

## Burden of disease from the joint effects of Household and Ambient Air Pollution for 2012

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### Summary of results

Globally, 6.5 million deaths were attributable to the joint effects of household (HAP) and ambient air pollution (AAP) in 2012. The Western Pacific and South East Asian regions bear most of the burden with 2.4 and 2.2 million deaths, respectively. About 700 000 deaths occur in Africa, almost 400 000 in the Eastern Mediterranean region, 268 000 in Europe and 150 000 in the Americas. The remaining deaths occur in high-income countries of Europe (311 000), Americas (45 000), Western Pacific (44 000), and Eastern Mediterranean (10 000) (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.

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 2012”<sup>5</sup>.

**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>6</sup>. In the case of air pollution, however, there are some limitations to estimate the joint effects: limited 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>7,8</sup>. In several regions, however, household air pollution remains mainly a rural issue, while ambient air pollution is predominantly an urban problem. Also, in some continents, many countries are relatively unaffected by household air pollution, while ambient air pollution is a major concern. If assuming independence and little correlation, a rough estimate of the total impact can be calculated, which is less than the sum of the impact of the two risk factors. The joint effects of both ambient and household air pollution would result in the impacts shown in Figure 1-5. Given the limitations, however, the estimates presented below should be interpreted with caution, and provide indicative values only.

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<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 2016 data visualizations dashboard, <http://apps.who.int/gho/data/node.sdg.3-9-data?lang=en>, accessed November 11, 2016.

<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>, accessed November 11, 2016.

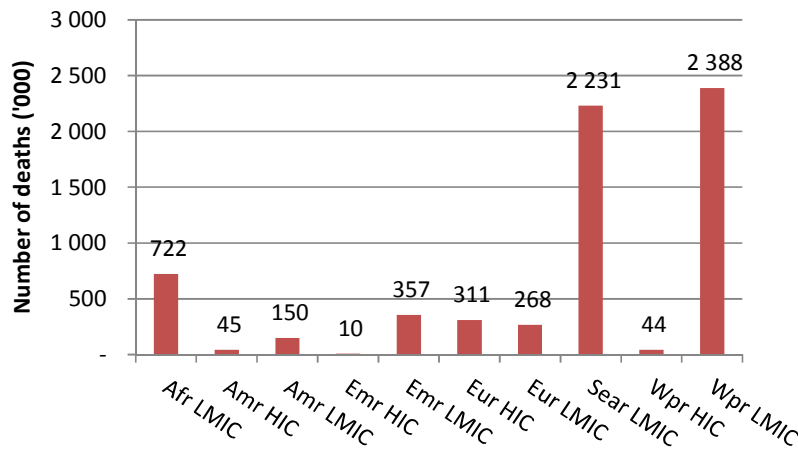
<sup>5</sup> [http://www.who.int/phe/health\\_topics/outdoorair/databases/AP\\_jointeffect\\_methods\\_Nov2016.pdf](http://www.who.int/phe/health_topics/outdoorair/databases/AP_jointeffect_methods_Nov2016.pdf)

<sup>6</sup> Ezzati et al (2003), *The Lancet*, 362:271-80.

<sup>7</sup> Lim et al (2012), *The Lancet*, 380:2224-2260.

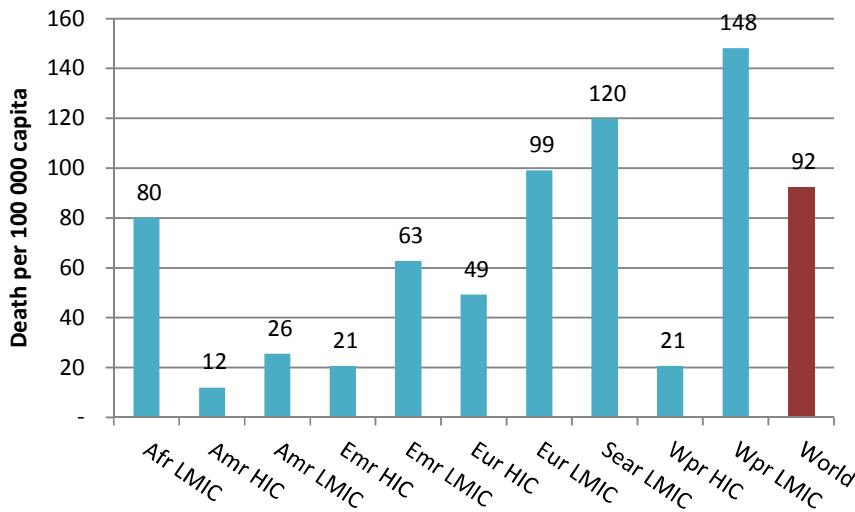
<sup>8</sup> Smith et al (2014), *Annu. Rev. Public Health* 2014. 35:185–206.

**Figure 1.** Total deaths attributable to the joint effects of HAP and AAP in 2012, by region



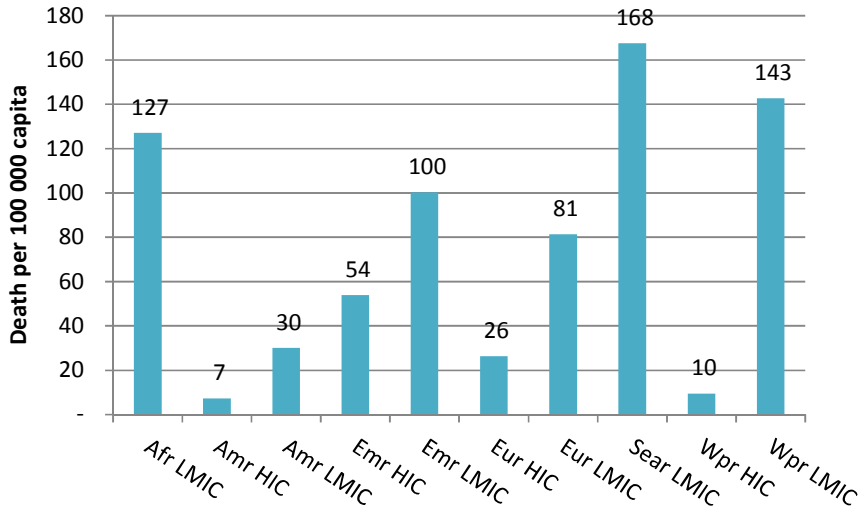
HAP: Household air pollution; AAP: Ambient air pollution; Amr: America, Afr: Africa; Emr: Eastern Mediterranean, Sear: South-East Asia, Wpr: Western Pacific; LMIC: Low- and middle-income countries; HIC: High-income countries.

**Figure 2.** Deaths per capita attributable to the joint effects of HAP and AAP in 2012, by region



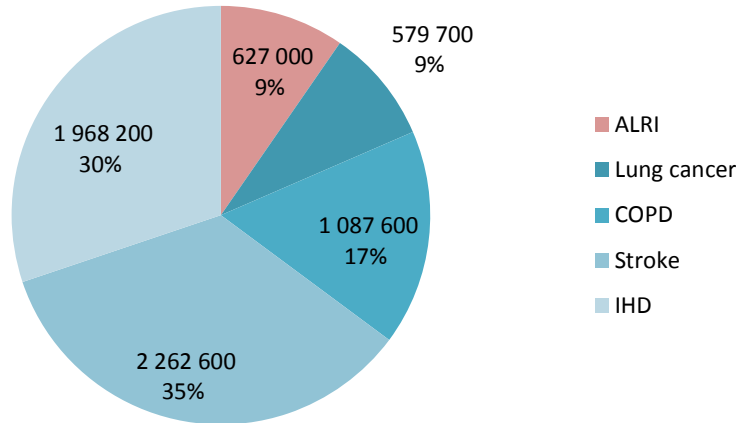
HAP: Household air pollution; AAP: Ambient air pollution; Amr: America, Afr: Africa; Emr: Eastern Mediterranean, Sear: South-East Asia, Wpr: Western Pacific; LMIC: Low- and middle-income countries; HIC: High-income countries.

**Figure 3.** Age-standardized deaths per capita attributable to the joint effects of HAP and AAP in 2012, 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.

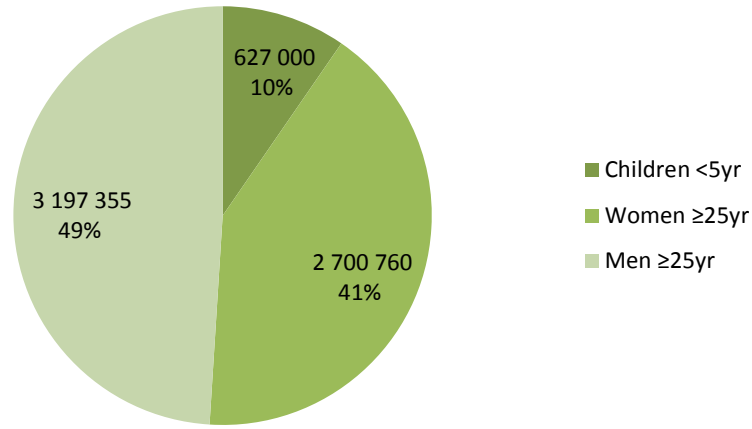
**Figure 4.** Deaths attributable to the joint effects of HAP and AAP in 2012, by disease



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 attributable to the joint effects of HAP and AAP in 2012, by age and sex



Percentage represents percent of total burden (add up to 100%).  
HAP: Household air pollution; AAP: Ambient air pollution; yr: year.

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