

**Authors**

Esther Duflo  
Massachusetts Institute of Technology

Michael Greenstone  
The University of Chicago

Rema Hanna  
Harvard University



**UP IN SMOKE**

Improved cookstoves in India did not reduce smoke exposure, improve health, or reduce fuel usage of recipients because they were not used regularly and recipients did not invest to maintain them properly.



Nearly half of the world's population continues to rely on solid fuels, including wood, dung, agricultural waste, and coal, for its energy needs. The smoke released from using such fuels has been shown to lead to respiratory diseases and lung cancer. The World Health Organization (WHO) lists indoor air pollution as the "leading environmental cause of death in the world," stating that it contributes to two million deaths annually. Cooking with biomass fuels also contributes to climate change: Using biomass fuels releases carbon dioxide (CO<sub>2</sub>) and black carbon into the atmosphere and also plays a role in deforestation.

Improved cooking stoves have been promoted as a simple solution to these problems. Based on their technical design, improved stoves have the potential to reduce emissions, fuel use, and the incidence of pneumonia and other lung diseases. The stoves have gained considerable international attention, and the Global Alliance for Clean Cookstoves has announced a goal of having one million households adopt clean cooking technologies by 2020. A randomized evaluation in Guatemala found substantial reductions in smoke exposure indicators when five improved cooking stoves were distributed to 500 women and children, as well as improvements in some dimensions of health (Smith-Sivertsen et al. 2009). However, these results derived from a controlled setting in which households' usage was closely monitored and repairs were provided weekly at no cost. The evaluated stove was also too expensive for households to purchase or for it to be practical for large-scale distribution. Evidence was still needed from real-world conditions: How much would households use and maintain the stoves? Given that level of use, what impact would these stoves have on household health?

To answer these questions, IPA-affiliated professors Rema Hanna (Harvard University), Esther Duflo (MIT), and Michael Greenstone (MIT), working in conjunction with a local NGO, Gram Vikas, evaluated the impact of inexpensive, improved cooking stoves on household well-being in Orissa, India.

- **Though many households accepted the stoves when offered, they did not use them regularly or maintain them properly, and use declined over time.** Households initially cooked about 1.4 more meals per week using a good condition, low-pollution stove than those in the comparison group, out of an average of about 14 meals per week. By year three, this difference had fallen to 1.5 meals per week.
- **Low usage limited the impact of the stoves on smoke exposure.** In the first year of the program, when use was at its highest, there was a 7.5 percent reduction in carbon monoxide (CO) in the breath of the primary cooks in the households, but no meaningful change for other household members. By the second year, as use fell further and the stoves experienced normal wear and tear, there was no longer a significant effect.
- **The stoves had no effect on household health.** There were no improvements in measurable health outcomes (e.g., lung functioning, blood pressure, child body mass index, infant mortality rates), nor in self-reported symptoms such as coughs and colds.
- **The improved stoves did not decrease the amount of fuel households used, fuel costs, or time spent cooking.** Lab testing showed that when used properly, the improved stoves required less wood and heated up faster. Households indeed reported that they thought the stoves required less fuel. However, measured fuel usage and costs did not actually change. Treatment households spent more time repairing their stoves than comparison households did.

# Up in Smoke

Improved cookstoves in India did not reduce smoke exposure, improve health, or reduce fuel usage of recipients because they were not used regularly and recipients did not invest to maintain them properly.

Nearly half of the world's population continues to rely on solid fuels, including wood, dung, agricultural waste, and coal, for its energy needs. The smoke released from using such fuels has been shown to lead to respiratory diseases and lung cancer. The World Health Organization (WHO) lists indoor air pollution as the "leading environmental cause of death in the world," stating that it contributes to two million deaths annually. Cooking with biomass fuels also contributes to climate change: Using biomass fuels releases carbon dioxide (CO<sub>2</sub>)

and black carbon into the atmosphere and also plays a role in deforestation.

Improved cooking stoves have been promoted as a simple solution to these problems. Based on their technical design, improved stoves have the potential to reduce emissions, fuel use, and the incidence of pneumonia and other lung diseases. The stoves have gained considerable international attention, and the Global Alliance for Clean Cookstoves has announced a goal of having 100 million households adopt clean cooking technologies by 2020. A randomized evaluation in Guatemala found substantial reductions in smoke exposure indicators when free improved cooking stoves were distributed to 500 women and children, as well as improvements in some dimensions of health (Smith-Sivertsen et al. 2009). However, those results derived from a controlled setting in which households' usage was closely monitored and repairs were provided weekly at no cost. The evaluated stove was also too expensive for households to purchase or for it to be practical for large-scale distribution. Evidence was still needed from real-world conditions: How much would households use and maintain the stoves? Given that level of use, what impact would these stoves have on household health?

July 01, 2012