



Proportion of children living in homes using solid fuels

FACT SHEET NO. 3.6 · MAY 2007 · CODE: RPG3_Hous_Ex3

Percentage of children aged 0–4, 5–9 and 10–14 years living in households using coal, wood or dung as the main source of heating and cooking fuel

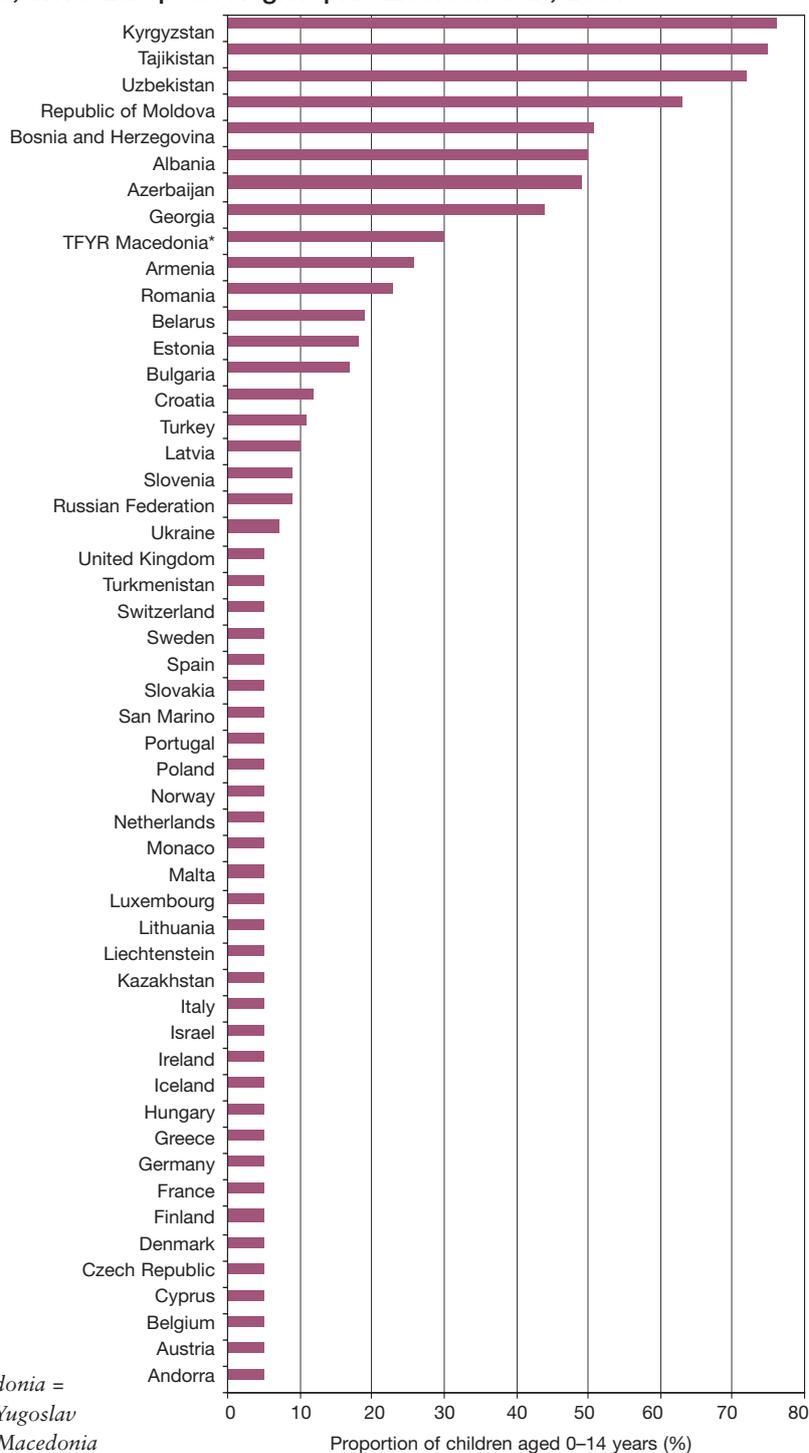
KEY MESSAGE

 Solid fuel use in homes in the 52 Member States of the WHO European Region in 2004 varied from below 5% to over 70%, even though the regional average of 16% was relatively low compared with other regions. The geographical pattern shows a gradual increase from west to east of the Region. Studies suggest that the WHO Air Quality Guideline limit of 20 $\mu\text{g}/\text{m}^3$ for annual PM_{10} (1) is exceeded in most homes where solid fuel is used, pointing to a substantial public health problem in the Region.

RATIONALE

The indicator provides a general measure of exposure to pollutants from indoor combustion sources, in particular with respect to fine particles. In terms of children's health, epidemiological studies demonstrate that the risk for child morbidity and mortality due to pneumonia is higher in households that use solid fuel than in households using liquid or gaseous fuels.

Fig. 1. Proportion of children aged 0–14 years living in homes using solid fuels, WHO European Region plus Liechtenstein, 2004



*TFYR Macedonia =
The former Yugoslav
Republic of Macedonia

Note. The actual proportion of children aged 0–14 years living in homes where solid fuels are used is under 5% in Andorra, Austria, Belgium, Cyprus, the Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Israel, Italy, Kazakhstan, Liechtenstein, Lithuania, Luxembourg, Malta, Monaco, the Netherlands, Norway, Poland, Portugal, San Marino, Slovakia, Spain, Sweden, Switzerland, Turkmenistan and the United Kingdom.

Source: World health statistics (2).

PRESENTATION OF DATA

Figure 1 presents the value of the indicator for the latest available year for the European Member States plus Liechtenstein. It is assumed that exposure to solid fuel combustion among children is equal to the exposure among the total population

HEALTH – ENVIRONMENT CONTEXT

Cooking and heating with solid fuels, such as dung, wood, agricultural residues, grass, straw, charcoal and coal, is a major source of indoor air pollution. The indoor smoke comprises a variety of health-damaging pollutants, such as particles (complex mixtures of chemi-

cals in solid form and droplets), carbon monoxide, nitrogen oxides, sulfur oxides, formaldehyde and carcinogens, such as benzo[a]pyrene and benzene. Small particles with a diameter of 10 µm or less (PM₁₀) are able to penetrate deep into the lungs. The smallest particles with a diameter of 2.5 µm or less (PM_{2.5}) appear to have the greatest health-damaging potential.

Combustion of solid fuels in inefficient stoves under poor ventilation conditions can result in large exposure burdens, particularly for women and young children who spend the major part of their time in the home (3). Of 1.6 million deaths globally related to indoor air pollution from the use of solid fuel, 52% are in children aged under five years. There is consistent evidence that exposure to indoor air pollution increases the risk of pneumonia among children in this age group, and chronic respiratory disease and lung cancer (in relation to coal use) among adults aged over 30 years (4).

There is some evidence for associations between biomass smoke and lung cancer, asthma, cataracts and tuberculosis. On the basis of the few available studies there is suggestive evidence of a link between indoor air pollution and adverse pregnancy outcomes, in particular low birth weight. Tentative evidence exists for associations with ischaemic heart disease and cancers of the nose and throat (5).

While the precise mechanism of how exposure causes disease is still unclear, it is known that small particles and several of the other pollutants contained in indoor smoke cause inflammation of the airways and lungs and impair the immune response. Carbon monoxide also results in systemic effects by reducing the oxygen-carrying capacity of the blood. Other components of indoor air pollution can cause healthy cells to mutate into cancerous ones.

POLICY RELEVANCE AND CONTEXT

In September 2000, the World Summit of Heads of State established the Millennium Development Goals (MDGs) (6) with the overall objective of encouraging healthy and prosperous development around the world. The seventh MDG calls for environmental sustainability. Within this context WHO has identified the “proportion of the population using solid fuels for cooking” as an indicator for assessing progress towards the integration of the principles of sustainable development into country policies and programmes. In addition, indoor air pollution as a consequence of

Table 1. Estimated burden of acute lower respiratory infections in children aged under five years attributable to use of solid fuels at home, 2004 and 2006

WHO epidemiological sub-regions	Comparative risk assessment project, 2004		Burden of disease study, 2006	
	No. of deaths (000s)	DALYs (000s)	No. of deaths (000s)	DALYs (000s)
<i>Eur-A</i> Andorra, Austria, Belgium, Croatia, Czech Republic, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Israel, Italy, Luxembourg, Malta, Monaco, Netherlands, Norway, Portugal, San Marino, Slovenia, Spain, Sweden, Switzerland, United Kingdom	0	0	0	0
<i>Eur-B</i> Albania, Armenia, Bosnia and Herzegovina, Bulgaria, Georgia, Kyrgyzstan, Poland, Romania, Serbia and Montenegro*, Slovakia, Tajikistan, TFYR Macedonia**, Turkey, Turkmenistan, Uzbekistan	12	417	5	160
<i>Eur-C</i> Belarus, Hungary, Kazakhstan, Latvia, Lithuania, Republic of Moldova, Russian Federation	1	22	0	3

* Serbia and Montenegro became two separate Member States of WHO in September 2006. In this fact sheet the data refer to before that date and relate to the then one country of Serbia and Montenegro.

**TFYR Macedonia = The former Yugoslav Republic of Macedonia

Source: Comparative risk assessment project (8); Burden of disease study (5).

household energy problems is linked to the achievement of other MDGs, in particular those for reducing child mortality (Goal 4) and improving maternal health (Goal 5).

The WHO European Member States have declared that they will aim to substantially reduce morbidity and mortality from acute and chronic respiratory disorders (7). They plan to do so through developing indoor air quality strategies that take into account the specific needs of children and improving access to healthier and safer heating and cooking systems.

Measures to reduce indoor air pollution and associated health effects range from switching to cleaner alternatives, such as gas, electricity, solar energy or modern biofuels, to improving stoves or hoods that vent health-damaging pollutants to the outside, to changing behaviour patterns. There is an urgent need to investigate the real scale of the problem in Europe and to promote successful and sustainable interventions accordingly.

ASSESSMENT

All assessments are based on the indicator as defined for the MDG: percentage of the population using solid fuels. Not all countries have conducted surveys of energy use for cooking and heating. Where no data are available, the indicator is modelled; countries with a gross

national income of more than US\$ 10 500 are assumed to have made an almost complete transition to cleaner cooking fuels (less than 5% solid fuel use).

According to the WHO regional assessment of the burden of disease related to the use of solid fuels carried out at WHO headquarters in 2006 with health data from 2002, the highest burden lies on children aged under five years living in Eur-B countries (5). The lower number of disability-adjusted life-years (DALYs) per 100 000 in 2006 estimations in Eur-C countries is related to more accurate data on solid fuel use in homes which became available from national surveys.

Taking into account the model that has been applied for estimation, findings would suggest that indoor air pollution from solid fuel combustion is a public health problem in some areas of the Region. The scale of the problem is difficult to ascertain due to the fact that the data reported by many Member States, in particular those in the Eur-C sub-region, do not show the use of solid fuel at household level. However, the estimates that take into account sociodemographic and economic parameters result in noticeable use rates. The projected use of solid fuels in households is higher in the eastern countries than in the west.

In line with the indicator, a burden of disease study was conducted in 2005 which looked at indoor air pollution caused by the use of solid fuels in households (8). This study, which was

based on a number of assumptions, provides an estimate of the probable exposure rate to indoor air pollution from solid fuels in the WHO regions. For many of the regions (including the European Region) the exposure data were statistically modelled and all the calculations obtained are, therefore, estimates. According to this study, the estimated burden in the European Region is the highest in the Eur-B sub-region countries (Table 1). The WHO epidemiological sub-regions are defined by geographic location and patterns of child and adult mortality (9).

This indicator should be interpreted with caution, due to the inherent problems associated with the methodology and data used. The indicator does not take into account factors such as stove type, ventilation and behaviour, which are likely to affect exposures and health outcome. Additionally, health outcomes may be confounded by other factors such as socioeconomic status or age.

DATA UNDERLYING THE INDICATOR

Data source

World health statistics (2)

Indoor air pollution (10)

Population data: EUROSTAT (11)

Description of data

Data are based on international surveys (e.g. Demographic and Health Surveys, the World Health Survey), censuses and national energy statistics.

Method of calculating the indicator

Percentage of general population using solid fuels.

Average population by country and five-year age groups.

The indicator is computed as simple percentages: $100 \times C_{\text{solid}}/C_{\text{tot}}$, where C_{solid} is the number of children living in households using coal, wood or dung as the main source of cooking/heating fuel in a given age group, and C_{tot} is the total number of children in the same age group.

Geographical coverage

Data are available for 52 countries of the WHO European Region. The data for Andorra, Austria, Belgium, Cyprus, the Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Israel, Italy, Kazakhstan, Lithuania, Luxembourg, Malta, Monaco, the Netherlands, Norway, Poland, Portugal, San Marino, Slovakia, Spain, Sweden, Switzerland, Turkmenistan and the United Kingdom are estimates.

Period of coverage

A single year (based on current data).

Frequency of update

Depends on availability of new data.

Data quality

Current limitations in the definition and reporting of the indicator should be overcome in order to improve accuracy in estimating health and other impacts and to provide a better basis for designing interventions. At present, data are compiled on a country-by-coun-

try basis from different sources. For the majority of the countries this is done through various surveys and censuses. In other countries data come from models using parameters such as proportion of people living in rural areas and the gross national income for the year corresponding to the data surveyed. For upper-middle or high-income countries with a gross national income of more than US\$ 10 500 per capita in 2003, the proportion of the population using solid fuels is assumed to be less than 5%. Efforts must continue to improve regular data collection through relevant international

and national surveys, such as the Demographic and Health Survey (12), the World Bank Living Standards Measurement Study (13), the United Nations Children's Fund's Multiple Indicator Cluster Survey (14), the World Health Survey (15) and national censuses by integrating additional questions on type of cooking stove and kitchen characteristics as well as heating and ventilation practices. Furthermore, given the stark contrast between urban and rural populations, household energy practices should be disaggregated according to place of residence (4).

References

1. *Air quality guidelines for Europe, 2nd ed.* Copenhagen, WHO Regional Office for Europe, 2000 (WHO Regional Publications, European Series, No. 91; http://www.euro.who.int/air/activities/20050223_3, accessed 2 March 2007).
2. *World health statistics 2006.* Geneva, World Health Organization, 2007 (<http://www.who.int/whosis/whostat/2006.pdf>, accessed 26 March 2007).
3. Mehta S et al. Modeling household solid fuel use towards reporting of the Millennium Development Goal indicator. *Energy for Sustainable Development*, 2006, 10(3):36–45 (<http://www.who.int/indoorair/mdg/esdmodellingsolidfueluse.pdf>, accessed 26 March 2007).
4. *Indoor air pollution and health.* Geneva, World Health Organization, 2005 (fact sheet No. 292; <http://www.who.int/mediacentre/factsheets/fs292/en/index.html>, accessed 26 March 2007).
5. Rehfuess E, Mehta S, Prüss-Üstün A. Assessing household solid fuel use: multiple implications for the Millennium Development Goals. *Environmental Health Perspectives*, 2006, 114(3):373–378 (<http://www.ehponline.org/members/2006/8603/8603.html>, accessed 26 March 2007).
6. *Millennium Development Goals Report 2006.* New York, United Nations, 2006 (<http://mdgs.un.org/unsd/mdg/Resources/Static/Products/Progress2006/MDGReport2006.pdf>, accessed 27 March 2007).
7. *Children's Environment and Health Action Plan for Europe. Declaration.* Fourth Ministerial Conference on Environment and Health, Budapest, 23–25 June 2004 (EUR/04/5046267/6; <http://www.euro.who.int/document/e83338.pdf>, accessed 26 March 2007).
8. Smith KR, Mehta S, Maeusezahl-Feuz M. Indoor air pollution from household use of solid fuels. In: Ezzati M et al., eds. *Comparative quantification of health risks: global and regional burden of disease attributable to selected major risk factors*, Vol. 2. Geneva, World Health Organization, 2004:1435–1493 (<http://ehs.sph.berkeley.edu/krsmith/publications/Chapt%2018%20IAP%20from%20Soid%20Fuels.pdf>, accessed 28 March 2007).
9. *The world health report 2002 – reducing risks, promoting healthy life.* Geneva, World Health Organization, 2002 (<http://www.who.int/wbr/2002/en/>, accessed 26 March 2007).
10. *Indoor air pollution [web site].* Geneva, World Health Organization, 2007 (<http://www.who.int/indoorair/en/>, accessed 26 March 2007).
11. *EUROSTAT [web site].* Brussels, EUROSTAT, 2007 (<http://epp.eurostat.ec.europa.eu>, accessed 26 March 2007).
12. *Demographic and health survey [web site].* Calverton, MD, Measure DHS, 2007 (<http://www.measuredhs.com>, accessed 26 March 2007).
13. *Living standards and measurement survey [web site].* New York, World Bank, 2007 (<http://www.worldbank.org/LSMS>, accessed 26 March 2007).
14. *End decade assessment. Multiple cluster interview survey [online database].* New York, United Nations Children's Fund, 2007 (<http://www.childinfo.org/MICS2/Gj99306k.htm>, accessed 26 March 2007).
15. *World health survey [web site].* Geneva, World Health Organization, 2007 (<http://www.who.int/healthinfo/survey/en/index.html>, accessed 26 March 2007).

Further information

Fuel for life: Household energy and health. Geneva, World Health Organization, 2006 (<http://www.who.int/indoorair/publications/fuelforlifelen/>, accessed 26 March 2007).

Study on environmental burden of disease in children: key findings. Copenhagen, WHO Regional Office for Europe, 2004 (Fact Sheet EURO/05/04; <http://www.euro.who.int/document/mediacentre/fs0504e.pdf>, accessed 15 March 2004).

Authors:

Momchil Sidjimov, National Centre for Public Health Protection, Sofia, Bulgaria;
Ingrida Zurlyte, State Environmental Health Centre, Vilnius, Lithuania.