Exposure to household air pollution for 2016
version 5 April 2018

Summary of results
The proportion of households in a country relying mainly on polluting fuels and technologies for cooking is currently used as a proxy indicator for estimating population exposure to household air pollution. Households mainly cooking with coal, wood, charcoal, dung, crop residues or kerosene are considered exposed.

Globally, 41% of the world population is exposed to household air pollution resulting from cooking with polluting fuels and technologies in 2016. The use of polluting fuels and technologies for cooking is almost exclusively a problem in low and middle income countries, with 83% of the African region, 59% of the South-East Asia region and 42% of the Western Pacific region primarily reliant on polluting cooking options. The Eastern Mediterranean region follows with 31% of its population relying primarily on polluting fuels, while the Americas and European regions with 13% and 6%, respectively (Figure 1).

*Figure 1. Population access to clean and polluting fuels for cooking in 2016, by region*

Linkages to the tracking of the Sustainable Development Goals

The percentage of the population primarily relying on clean fuels and technologies serves as one of the two main indicators (with electricity access) for monitoring progress towards the SDG 7 target on universal access to modern energy services. These estimates are also used in the calculation of the mortality rate attributed to the joint effects of ambient and household air pollution, SDG 3 indicator 3.9.1.

Since 2000, all regions have seen progress in household energy access but at varying rates. The South-East Asia region has outpaced other regions, doubling its share of population relying on clean fuels and technologies as shown in Figure 2 over the last two decades. The African region has shown
the slowest progress, falling short of the global trend with less than a 4% increase in the population using clean cooking since 2000.

Despite the apparent increase in the percentage of the population using clean fuels and technologies for cooking, the absolute number of people without access to clean fuels and technologies has stayed fairly constant. Since 2000, the global figures have remained unchanged, with 3 billion people still relying on polluting fuels and technologies for cooking (Figure 3).

**Figure 2.** Trends in access to clean fuels and technologies for cooking for the years 2000-2016, by region.

**Figure 3.** Population with and without access to clean technologies and fuels for cooking, by year and by region.
Methods

Data source: Information on the types of technologies and fuels used by households for cooking is regularly collected on nationally-representative household surveys or censuses. WHO regularly collects and compiles such household energy data in the WHO Household energy database. The data housed in this database is then the input data for a statistical model used to derive point estimates for global monitoring of household energy use and health impacts. For 2016 estimates, a version of the WHO Household energy database containing over 1100 surveys with data from 157 countries for the years 1974 to 2016 was used as data inputs in the statistical model.

Modelling techniques: The percentage of households that mainly use fuels such as wood, charcoal, crop waste, coal, dung and kerosene for cooking were considered ‘exposed’. Currently there is a very little to no nationally representative data capturing the type of solid fuel cookstove. However recognizing the importance of how the fuel and technology impact the level of household air pollution, in future updates, WHO will estimate exposure and disease burden attributed to both the fuel and solid fuel stove in combination (pending data availability). The percentage of households mainly using electricity, natural gas, liquefied petroleum gas, biogas, biofuels (e.g. ethanol), or solar energy for cooking were assumed to be ‘unexposed’.

The percentage of households mainly using electricity, natural gas, liquefied petroleum gas, biogas, biofuels (e.g. ethanol), or solar energy for cooking were assumed to be ‘unexposed’.

Together with the University of Exeter, the WHO has developed a global hierarchical household energy model (GHHEM) for producing estimates of overall polluting (and clean) fuel and technology usage. Set within a Bayesian hierarchical modelling framework, trends in the proportions of the population mainly using “polluting” or “clean” fuels and technologies are estimated for each country, based on survey information for that country, and using time as the only covariate.

The GHHEM is implemented using Markov chain Monte Carlo (MCMC), a type of Bayesian analysis. Summaries of these distributions can be taken to provide both point estimates (e.g. means) and measures of uncertainty (e.g. 95% credible and 95% prediction intervals). The GHHEM is applied to the WHO household energy database to produce a comprehensive set of estimates, together with associated measures of uncertainty, of the use of polluting fuels and technologies from cooking, by country, for each year for which survey data was available (1990-2016).

Data analysis: Only survey data providing individual fuel breakdowns and with less than 15% of the population reporting “missing” and “no cooking” and “other fuels” were included in the analysis. Countries with no household fuel data but classified as high income according to the World Bank country classification (37 countries) were assumed to have fully transitioned to clean household

---

energy and therefore are reported as >95% access to clean technologies and fuels. No estimates were reported for low and middle income countries without data (Lebanon, Libya and Turkey).

*Regional and global aggregates:* Population data from the United Nations Population Division were used to derive the population-weighted regional and global aggregates. Low- and middle income countries without data were excluded from the aggregate calculations.

---

**For more information:**

- Household air pollution: [www.who.int/airpollution/household](http://www.who.int/airpollution/household)
- Maps and databases: [www.who.int/airpollution/data](http://www.who.int/airpollution/data)
- Global Health Observatory: [www.who.int/gho/phe/indoor_air_pollution](http://www.who.int/gho/phe/indoor_air_pollution)
- SDG 7.1.2: [apps.who.int/gho/data/node.sdg.7-1](http://apps.who.int/gho/data/node.sdg.7-1)

---

**Acknowledgement**

The household energy database was updated during Fall/Winter 2017-2018 by Jessica Lewis, Itzel Martinez, Karen Zukor, Heather Adair-Rohani and Sophie Gumy (WHO Geneva). The modelling work was developed for and in collaboration with WHO by Gavin Shaddick, Oliver Stoner and Theo Economou, University of Exeter, United Kingdom.

The work was supported by the Norwegian Ministry of Foreign Affairs.

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: householdenergy@who.int

© World Health Organization 2018

All rights reserved.

---