Implementation Science for Clean Cooking

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Coordinated by the U.S. National Institutes of Health

- Improve the science of uptake of clean fuel based cooking
- Systems approach
- Development of casestudies, methods tools, models, synthesis papers

Rosenthal et al 2017 Environmental Health Perspectives
https://doi.org/10.1289/EHP1018
Clean cooking theory of change

Make and provide improved stoves

- How clean is it really?
- Fuel?
- Affordability?
- Financing?
- Who decides to invest?

Cooks use them in place of traditional stoves

- Ease of use?
- Works as well for all tasks?
- Reliability of fuel supply?
- When it breaks?
- Seasonality
- Firewood may be free?

Household air becomes much cleaner

- Other pollution sources:
- Lighting, heating, burning waste, traffic, dust, manufacturing, kilns...
- What are your neighbors using?
- Why not use both?

People are healthier and happier!

- Population baseline health conditions
- Time to effect
Why have most stove programs and projects failed to see a significant health effect?

• H1: The new technology is not clean enough

• H2: Stoves not used appropriately and/or sufficiently to reduce exposures

• H3: Other sources of air pollution swamp the improved stove effects

• H4: Study Design issues (small sample sizes, inadequate follow-up, etc.)

• H5: Health-related hypotheses are incorrect?
Implementation Science

...is about trying to use research strategies to gain a better understanding of the complex array of structural and human factors that can determine whether new programmes or interventions will work as intended.

Lavery 2016

http://dx.doi.org/10.1136/medethics-2016-103573
11 Clean fuel case studies (2018)

Analyzed using Adapted RE-AIM framework

Energy for Sustainable Development, Special Issue: Scaling up Clean Fuel Cooking Programs

https://www.sciencedirect.com/journal/energy-for-sustainable-development/vol/46
Generalized logic model for clean fuels scale-up

**ENABLING ENVIRONMENT**
1. **POLICY**: extent of supportive policy, plans and targets.
2. **FISCAL**: tax regimes, tax on imported components, subsidy (general, targeted, and cross subsidy).
3. **POLITICAL STABILITY**: factors impacting the consistency over time of the enabling environment.
4. **REGULATIONS**: regulations and standards for equipment and services, and enforcement.

**INDUSTRY** STRUCTURE AND SERVICES
1. **PHYSICAL INFRASTRUCTURE**: importation facilities, bulk storage (liquid and gaseous fuel), refining, distillation, generation (electricity) and construction (biogas).
2. **DISTRIBUTION**: transport of stored fuel, transmission (local and national power).
3. **RULES AND PRACTICES**: industry organisation and rules governing market actors.
4. **SAFETY REGULATIONS AND PRACTICES**: industry (LPG cylinders, ethanol denaturisation), fuel transport (gas, liquid) and supply (electricity).
5. **SERVICES**: Advice and support, after-sales service.
6. **SUSTAINABILITY OF SUPPLY**: feedstock shortages (pellets, ethanol), fuel shortages (LPG) blackouts (electricity).

**ENERGY PRICING AND COSTING**
1. **ENERGY ALTERNATIVES**: costs of alternative fuels.
2. **INITIAL COSTS**: Start-up costs (stoves and associated fuel, LPG kit, biogas digester, electrical connection).
3. **ONGOING COSTS**: costs of fuel, fluctuations, frequency of outlay.
4. **POTENTIAL CO-BENEFITS**: Bio-slurry production (biogas).

**FACTORS INFLUENCING CONSUMER DEMAND**
1. **KNOWLEDGE**: fuel, performance, uses and benefits.
2. **SUPPLY**: reliability and quantity to meet demand.
3. **ACCESSIBILITY**: proximity to sources (biomass, LPG and ethanol retail outlets), whether at/to home (biogas, electricity).
4. **AFFORDABILITY**: universal and targeted subsidies, handouts (free start-up kit, ethanol in refugee camps), exchanges (pellet feedstock).
5. **SOCIO-ECONOMIC**: barriers and incentives.
6. **SETTING**: urban and rural factors (distance from supply), biogas (cattle/water requirements).
7. **CONSUMER FINANCE**: loans for e.g. start-up.
8. **TRAINING**: in use, safety, and maintenance.

**USER AND COMMUNITY NEEDS AND PERCEPTIONS**
1. **PERCEIVED AFFORDABILITY**: whether stove/fuel costs are acceptable; willingness/ability to access loans and other credit arrangements where available.
2. **PERCEIVED SAFETY**: how risks of use are viewed, and the resulting safety practices in and around the home.
3. **PERCEIVED CONVENIENCE**: whether meets cooking needs, resulting behaviour (use/non-use, and ‘stacking’).
4. **AWARENESS**: health risks, benefits and resulting behaviour in fuel choices and use.
5. **PERCEIVED PRESTIGE**: whether the fuel offers an image of more prosperity, modernity, or other desirable social value.
Everybody Stacks – The use of biomass stoves alongside clean fuel stoves is ubiquitous. Health benefits require near complete replacement of solid fuels, requiring strategies to discourage use of solid fuels.

Fuel supply challenges are regular and common barriers – LPG, ethanol, biogas, pellets and electric induction stoves. Must be anticipated and planned for. What is the back up fuel?

Almost all programs rely on public financing to ensure access to the poorest. Even private sector driven initiatives require government support to reach the poorest, and this may include funding and other regulatory measures to maximize access and sustainable use.

Most programs lack clearly defined benchmarks and evaluation methods. These are critical to regular review of progress and adjustments of plans to ensure success of access and regular use.

Quinn et al 2018

https://doi.org/10.1016/j.esd.2018.06.011
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Non-exclusive use: “stove stacking” and continued use of biomass stoves
Less than 10 minutes/day (or 1hr/week) of traditional wood stove use will raise exposure above WHO threshold.

Johnson et al. 2015
http://dx.doi.org/10.1289/ehp.1408681
Continued biomass stove use: can be seasonal, by cooking task, for supply-related reasons, etc.

Ruiz Mercado and Masera 2015 https://doi.org/10.1007/s10393-015-1009-4
The “clean stack”

Example from Indonesia
(Dutrix et al. 2016, as shown in Thoday et al. 2018)
https://doi.org/10.1016/j.esd.2018.05.011

How can we promote stacking with clean fuels and devices?
Latest round of ISN funding: Scaling the “clean stack” (7 projects)

- Feasibility of Scaling “Clean Stacking” Options in Southern Africa
- Real Option Strategies for Achieving Scale (ROSAS) (model)
- Constructing a clean cookstove stack in Ghana
- Clean stacking in Ecuador: Investigating how induction changes household energy use and HAP exposures across scales
- Clean Stacking Options and Regional IAP Scenarios for Rural Mexico
- Investigating Factors Influencing Household Transitions to Clean Energy Use (framework)
- Stackable clean cooking in rural Rwanda