

Indoor air pollution: There is no smoke without fire



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Overview

Few rigorous impact evaluations are available. While assessments of the broad range of interventions find indoor air pollution is reduced, there is less evidence on how these affect health outcomes and which interventions are most cost-effective.

Key words: Indoor air pollution, climate change

Mind the gap

Over half the world's population relies on solid fuels, such as wood, dung or agricultural residues for cooking, which is responsible for a range of respiratory conditions mostly affecting women and children in developing countries. Every year, indoor air pollution contributes to about 1.5 million deaths (Rehfuess, 2006). Dependence on solid fuels exacerbates deforestation, which contributes to the build-up of carbon dioxide in the earth's atmosphere, and thus to global climate change (WHO/UNEP, 2009).

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The wide variety of interventions available to reduce indoor air pollution levels, exposure and the associated health effects can be grouped into three categories: (i) those that change the source of pollution such as fuel switching or better cooking devices; (ii) those that improve the living environment like smoke hoods or windows; and (iii) those that modify user behaviour and have people change cooking practices and avoid exposure to smoke.

Their effectiveness can be evaluated in terms of their adoption; market development; performance; pollution levels and personal exposure; health and safety; time and socio-economic impacts; and environmental impacts (WHO, 2008). Most evaluations of indoor air pollution interventions focus on their effectiveness in reducing pollution levels and improving variables related to health.

Lessons learned

There have been several hundred improved stoves programmes alone in over 50 countries, ranging from small-scale local, non-governmental initiatives to national interventions reaching millions of households, such as in China (WHO, 2002).

The implementation of these and other interventions has often been unsystematic. This is in part due to the lack of rigorous impact evaluations linking interventions not only to indoor air pollution reduction, but also to improved health outcomes.

The only randomised controlled trial to attempt to do so, RESPIRE (Randomized Exposure Study of Pollution Indoors and Respiratory Effects) was conducted in the highlands of Guatemala from 2002-2004. The Guatemala study found a 44 per cent reduction in child exposure to Carbon Monoxide in households using the improved stoves, with a corresponding reduction diagnosed rates of respiratory infection compared to the control groups (WHO, 2007).

Most evaluations are less complex, more budget-conscious, and context-specific. Studies such as Dasgupta et al. in Bangladesh (2006) and Parikh et al. in India (2001) find that fuel choice significantly affects indoor air pollution levels. Natural gas and kerosene are significantly cleaner than biomass fuels, but household-specific factors also influence particulate matter concentrations significantly.

In Mexico, households were selected from a health intervention study and monitored before and after receiving improved wood-burning stoves. On average, personal exposures to fine particles in a day were reduced by half (Zuk et al., 2007).

Another Mexican case study evaluates a risk reduction programme that involved removing indoor soot, paving dirt floors and introducing improved stoves. There were positive changes in three health variables, including the level of Blood carboxyhemoglobin

formed when carbon monoxide combines with hemoglobin and inhibits oxygen intake. These positive changes suggest risk reduction worked for families using biomass fuels (Torres-Dosal et al., 2008).

In Kenya, smoke hoods installed under the ITDG Smoke and Health Project were found to reduce women's personal exposure to about a third (Warwick and Doig, 2004).

Broader evaluations of interventions remain for the most part modelling exercises using WHO methodological guidelines such

as a cost-benefit analysis of interventions reducing indoor air pollution across 11 global sub-regions (Hutton et al., 2007) and a cost-effectiveness analysis of using cleaner fuels and improved stoves (Mehta and Shahpar, 2004).

The findings are useful but do not constitute rigorous evaluations of specific interventions. A more comprehensive review by Tremeer et al. (2000) shows that the most effective and beneficial interventions would be a shift from wood or charcoal to kerosene, LPG, biogas or grid electricity. Living space interventions such as cooking windows are also promising (Tremeer et al., 2000).

The World Bank Environment Strategy reviews studies on the costs of health gains due to these kinds of interventions, using measures of disability-adjusted life year (DALY) saved. DALY is a measure of the burden of disease, incorporating both mortality and morbidity due to disabilities. Improved biomass stoves cost US\$50-100 per disability-adjusted life year (DALY) saved, and kerosene and LPG stoves cost US\$150-200 per DALY. The World Bank proposes that health sector interventions of up to US\$150 should be considered cost-effective (World Bank, 1993).

Closing the evaluation gap

There is a need for more rigorous evaluations that allow for comparisons of interventions across contexts. This will require evaluations focusing on the cost-effectiveness of interventions, as well as how effective they are in improving health, welfare

and the environment. The WHO catalogue of methods (2008) is a useful guide on conducting evaluations that may not be as rigorous as the Guatemalan Randomized Control Trials, but more suited to organisational aims and resources.

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Credits

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