



CURT CARNEMARK/WORLD BANK

2. About this catalogue

What is the purpose of this catalogue, and who is it for?

This catalogue of methods is intended to help governmental agencies, non-governmental organizations and universities involved with household energy interventions develop an evaluation strategy appropriate to their needs. It provides information on a diverse range of evaluation options ranging from simple questionnaires to complex monitoring techniques. The catalogue provides basic guidance on choosing between different evaluation options according to feasibility, organizational objectives, type of intervention and so on. It also outlines practical issues related to study design, ethical considerations, analysis and reporting. Ultimately, it is intended to save organizations time and effort in identifying evaluation methods and developing an evaluation strategy. By describing advantages and drawbacks of different approaches it aims to help organizations identi-

fy methods appropriate to their goals and organizational capacities.

This catalogue is appropriate for a wide range of organizations. For example, the methods described in this document could be employed by:

- organizations with limited resources looking to undertake simple evaluations to improve their interventions and report back to beneficiaries and donors; or
- organizations/partnerships with significant resources planning a scientific evaluation to contribute credible evidence to the international knowledge base.

Does this catalogue contain all the information required to conduct successful evaluation?

This catalogue provides resources and ideas to help structure evaluation planning. Although the catalogue of methods does not attempt to

Table 1 Health impacts of indoor air pollution¹

Health outcome	Evidence ^a	Population	Relative risk ^b	Relative risk (95% confidence interval) ^c
Acute infections of the lower respiratory tract	Strong	Children aged 0–4 years	2.3	1.9–2.7
Chronic obstructive pulmonary disease	Strong	Women aged ≥ 30 years	3.2	2.3–4.8
	Moderate I	Men aged ≥ 30 years	1.8	1.0–3.2
Lung cancer (coal)	Strong	Women aged ≥ 30 years	1.9	1.1–3.5
	Moderate I	Men aged ≥ 30 years	1.5	1.0–2.5
Lung cancer (biomass)	Moderate II	Women aged ≥ 30 years	1.5	1.0–2.1
Asthma	Moderate II	Children aged 5–14 years	1.6	1.0–2.5
	Moderate II	Adults aged ≥ 15 years	1.2	1.0–1.5
Cataracts	Moderate II	Adults aged ≥ 15 years	1.3	1.0–1.7
Tuberculosis	Moderate II	Adults aged ≥ 15 years	1.5	1.0–2.4

^a Strong evidence: Many studies of solid fuel use in developing countries, supported by evidence from studies of active and passive smoking, urban air pollution and biochemical or laboratory studies.

Moderate evidence: At least three studies of solid fuel use in developing countries, supported by evidence from studies on active smoking and on animals. Moderate I: strong evidence for specific age/sex groups. Moderate II: limited evidence.

^b The relative risk indicates how many times more likely the disease is to occur in people exposed to indoor air pollution than in unexposed people.

^c The confidence interval represents an uncertainty range. Wide intervals indicate lower precision; narrow intervals indicate greater precision.

be comprehensive, it includes a broad range of evaluation methods. Other methods developed specifically for household energy and health interventions are likely to exist, as well as generic evaluation tools. Organizations wishing to use evaluation methods not described in this catalogue may still find some of the general guidance useful.

This catalogue cannot be seen as a substitute for specialist training, or as a replacement for expert knowledge and experience. Organizations looking to contribute to the international evidence base will probably need to seek expert assistance.

What do we already know, and what are the knowledge gaps?

We know that indoor smoke contributes to childhood pneumonia as well as chronic obstructive pulmonary disease (COPD) and lung cancer (from coal) in adults, making it responsible for 1.5 million deaths per year. We also suspect that inhaling smoke may be linked to a range of other health outcomes, such as tuberculosis, low birth weight and cataracts, based on a limited number of studies in developing countries and complementary evidence on exposure to tobacco smoke and outdoor air pollution. Table

1 indicates the strength of evidence for the link between IAP exposure and health outcomes for different population groups.

We do not know the exposure-response relationship between IAP and different health outcomes, i.e. what levels of IAP cause different health outcomes. Consequently, we also do not know by how much it is necessary to reduce IAP levels in order to see benefits to health.

Several interventions can effectively reduce IAP levels (Table 2). Switching from wood, dung or charcoal to more efficient modern fuels, such as kerosene, liquefied petroleum gas (LPG) and biogas, brings about the largest reductions. A study in rural Tamil Nadu, India, compared the levels of respirable particles between homes where cooking was done using gas or kerosene and homes using wood or animal dung. Average pollution levels of 76 µg/m³ and 101 µg/m³ in kitchens using kerosene and gas, respectively, contrasted with levels of 1500 to 2000 µg/m³ in kitchens where biomass fuels were used.²

¹ Smith KR, Mehta S, 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*. Geneva, WHO, 2004.

² Parikh J, Balakrishnan K, Laxmi V, Haimanti B. 2001. Exposures from cooking with biofuels: pollution monitoring and analysis for rural Tamil Nadu, India. *Energy* 26: 949–62.

Improved stoves – provided they are adequately designed, installed and maintained – can also cut back IAP levels considerably. Cheap wood-burning stoves in East Africa lower pollution by 50 per cent;¹ *plancha* stoves in Latin America reduce indoor smoke levels by as much as 90 per cent. Eaves spaces and extraction through smoke hoods can also curb levels of carbon monoxide and particulate matter. For example, a smoke hood installed into Maasai homes in Kenya reduced the concentration of respirable particles by up to 80 per cent, from more than 4300 µg/m³ to about 1000 µg/m³.² Changes to cooking location and ventilation characteristics, such as placement of doors and windows, were shown to have a significant impact on pollution levels in Bangladesh.³

Changing cooking behaviours, such as drying fuel wood before use or keeping children away from the fire, also plays a role. Such changes are unlikely to bring about reductions as great as those from switching to a cleaner fuel or the installation of a chimney stove, but they are important supporting measures for all interventions.

Yet, so far, there is little evidence that demonstrates the success of these interventions in reducing the health burden in women and children. Consequently, the key question regarding the health impacts of interventions remains:

- Which interventions reduce IAP and respiratory health outcomes, and by how much?

The first ever randomized controlled trial attempting to answer this question has recently been completed in Guatemala, evaluating the impact of reduced indoor smoke levels on childhood pneumonia and women's respiratory health. In this case the intervention, a *plancha* stove, was implemented exclusively for the sake of research. These scientific studies are complex, time-consuming and costly. They make an essential contribution to knowledge but it is not feasible to undertake such randomized controlled trials for many different interventions in many different settings.

There is thus an urgent need for the more thorough evaluation of ongoing and planned intervention projects and programmes to complement the evidence from scientific studies. Moreover, the evaluation of projects and programmes can answer important questions regarding the suc-

cessful implementation of interventions in a sustainable way. In particular:

- How can interventions which meet the needs of users in the long-term and reduce IAP in real-life conditions be scaled up?
- Which interventions result in the greatest benefits at the lowest cost, providing the best value for money for limited financial resources?
- Which interventions will bring most widespread benefits to health, welfare and the environment?

Why evaluate?

Ultimately we evaluate to determine whether a given intervention has been well-received, adopted and retained by the users, and to examine whether it has been effective in achieving various objectives related to pollution levels and the health and socio-economic conditions of the target group, especially women and children.

Thorough evaluation of an intervention project/programme can:

- *Ensure that interventions address communities' needs and concerns.* Often the poor are most affected by IAP and the success or failure of interventions to address it. The indicators of success from the perspective of the users may be very different from those set by funders or implementers of the same project.
- *Help implementers and donors focus their efforts on the most effective strategies* to improve household energy and health. Implementing organizations have a duty to ensure that their interventions are safe and effective, and that they do not waste resources. Evaluation is a way for organizations to review their work and ensure that they are having a lasting

¹ Ezzati M, Mbinda MB, Kammen DM. 2000. Comparison of emissions and residential exposure from traditional and improved cookstoves in Kenya. *Environmental Science and Technology* 34(4): 578–83.

² Practical Action. *Reducing indoor air pollution in rural households in Kenya: working with communities to find solutions. The ITDG Smoke and Health Project, 1998–2001.* Available at: <http://www.itdg.org/docs/advocacy/smoke-project-report-kenya.pdf>

³ Dasgupta S, Huq M, Khaliqzaman M, et al. 2006. Indoor air quality for poor families: new evidence from Bangladesh. *Indoor Air* 16(6):426–44.

⁴ <http://www.who.int/indoorair/interventions/guatemala/>

positive impact. Evaluation during the implementation of a project or programme may reveal that an intervention is not achieving its intended impacts, pointing to necessary 'midcourse corrections' and enabling improvements in the future. Moreover, funding organizations want to make sure that their money is spent well, and will base strategic decisions on evaluation outcomes.

- *Generate the evidence needed by local, national and international policy-makers and donors* that interventions to reduce IAP make a difference to people's lives and are a worthwhile investment of scarce resources. Although some aspects of household energy and health interventions are well understood and accepted, many knowledge gaps remain. Evaluation results can help to fill these and thus contribute evidence to the international knowledge base. There is particularly a need to complement evidence based on scientific research, with evidence based on interventions implemented in real-life situations.
- *Help implementers make the case for the value of their work* and attract more funding for ongoing and future activities. Careful evaluation enables organizations to provide evidence to donors when seeking further funding to continue or upscale activities. It can also help inform governments about how to allocate their limited resources.
- *Contribute to economic evaluation.* Such analyses demonstrate the economic returns on investment in the intervention and enable the comparison of cost-effectiveness or costs and benefits of different interventions. Ultimately, economic evaluation helps inform policymakers on how to allocate budgets and answers the question *Which interventions offer the greatest benefits at the lowest cost?*. For example, should a government spend a given sum of money on a small-scale improved stoves programme, or on a large-scale behaviour change campaign?

What kind of interventions and projects or programmes should we evaluate?

In principle, many interventions can reduce exposure to IAP and related health outcomes, but for the majority we have little information on

how they actually impact IAP levels and people's health and livelihoods. The methods presented in this catalogue can be used to evaluate any of the interventions listed in Table 2.

This catalogue is appropriate for a wide range of projects or programmes. For example, the methods described could be applied to:

- a small-scale project promoting improved cooking stoves in a village to determine level of adoption, performance of the technology and effectiveness at reducing IAP levels;
- a medium-scale project disseminating behaviour change messages throughout a district to determine the level of adoption and perceived impact on health and welfare; or
- a large-scale programme encouraging fuel-switching across a region to determine the level of switching and the impact on health, family livelihoods and the environment.

Many NGOs across the globe are implementing small-scale household energy projects. Individually and cumulatively it is important that their effectiveness is understood, particularly prior to scaling up. The type of evaluation conducted must, however, be appropriate to the size of intervention. For example, it is not worth spending US\$ 50 000.- on evaluation for a US\$ 100 000 project, yet, for a US\$ 1 million project this investment is certainly worthwhile.

What aspects of projects or programmes should we evaluate?

The type of intervention and the intended use and audience for the evaluation results will determine what can or should be measured. Implementers, researchers, donors and different sectors (e.g. health, energy and environment) will be interested in monitoring different aspects given their respective objectives, expertise and resources. At the same time, it is assumed that there is benefit in identifying a core set of indicators that are useful for:

- identifying which interventions are most effective; and
- making the case with policy-makers and donors about the need to reduce IAP and related health outcomes through household energy interventions.

Table 2 Interventions for reducing exposure to indoor air pollution¹

Changing the source of pollution	Improving the living environment	Modifying user behaviour
<p>Improved cooking devices</p> <ul style="list-style-type: none"> • Improved biomass stoves without flues • Improved stoves with flues <p>Alternative fuel-cooker combinations</p> <ul style="list-style-type: none"> • Briquettes and pellets • Kerosene • Liquefied petroleum gas • Natural gas • Biogas, Producer gas • Solar cookers • Modern biofuels (e.g. ethanol, methanol, plant oils) • Electricity <p>Reduced need for the fire</p> <ul style="list-style-type: none"> • Retained heat cooker (haybox) • Efficient housing design and construction • Solar water heating • Pressure cooker 	<p>Improved ventilation</p> <ul style="list-style-type: none"> • Smoke hoods • Eaves spaces • Windows <p>Kitchen design and placement of the stove</p> <ul style="list-style-type: none"> • Kitchen separate from house reduces exposure of family (less so for cook) • Stove at waist height reduces direct exposure of cook leaning over fire 	<p>Reduced exposure by changing cooking practices</p> <ul style="list-style-type: none"> • Fuel drying • Pot lids to conserve heat • Food preparation to reduce cooking time (e.g. soaking beans) • Good maintenance of stoves and chimneys and other appliances <p>Reductions by avoiding smoke</p> <ul style="list-style-type: none"> • Keeping children away from smoke, e.g. in another room (if available and safe to do so)

This catalogue of methods aims to provide each audience with tools to meet a range of objectives while remaining comparable as much as possible. Although it is not possible to harmonize evaluation of different interventions around the world, it is possible for many evaluations to incorporate some key indicators. Chapter 3 considers seven thematic evaluation areas and, for each of these, describes key questions to generate comparable data.

When should we evaluate?

It is possible to include monitoring and evaluation elements in a project from the very outset, or to evaluate projects retrospectively. Currently, the most commonly used approach to monitor impacts involves a baseline survey prior to introducing the intervention, and follow-up surveys 6 and 12 months after the intervention has been implemented (see also Box 1). Chapter 5 describes different available study design options.

BOX 1 Avoiding snapshot evaluation

Conducting evaluation at only one point in time can result in unrepresentative results. For example, if a fuel-use questionnaire is administered during dry summer months, it may not account for space heating during winter or the use of damp fuel during the rainy season.

Snapshot evaluation can be avoided either by conducting monitoring at different times and seasons of the year, or by investigating and discussing the impact of seasons on the intervention. Several participatory methods, such as seasonal charting, are designed for this task.

Isn't evaluation very expensive and time-consuming?

Depending on the approach taken, evaluation certainly can be expensive and time-consuming. This catalogue describes a range of methods, including simple approaches particularly suited to smaller organizations and small-scale projects. These include aspects of routine project planning and development, such as testing technologies and undertaking initial surveys to understand needs and demands, as well as monitoring the uptake of an intervention by different popula-

¹ World Health Organization. *Fuel for life: household energy and health*. Geneva, WHO, 2006.

tion groups. Other methods, however, require specialized equipment and training. Where this is the case, it is clearly indicated. Many of the more sophisticated methods also require specialist expertise that often can only be obtained in collaboration with universities. Chapter 4 presents ideas on capacity building and accessing funds and support for evaluation.

What about evaluating unsuccessful projects or programmes?

Understanding barriers and constraints to intervention success is of critical importance. Honest reporting on interventions which have not achieved the intended impacts can enable lessons to be drawn and applied by the implementing organization as well as others facing similar situations around the world.