World Health Organization

Burden of disease from Household Air Pollution for 2012

Description of method

Version 1.2

The burden of disease attributable to household air pollution was estimated for the year 2012 based on Comparable Risk Assessment methods (1) and methods developed by IHME (Institute for Health Metrics and Evaluation) and expert groups for the Global Burden of Disease (GBD) 2010 study (2-3).

Source of the data

Health data

The total number of deaths and DALYs (disability-adjusted life years) by disease, country, sex and age group have been developed by the World Health Organization (4).

Exposure data

Modelled estimates for 2012 of the percentage of the population using solid fuels for cooking have been developed by the World Health Organization (5) according to methods described in Bonjour et al. (6) and were used as basis for disease burden calculation.

Exposure-risk relationships

The integrated exposure-response functions (IER) developed for the GBD 2010 study were used for ALRI (acute lower respiratory infections), lung cancer, stroke and IHD (ischaemic heart disease) (7) (Table 1). Personal exposure values for women, men and children were derived by Balakrishnan et al. (8) for the GBD 2010 (Table 2).

For COPD (chronic obstructive pulmonary disease), the relative risks from the systematic review / meta-analysis conducted for the GBD 2010 study were used (3).

Table 1. Relative risks

Disease	RR (95% CI) women	RR (95% CI) men	Reference
ALRI	2.9 (2.0-3.8) for children		(3, 7)
COPD	2.3 (1.7- 3.1)	1.9 (1.2- 3.1)	(3)
Lung cancer	2.3 (1.5-2.8)	1.9 (1.4-2.3)	(3, 7)
IHD	(1.4-2.2)	(1.4-2.2)	(3, 7)
Stroke	(1.4-2.4)	(1.3-2.4)	(3, 7)

RR: Relative risks; CI: Confidence interval; ALRI: Acute lower respiratory disease; COPD: Chronic obstructive pulmonary disease; IHD: Ischaemic heart disease. Women, resp. men, refer to adult women, resp. men aged ≥25years. Children refer to children under 5 years.
For stroke and IHD, there is an age-gradient for the relative risks, but presented here are the 95% confidence interval over their predicted values from the integrated exposure response functions over all ages.

Table 2. Personal exposure values

Group	Mean $PM_{2.5}$ (95% CI)	Reference
Children	285 $\mu g/m^3$ (201,405)	(3, 8)
Women	337 $\mu g/m^3$ (238,479)	(3, 8)
Men	204 $\mu g/m^3$ (144,290)	(3, 8)

$PM_{2.5}$: particulate matter with a diameter of 2.5 micrometre or less; CI: confidence interval. . Women, resp. men, refer to adult women, resp. men aged ≥25years. Children refer to children under 5 years.

Demographic data
Population data used were from the United Nations Population Division, Revision 2012 (9).

Methods

Estimation of disease burden
The percentage of the population exposed to household air pollution was provided by country; relative risks were calculated separately for men, women and children, based on the integrated exposure-response functions (IER) for all diseases but COPD. The counterfactual concentration was selected to be between 5.8 and 8.8 μg/m^3, as described in (2) and (6). The country population attributable fractions for ALRI, COPD, LC, stroke and IHD were calculated using the following formula:

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

where P_e is the percentage of the population exposed to that level of air pollution, i.e. the percentage of the population using solid fuels for cooking.

Uncertainty analysis
The uncertainty intervals are based on the 2.5th and 97th percentiles of 1000 draws for the relative risks of the integrated exposure-response functions, the personal exposure values and the modelled solid fuel use estimates. Uncertainty is however still underestimated given that uncertainty for baseline mortality is not taken into account.

References

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