex in the WHO website<sup>5</sup>. More details on the estimation methods are available in the document “Burden of disease from the joint effects of Household and Ambient Air Pollution for 2016 – Method description”<sup>6</sup>.

### *Linkages to the tracking of the Sustainable Development Goals*

The mortality rate attributed to the joint effects of ambient and household air pollution is reported as SDG 3 indicator 3.9.1 for which WHO is custodial agency. The percentage of the population primarily relying on clean fuels and technologies (SDG indicator 7.1.2) serves as one of the two main exposure indicators, together with annual mean PM<sub>2.5</sub> concentration (SDG indicator 11.6.2) to derive SDG 3.9.1.

**Note of caution:** An approximation of the combined effects of risk factors is possible if independence and little correlation between risk factors with impacts on the same diseases can be assumed<sup>7</sup>. In the case of air pollution, however, there are some limitations to estimate the joint effects: limited

---

<sup>1</sup> Age-standardized measures of deaths are often used to compare countries, as they adjust for age distribution differences by applying age-specific mortality rates for each population.

<sup>2</sup> WHO Global Health Observatory, World Health Statistics data visualizations dashboard, <http://apps.who.int/gho/data/node.sdg.3-9-data?lang=en>.

<sup>3</sup> Transforming our world: The 2030 Agenda for Sustainable Development (resolution A/RES/70/1). New York: United Nations; 2015.

<sup>4</sup> SDG 7.1.2 Proportion of population with primary reliance on clean fuels and technologies, and SDG 11.6.2 Annual mean levels of fine particulate matter in cities (population weighted), available at <http://apps.who.int/gho/data/node.sdg>.

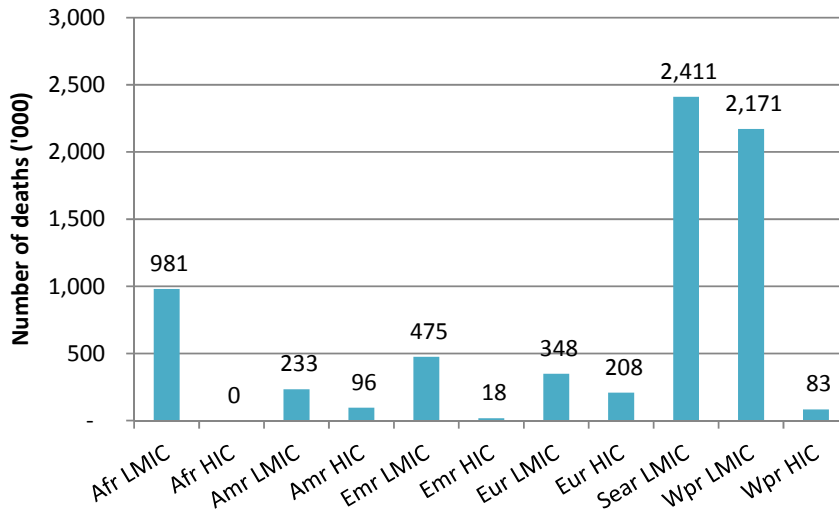
<sup>5</sup> WHO Air Pollution : [www.who.int/airpollution/data](http://www.who.int/airpollution/data) and Global Health Observatory: [www.who.int/gho/phe/outdoor\\_air\\_pollution](http://www.who.int/gho/phe/outdoor_air_pollution)

<sup>5</sup> <http://www.who.int/airpollution/data>

<sup>7</sup> Ezzati et al (2003), The Lancet, 362:271-80.

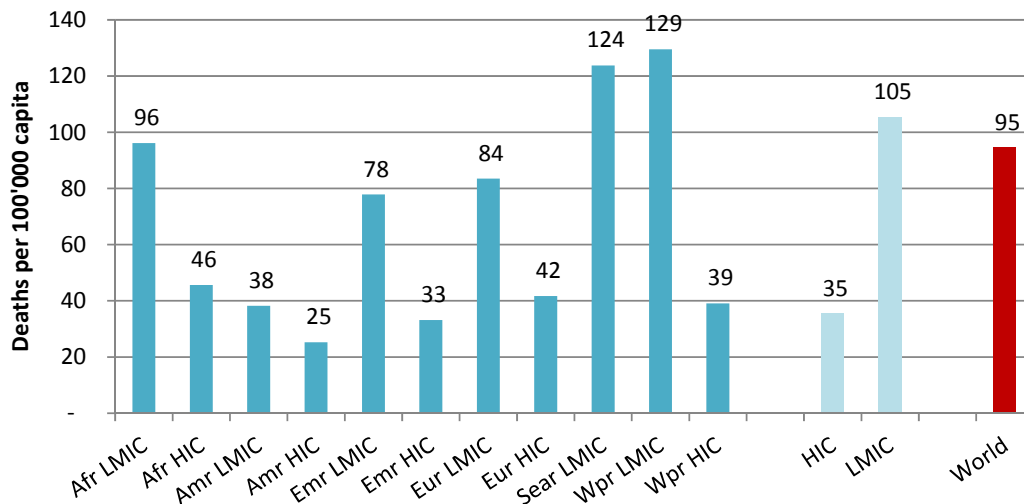
knowledge on the distribution of the population exposed to both household and ambient air pollution, correlation of exposures at individual level as household air pollution is a contributor to ambient air pollution, and non-linear interactions<sup>8,9</sup>.

**Figure 1.** Total deaths attributable to the joint effects of HAP and AAP in 2016, by region



HAP: Household air pollution; AAP: Ambient air pollution; Amr: America, Afr: Africa; Emr: Eastern Mediterranean, Sear: South-East Asia, Wpr: Western Pacific; LMIC: Low- and middle-income countries; HIC: High-income countries.

**Figure 2.** Deaths per capita attributable to the joint effects of HAP and AAP in 2016, by region

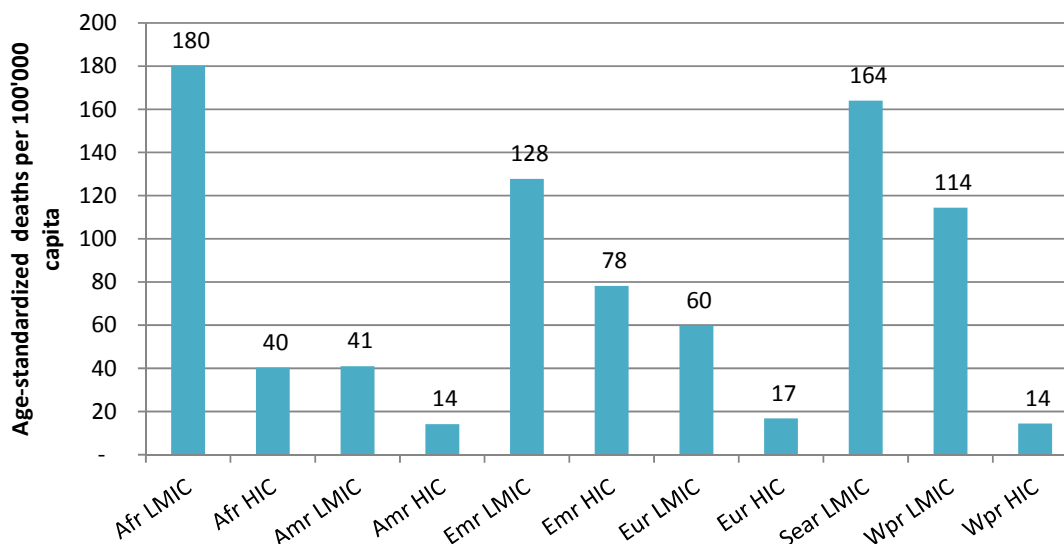


HAP: Household air pollution; AAP: Ambient air pollution; Amr: America, Afr: Africa; Emr: Eastern Mediterranean, Sear: South-East Asia, Wpr: Western Pacific; LMIC: Low- and middle-income countries; HIC: High-income countries.

<sup>8</sup> Lim et al (2012), The Lancet, 380:2224-2260.

<sup>9</sup> Smith et al (2014), Annu. Rev. Public Health 2014. 35:185-206.

**Figure 3.** Age-standardized deaths per capita attributable to the joint effects of HAP and AAP in 2016, by region



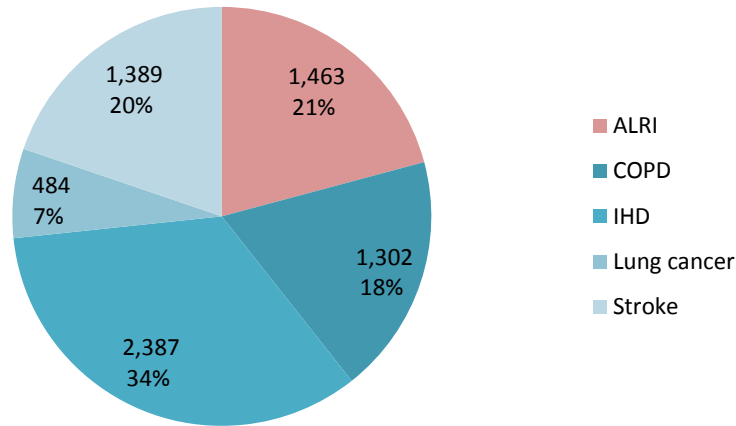
HAP: Household air pollution; AAP: Ambient air pollution; Amr: America, Afr: Africa; Emr: Eastern Mediterranean, Sear: South-East Asia, Wpr: Western Pacific; LMIC: Low- and middle-income countries; HIC: High-income countries.

**Table 1.** Population attributable fraction (PAF) for mortality attributable to the joint effects of HAP and AAP in 2016, by region and disease

WHO region	ALRI	COPD	Lung cancer	IHD	Stroke
Afr LMIC	64%	55%	39%	38%	36%
Afr HIC	19%	16%	14%	16%	13%
Amr LMIC	25%	23%	16%	18%	14%
Amr HIC	8%	9%	4%	9%	7%
Emr LMIC	54%	46%	30%	28%	26%
Emr HIC	42%	37%	31%	26%	22%
Eur LMIC	22%	22%	15%	15%	12%
Eur HIC	12%	13%	8%	11%	9%
Sear LMIC	61%	57%	50%	38%	33%
Wpr LMIC	52%	50%	45%	29%	27%
Wpr HIC	13%	14%	9%	11%	9%
HICs	12%	12%	7%	11%	9%
LMICs	56%	50%	39%	29%	27%
<b>World</b>	<b>50%</b>	<b>43%</b>	<b>29%</b>	<b>25%</b>	<b>24%</b>

HAP: Household air pollution; AAP: Ambient air pollution; Afr: Africa; Amr: America; Emr: Eastern Mediterranean; Eur: Europe; Sear: South-East Asia, Wpr: Western Pacific; LMIC: Low- and middle-income; HIC: High-income; ALRI: Acute lower respiratory disease; COPD: Chronic obstructive pulmonary disease; IHD: Ischaemic heart disease.

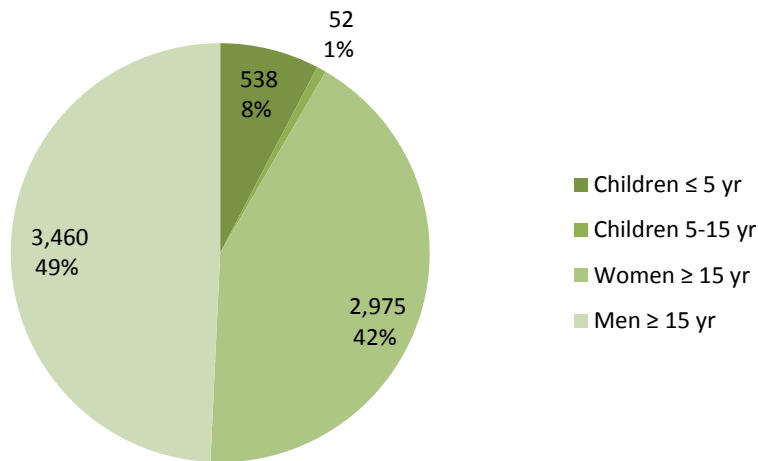
**Figure 4.** Deaths (000's) attributable to the joint effects of HAP and AAP in 2016, by disease.



Percentage represents percent of total HAP burden (add up to 100%).

HAP: Household air pollution; AAP: Ambient air pollution; ALRI: Acute lower respiratory disease; COPD: Chronic obstructive pulmonary disease; IHD: Ischaemic heart disease.

**Figure 5.** Deaths (000's) attributable to the joint effects of HAP and AAP in 2016, by age and sex.



Percentage represents percent of total burden (add up to 100%).

HAP: Household air pollution; AAP: Ambient air pollution; yr: year.

**For more information :**

Air pollution: [www.who.int/airpollution](http://www.who.int/airpollution)  
Maps and databases : [www.who.int/airpollution/data](http://www.who.int/airpollution/data)  
Global Health Observatory: [www.who.int/gho/phe/outdoor air pollution](http://www.who.int/gho/phe/outdoor_air_pollution)

**Note: All figures presented have been computed by WHO to ensure comparability; thus they are not necessarily the official statistics of Member States, which may use alternative rigorous methods.**

For further information, please contact:  
Public Health, Social and Environmental Determinants of Health Department,  
World Health Organization, 1211 Geneva 27, Switzerland  
Website: [www.who.int/phe](http://www.who.int/phe); email: [ambientair@who.int](mailto:ambientair@who.int)

© World Health Organization 2018

All rights reserved.