

Indoor Air Pollution: Issues for Bangladesh

J R Rouse

Water, Engineering and Development Centre (WEDC)

Loughborough University, UK

ABSTRACT: Exposure to indoor air pollution, resulting from the burning of biomass in homes (e.g. wood, agricultural residues, leaves and dung) has been linked to a number of acute respiratory infections (ARIs). ARIs are the biggest killer of children under five and responsible for 9% of the global burden of disease. This paper provides an overview of issues relating to indoor air pollution (IAP), describes why tackling IAP is important and looks at what has been learnt internationally and how lessons relate to Bangladesh.

The paper begins by describing the background to IAP, and then places it in the context of the 'Health agenda' and 'People's agenda'. The former is that of the international donor community, the latter is concerned with users and potential beneficiaries. The next section links IAP to the millennium development goals to illustrate the multidisciplinary nature of issues relating to household energy. A number of interventions used in recent years to tackle indoor air pollution are presented, including promotion of improved cooking stoves. These are briefly discussed, and the author draws some broad lessons from their success and failure.

The paper then focuses on Bangladesh, looking first at what organisations are doing to tackle IAP exposure, and then at what opportunities exist for further interventions and applied research.

Nowadays, the most important driving force behind IAP-reduction interventions is health improvement, particularly as the evidence-base grows. However, there are many other reasons for improving the poor's access to clean household energy such as addressing deforestation and air pollution, saving people money, labour and time-saving, and making people's use of energy safer and more convenient. Successful interventions usually have participation and consultation at their centre, and many interventions fail because of the 'top-down' nature of their implementation. This paper strongly advocates participation and putting people at the centre of the process of developing solutions. Considerable research and projects are underway in Bangladesh, contributing to international understanding on the subject. However, certain major gaps persist, such as the exact relationship between exposure to IAP and ARI, and the extent by which different interventions reduce exposure to IAP.

1 INTRODUCTION

1.1 *Background*

More than 2 billion people worldwide use biomass for heating their homes and cooking food (UN 2002). The majority of these live in low-income countries and burn wood, dried dung or other low-grade fuels in open fires or simple mud stoves.

Since as far back as the 1960s attempts have been made to improve the poor's access, particularly in rural areas, to cleaner and more efficient forms of household energy (HE). The objectives of these interventions have varied over the years, as have the agendas of funding organisations. Objectives have included:

- to curb deforestation by reducing people's need for firewood;
- to reduce the health impact of HE by reducing exposure to smoky emissions from inefficient stoves; and,
- to reduce the hardship of the poor (particularly women), many of whom spend hours cooking and collecting firewood each day.

In recent years the focus of HE interventions has tended to shift away from environmental concerns towards health and welfare. Health issues are particularly grabbing the attention of international donors now as the relationship between indoor air pollution (IAP) and ill-health becomes better understood (Ezzati et al 2002). Many organisations worldwide are working to reduce household indoor

air pollution and improve access to cleaner, more efficient and convenient household energy sources.

1.2 *The health agenda*

Burning biomass produces a range of pollutants, many of which are harmful to health such as fine particles (diameter $\leq 10\mu\text{m}$), polycyclic aromatic hydrocarbons, carbon monoxide (CO), dioxins and other carcinogens. Open fires and poorly-designed stoves often produce these in high concentrations so cooks and their families can be exposed to very high levels of indoor air pollution (IAP) (Budds et al 2001).

A number of recent studies have found very strong links between exposure to IAP and acute respiratory infections (ARI) such as tuberculosis and pneumonia (Albalak et al 1999, Ezzati et al 2000, Smith et al 2000). ARIs account for up to 9% of the global burden of disease (Albalak et al 2001) making them the leading cause of disease worldwide and the biggest killer of children under five (Bruce et al 2000). The majority of these are found in low-income countries. For example, in India the World Bank IAP Newsletter (2000) reports that 28% of India's disease results from IAP, making it responsible for 500,000 deaths of women and children in India per year. Another study states that nearly 60% of active tuberculosis in rural areas worldwide is directly attributable to smoke from biomass fuels (Mishra et al 1999).

This evidence is leading to growing interest in HE issues among international donors.

1.3 *People's agenda*

Despite these links, many of those exposed to high levels of indoor air pollution do not associate smoke inhalation with ill-health. One woman in a village in Uttar Pradesh, India, when asked if she attributed her coughing fits to the chronic smoke pollution in her home simply said 'No. Every woman in the village coughs like this'. Reducing IAP can be a very low priority for cooks compared with other concerns such as saving money or effort on fuel collection or making the cooking process quicker and more convenient (Ahmed 2002). This section takes a brief look at HE and IAP from people's perspective.

For many people, particularly women and children in rural areas of low-income countries, household energy means hardship. Huge numbers of women and children walk many miles every day to collect heavy loads of firewood from distant, and frequently eroding, forest resources (Biran *et al*, *in press*). Others choose to buy wood or other fuels such as charcoal and kerosene to supplement their wood supply. Both of these can put a strain on family budgets. Cooks, who are mostly women, can

spend many hours every day preparing and cooking food, sitting next to the stove exposed to the smoke released. The following list reflects the diversity and tone of people's demands:

- affordable devices which use less wood for the same cooking task;
- knowledge about ways to use fuel more sparingly;
- stoves which cook food faster to save time;
- a chimney for the stove because the smoke makes eyes sting;
- stoves which continue to provide a social focus, warmth and light to the home;
- stoves which look modern and attractive;
- access to affordable cleaner fuels such as charcoal, kerosene, LPG and electricity.

Household energy interventions certainly have the potential to address the international health agenda, but also to address hardship. In many cases it is possible to address these simultaneously.

1.4 *Links to the Millennium Development Goals*

DFID identifies direct links between the millennium development goals and improving access to energy. The links are diverse. The following list outlines aspects particularly relevant to improving the way traditional fuels are used in Bangladesh:

1. Extreme poverty and hunger
 - 95% of staple foods need cooking before they are eaten and increased efficiency can save people money through fuel savings. Improved access to reliable energy enables enterprise development, and energy supply can generate employment.
2. Universal primary education
 - increased efficiency/ availability of modern energy sources can free children's time otherwise spent collecting fuel.
3. Gender equality and women's empowerment
 - increased efficiency/ availability of modern energy sources often frees girls' time disproportionately more than boys because of the way tasks are distributed within households. Health benefits resulting from reduced IAP are likely to most impact women who spend long periods near stoves.
4. Child mortality
 - ARI is the most significant killer of children under five (Bruce et al 2000) and has links between IAP and ARI become better understood so it becomes clear that children have much to benefit from cleaner energy sources. Gathering and preparing traditional fuels can also expose young children to health and safety risks.

5. Maternal health

- IAP has been linked to low birthweights and infant mortality (Bruce et al 2000). Better energy services can also result in better health-care facilities.

6. HIV/AIDS, malaria and other major diseases

- Tuberculosis has been clearly linked to IAP (Smith et al 1999). Access to improved energy services results in better health care facilities, and electricity enables refrigeration of vaccinations etc.

7. Environmental sustainability

- traditional fuel overuse can contribute to erosion, reduced soil fertility and desertification. This can become more sustainable through fuel substitution and improved efficiency. The use of cleaner, more efficient fuels could reduce greenhouse gas emissions which are a major contributor to climate change (DFID 2002).

This clearly illustrates the multidisciplinary nature of HE, and that IAP and HE issues cover gender, health, welfare, poverty-reduction and the environment.

2 INTERVENTIONS

This section briefly describes some of the common HE interventions used across the world.

2.1 Improved cooking stoves

One of the most common HE interventions is the improved cooking stove (ICS). In India and China, large-scale national programmes have focused on introducing stoves which burn fuel more cleanly and/or remove emissions from the cooking environment, usually via a chimney. In addition, many small projects have focused on introducing ICSs to homes. Interventions large and small, have met with a mixture of success and failure.

A number of studies have been undertaken to establish the effectiveness of ICSs for reducing IAP. Some have found that they are effective (Albalak et al 2001) while others question their worth, even proposing that ICSs can be *more* polluting than open fires (Smith 2002). Other studies have evaluated the stove programmes, such as the review of the China Stove Programme by the Shell Foundation (2003).

ICSs have the potential to reduce IAP levels, but they can also profoundly affect the cook's comfort. Many women appreciate a stove which cooks family meals more quickly, or one which is more efficient and burns less fuel, resulting in less time spent collecting wood and/or money spent buying it.

2.2 Other interventions

Aside from ICS promotion, other practical interventions have included:

- the installation of 'smoke hoods' into homes to remove smoke from over a simple stove (instead of a stove with a chimney);
- encouraging, enabling and facilitating fuel-switching to cleaner fuels, e.g. charcoal, kerosene, LPG or electricity; and,
- improving household ventilation (ITDG 2002).

Behaviour change is essential to the success of any technological intervention, and can also often bring about improvements in isolation. Examples of behaviour change include:

- encouraging people to cook outdoors to dissipate pollution;
- keeping children away from stove while cooking;
- teaching people to cook in different ways (e.g. reducing cooking time by using lids, pre-soaking pulses);
- drying fuel and breaking into small pieces prior to use; and,
- raising awareness of the dangers of exposure to IAP.

2.3 Successes

It is important to consider what constitutes success in HE interventions. Counting the number of stoves constructed and/or disseminated is not generally considered to be an acceptable measure of success, even if it is commonly used. Health benefits, often gauged by proxy indicators, or reduced hardship/expenditure are among more meaningful indicators (Biran and Rouse 2003).

Successful HE interventions are usually characterised by meaningful participation and have bought about benefits beyond positive health outcomes, which respond to users' priorities such as time-saving and convenience. It is important to listen to, and address, people's priorities while simultaneously achieving the 'development' objective of improve health. This is important for pragmatic reasons of fulfilling donor requirements as well as for affecting changes which are led by demand, and thus more likely to sustain.

In addition to participation, successes usually also involve:

- links to livelihoods/ micro-enterprise development;
- technologies designed specifically for the needs of beneficiaries;
- very careful consideration of cultural and social issues;

- low-cost technologies.

2.3.1 *Why do so many fail?*

Many of the less-successful household energy interventions have been characterised by:

- a failure to consult users, particularly women, during design and implementation. Despite women being the primary users of household energy technologies, in many instances stoves are developed by (male) engineers in laboratories, rather than women in villages;
- hi-priced technology dependent on expensive/remote resources for construction and maintenance. Poor/no financing mechanisms;
- poorly designed technologies and interventions not suited specifically to beneficiaries. Many stoves simply do not work properly with the fuels/ parts/ cooking methods used in people's homes.

3 WHAT'S HAPPENING IN BANGLADESH?

3.1 *Organisations and projects*

The following constitutes a summary of activities of a few organisations working in HE in Bangladesh. It is not exhaustive but based on the author's knowledge and recent correspondence.

Concern Bangladesh. As an element of its public health programme entitled 'Child Survival', Concern is working in seven municipalities to reduce exposure to indoor air pollution, mainly through promoting behaviour change and switches to more fuel-efficient stoves and cleaner fuels (Roche 2003).

Prokasushal Sangsad is managing a seed capital revolving fund to establish Energy Service Centres. Funded by the Shell Foundation, it is aiming to help remote rural households gain access to off-grade electricity services to replace polluting kerosene lamps. Electrification is also expected to help rural women increase their productivity and earning potential (Shell Foundation 2003).

ITDG have worked in Bangladesh on a number of energy-related projects including a study of the energy used by street-based food vendors. In partnership with Climate Care, ITDG is running training courses on how to construct improved energy efficiency stoves using local materials. The stoves reduce the amount of fuel used by around 50%, and micro-enterprises are formed to ensure stoves continue to be built (ITDG 2003).

USAID has been investing in the energy sector in Bangladesh for many years. In partnership with the National Rural Electricity Cooperative Association (NRECA) they have pioneered the Rural Electrification Programme which now brings electricity to over 20 million people across rural Bangladesh. They are

also promoting private-sector involvement at all levels and the exploitation of the natural gas reserves under Bangladesh (USAID 2003). USAID is also funding a Demographic Health Survey of Bangladesh beginning in January 2004. Three questions relating to IAP and HE are included in this, relating to type of fuel and cooking stove used, and location of cooking activities (Rehfuesse 2003)

The Village Education Resource Centre (VERC) established a network of NGOs and other institutions involved with ICSs and their dissemination. They have been involved with health awareness-raising campaigns and promote participative development of ICSs and micro-enterprise development (Nirapad 2003).

3.2 *Opportunities*

Bangladesh has the lowest per capita energy consumption in south Asia, and only around 20% of the total population has access to electricity (USAID 2003), the remainder using wood and traditional fuels for energy. Clearly there is considerable potential in Bangladesh to work with those affected by IAP.

This section briefly outlines some of the opportunities for interventions and research in Bangladesh.

3.2.1 *Interventions*

- *Practical interventions.* The WHO recommends that good ventilation, cleaner fuels and improved cooking stoves are effective means by which to decrease indoor air pollution and related acute respiratory infections for Asian countries (WHO 2003).
- *Putting people at the centre.* VERC emphasises the need to consider people: participation is key in developing successful and sustainable household energy interventions. Other considerations such as gender and subsidy are also vital.
- *Awareness raising.* Many organisations (including the Environment and Social Development Organisation (ESDO, Bangladesh)) highlight the need for awareness-raising of the health risks associated with IAP and the use of 'dirty' fuels and stoves. Ahmed (2002) suggests use of the media to raise awareness, and has demonstrated that the television can be a useful medium for reaching rural households. A further important area of awareness-raising is that of the time-saving and health benefits that can be realised from switches to cleaner fuels and use of improved stoves.
- *Networking.* There is a need to learn from others in Bangladesh and abroad (Rouse 2003).

3.2.2 *Research*

Despite the links between IAP and health that have been established to date, gaps in knowledge

still exist which are hindering the effectiveness of interventions and the interest of the international donor community. This section briefly outlines some outstanding research needs.

- The dose-response relationship between IAP and ARI. The extent by which IAP needs to be reduced in order to realise health benefits is not yet clearly understood. Although studies are underway to establish this, further epidemiological studies are required (Ahmed 2002). Randomised Control Trials are the most widely-accepted method for establishing such links.
- Understanding the extent by which interventions reduce IAP. Data relating to interventions is likely to be specific to Bangladesh. Understanding, and being able to demonstrate, the effectiveness of different interventions will enable a defective response to the problems of IAP once the dose-response relationship is understood.
- The effectiveness of proxy indicators for measuring exposure to IAP (particularly particulates) for Bangladesh. Most studies relating to IAP to date have made use of proxy indicators (e.g. amount of time spent cooking, tear-production or exposure to CO) for understanding exposure because of the difficulty associated with direct measurement. These have been shown to be meaningful for certain conditions, but individual conditions affect accuracy and need to be established for Bangladesh (Ellegard 1997, Biran and Rouse 2003).

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