

CHILDREN AGED 0-4 YEARS LIVING IN HOUSEHOLDS USING BIOMASS FUELS OR COAL AS THE MAIN SOURCE OF HEATING AND COOKING

GENERAL CONSIDERATIONS

<i>Issues</i>	Respiratory diseases
<i>Type of indicator</i>	Exposure (proximal)
<i>Rationale</i>	<p>Children spend a large proportion of their time indoors, either at home or at school. Levels of air pollution in the indoor environment are therefore important determinants of exposures to air pollutants, and thus of children's health. Short periods of high level exposure are known to be implicated in acute respiratory responses (e.g. reduced lung function, wheezing, asthma attacks). Sensitization to air pollution at an early age may also increase long-term susceptibility to air pollution and contribute to risks of chronic health effects in later life.</p> <p>Much of the pollution found indoors derives from outdoor sources; indoor concentrations thus depend in part on outdoor concentrations. Rates of ingress into, and egress from, buildings depend mainly on ventilation conditions, meteorology (e.g. temperature, wind speed, atmospheric pressure) and behavioural patterns of the occupants. Occupants themselves (both humans and pets) may introduce large quantities of pollutants into the home, for example on their clothes or feet, which are then recycled in the indoor air. In addition, a wide range of indoor sources and activities add to the pollutant concentrations in the home, including smoking, cooking, heating, chemicals usage and releases from furnishings. Indeed, these internal releases are often responsible for the major peaks in exposure experienced by children.</p> <p>Many different pollutants thus occur in the indoor environment, and many of these may pose risks to children's health. These include particulates, nitrogen oxides, carbon monoxide, sulphur oxides, ozone, volatile organic compounds (e.g. benzene, a-pyobenzene), metals (e.g. asbestos, lead, cadmium, mercury), radon, and organic agents and allergens (e.g. dust mite, fungi, moulds). These may act individually or in combination to affect health: for example risks from radon exposure seem to be exacerbated by environmental tobacco smoke.</p> <p>Combustion of biomass fuels in unvented (or poorly vented) stoves and fires for cooking and heating, together with smoking, often represent the most important indoor sources. Pollutants emitted from these sources include particles, carbon monoxide, sulphur dioxide, nitrogen dioxide and volatile organic compounds (of which a number are known or suspected carcinogens). In poorly vented environments, particles and carbon monoxide are often found at especially high levels and pose particular health threats. Potential health effects include acute respiratory infection, chronic pulmonary disease, cancer, tuberculosis, reduced birthweight and eye damage.</p>
<i>Issues in indicator design</i>	As with outdoor air pollution, the ideal indicator would be based on monitoring of air pollution in the indoor environment. Such data are, however, generally lacking, except where specific monitoring campaigns have been conducted (e.g. using personal monitoring). Even then, problems can occur, because of the wide range of pollutants potentially of interest. On the one hand, if separate indicators are developed for each pollutant, it becomes difficult to interpret these in any holistic way; on the other hand, difficulties occur in trying to combine data on individual pollutants into a

	<p>composite indicator of indoor air pollution (especially in the absence of widely accepted indoor air quality targets or standards).</p> <p>In most cases, therefore, indicators of indoor air pollution are computed in terms of indoor emission sources. The sources considered may vary according to local circumstances, but major sources of concern typically include smoking (environmental tobacco smoke), heating and cooking (e.g. fuel types and degree of emission control of heating and cooking facilities), building materials (e.g. asbestos, radon), geological sources (radon) and organic sources (e.g. dust mite, moulds). Describing these various sources in a consistent way, and combining them into a general index of indoor pollution sources, is nevertheless difficult. Possibly the best approach is to assess the percentage of premises (or their occupants) having specific types of indoor emission sources. Examples might be the proportion of homes in which adults smoke, or the proportion of homes with unvented gas or fossil fuel cookers and heaters. Alternatively, the indicator could be defined as the percentage of households connected to electricity and gas supplies. In each case, relevant data are often available from specially designed household surveys, from utility companies or perhaps from routine censuses and surveys. Here the focus is on use of biomass fuels indoors, since these are commonly a major source of children's exposure, and a major risk factor for respiratory health.</p> <p>An age range of 0-4 years is used because risks tend to be greatest for pre-school age children, who spend more of their time at home.</p>
SPECIFICATION	
<i>Definition</i>	Percentage (or number) of children aged 0-4 years living in households using coal, wood or dung as the main source of heating and cooking fuel.
<i>Terms and concepts</i>	<p>Household: a single dwelling unit (e.g. a house or apartment) intended for permanent residence.</p> <p>Use of coal, wood or dung as the main source of cooking or heating fuel: the reliance on coal (or lignite), wood or dung as the primary cooking or heating fuel in the home.</p>
<i>Data needs</i>	Number of children aged 0-4 years by type of fuel usage in the home.
<i>Data sources, availability and quality</i>	<p>Data on number of households using coal, wood or dung as the main source of cooking and heating fuel may be available from census statistics or household surveys, and in these cases are liable to be broadly reliable. In many cases, however, data will need to be collected via household surveys.</p> <p>Data on the total number of children by age and household should be available through national census statistics, though care is needed in relation to the definition of a 'household' (e.g. how collective dwellings are classified).</p>
<i>Level of spatial aggregation</i>	Community or administrative district
<i>Averaging period</i>	Annual or longer term

<i>Computation</i>	<p>The indicator can be computed as a simple percentage:</p> $100 * C_{bio} / C_{tot}$ <p>where: C_{bio} is the number of children living in households using coal, wood or dung as the main source of cooking/heating fuel;</p> <p>C_{tot} is the total number of children aged 0-4 years.</p>
<i>Units of measurement</i>	Percentage (or number) or percentage change
<i>Worked example</i>	<p>Assume that, based on a sample survey shows that 9 300 children (from a total of 27 000) live in homes relying on coal, wood or dung as the main fuel source for cooking and heating. The value of the indicator is thus:</p> $100 * 9\,300 / 27\,000 = 34.4\%$
<i>Interpretation</i>	<p>This indicator provides a general measure of differences or trends in exposure to air pollutants from indoor heating and cooking sources: a reduction in the percentage of children living in homes relying on coal, wood or dung may be taken to imply a reduced level of exposure and thus a reduced risk of respiratory illness.</p> <p>In applying and interpreting the indicator, however, it should be noted that:</p> <ul style="list-style-type: none"> • it takes no account of use of other sources of indoor pollution (e.g. smoking, furnishings, solvents); • the indicator takes no account of the many other factors (e.g. lifestyle and ventilation behaviour) likely to affect exposures; • relationships with health outcome may be heavily confounded by other factors, including exposures to outdoor and occupational pollution, housing conditions and socio-economic factors.
<i>Variations and alternatives</i>	<p>Many variations on this indicator are possible, to reflect local circumstances. Different fuel sources or different heating and cooking facilities might be selected, for example, as a basis for the indicator (e.g. 'open fires or unvented gas cookers and heaters' may be more appropriate in more developed areas of the world).</p> <p>Similar indicators can also be designed to include other sources of indoor air pollution, such as asbestos-containing materials, radon-bearing rocks or cements, or homes in which adults smoke.</p> <p>It might also be possible in some cases to score homes according to the presence or absence of several different types of indoor air pollution source, for example: smoking in the home; reliance on coal, wood or dung as the main heating fuel; presence of asbestos-bearing building materials; presence of radon-bearing building materials or underground radon sources. In this case, weights might be used to reflect the differing levels of health risk considered to derive from each source.</p>
<i>Examples</i>	<p>WHO <i>Environmental health indicators: framework and methodologies</i></p> <ul style="list-style-type: none"> • Sources of indoor air pollution
<i>Useful references</i>	<p>Albalak, R., Frisancho, A.R. and Keeler, G.J. 1999 Domestic biomass fuel combustion and chronic bronchitis in two rural Bolivian villages. <i>Thorax</i> 54, 1004-8.</p> <p>Bruce, N., Perez-Padilla, R. and Albalak, R. 2000 Indoor air pollution in developing countries: a major environmental and public health challenge.</p>

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