Household Energy and Air Pollution in India: What is being done?

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Amity University, Lucknow, Dec 1, 2017
India Leads the Way: A Health-Centered Strategy for Air Pollution

- Report of the Steering Committee on Air Pollution and Health Related Issues, Ministry of Health and Family Welfare, December 2015
- First Ministry of Health in the world to pay attention to air pollution and put into national health context
- Mandate was health, not pollution from particular sources or in particular places – thus not indoor or outdoor, rural or urban, but integrated human exposure (non occupational)
India Burden of Disease, 2017
Satellite-based ambient PM$_{2.5}$

29% from households in India
Household air pollution from solid fuels
Both sexes, All ages, 2016, DALYs per 100,000

India Burden of Disease, 2017
Remember

• Numbers are highly uncertain – here are central estimates

• And changing with new models and databases

• Some health outcomes not included
  – Low birth weight/prematurity
  – TB/asthma
  – Other cancers: cervical, etc.
  – Diabetes, arthritis, low IQ
The three major solid fuels
Toxic Pollutants in Wood Smoke from Simple (poor) Combustion

- Small particles, CO, NO₂
- Hydrocarbons
  - 25+ saturated hydrocarbons such as n-hexane
  - 40+ unsaturated hydrocarbons such as 1,3 butadiene
  - 28+ mono-aromatics such as benzene & styrene
  - 20+ polycyclic aromatics such as benzo(a)pyrene
- Oxygenated organics
  - 20+ aldehydes including formaldehyde & acrolein
  - 25+ alcohols and acids such as methanol
  - 33+ phenols such as catechol & cresol
  - Many quinones such as hydroquinone
  - Semi-quinone-type and other radicals
- Chlorinated organics such as methylene chloride and dioxin

Typical biomass cookstove releases
300-400 cigarettes per hour worth of smoke

Source: Naehler et al, J Inhal Tox, 2007
Does Not Take Much Time in Villages to See Smoky Households
Health-Damaging Air Pollutants From Typical Woodfired Cookstove in India.

Typical Health-based Standards

- Carbon Monoxide: 150 mg/m³ (10 mg/m³)
- Particles: 3.3 mg/m³ (0.1 mg/m³)

Wood: 1.0 kg Per Hour in 15 ACH 40 m³ kitchen

Typical Indoor Concentrations

- Benzene: 0.8 mg/m³ (0.002 mg/m³)
- 1,3-Butadiene: 0.15 mg/m³ (0.0003 mg/m³)
- Formaldehyde: 0.7 mg/m³ (0.1 mg/m³)

Best single indicator

IARC Group 1 Carcinogens

- IARC Group 1 Carcinogens

First person in human history to have her exposure measured doing the oldest task in human history

~6900 ug/m³ during cooking
>500 ug/m³ 24-hour
--50 times WHO guideline

Kheda District, Gujarat, 1981
State-wise estimates of 24-h kitchen concentrations of PM2.5 in India

Solid-fuel using households

Balakrishnan et al. 2013 (SRU group)
What has been done-#1
Wait for development to work.

• Percent using solid fuel slowly declines with development alone (no special policies)
• But in India, the number of people exposed has never declined
Low- and Middle-Income Countries

More than any time in human history
1990: 85%: 700 million people using solid fuels

2010: 60%: 700 million people

~1980 700 million people in entire country

Fig. 1. Distribution by state of households using biomass or coal as their main cooking fuel in 2005. From (IIPS, 2007).
What has been done #2: Make the available clean

• Many hundreds of “improved” biomass stove programs over ~60 years
• Including major national programs in China and India in the 1980/90s covering ~200 million households in all
• And in India, Peru, Mexico, Nepal, Honduras, and other countries today
• Hundreds of NGOs, big and small, promoting stoves around the world over the decades
Diversity of improved cook stoves
Unfortunately

• The cleanest “improved” biomass stoves have been disseminated to only a few tens of thousands of households in the world

• And, in spite of much progress, as yet, no “improved” biomass stove in the world comes close to the boundary between solid and non-solid fuels

• Thus, none seem clean enough to be reliably truly health protective in household use

• But more effort is still warranted.
Risk Curve for PM$_{2.5}$ and Child ALRI risk

WHO IT-1 (35 µg/m$^3$ PM$_{2.5}$)
Increasing Prosperity and Development

Decreasing Household Air Pollution

Very Low Income 200 million

Low Income 400 million

Middle Income 400 million

High Income 200 million

Crop Waste Dung

Solid Fuels

Wood

Coal

Kerosene

Biogas/Solar

Liquefied Petroleum Gas

Electricity

Natural Gas

Non-solid fuels

Conceptual Indian Energy Ladder
New Paradigm

Making the clean available
Liquefied Petroleum Gas - LPG

Except in USA, a mixture of butane and propane

Liquefies just above ambient pressure and thus easy to store and ship

Derived from natural gas production and off-gases from oil refining

World supply greatly increased due to “fracking”
Give It Up campaign

• Middle class gives up their LPG subsidies

• Health is the message – “make a poor man’s kitchen clean”

• Extensive social marketing
  – Modi and other celebrities in speeches, media ads, bill boards, etc
  – SMS messages
  – Fairs, athletic events, posters, skits, etc
  – Website linking those giving up to those receiving: middle class to poor
#GiveItUp
Feel the Joy of Giving

Initiated by Ministry of Petroleum & Natural Gas
Government of India

#GiveItUp
A GIFT OF GOOD HEALTH TO OTHERS AND A CLEANER ENVIRONMENT TO YOURSELF.
Now no more smoke-induced tears for our mothers while cooking
- Shri Narendra Modi, Hon’ble Prime Minister

Shri Narendra Modi
Hon’ble Prime Minister
shall distribute
LPG connections to 5000 BPL families under the GiveltUp campaign

Date: 2<sup>nd</sup> October 2015 | Venue: Dumka Airfield Ground, Dumka, Jharkhand | Time: 1:00 pm

Times of India
Oct 2, 2015

Gandhi’s Birthday
MyLPG website: Feb 24, 2016
Total no of customer who have Giveitup subsidy

We appreciate your action of giveitup. It truly demonstrates your care and concern towards the less privileged. Your example will surely motivate millions. Annual Savings accrued till now (₹ 13976740800)

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LPG expansion, cont.

- **Ujjwala Campaign: April 1, 2016**
  - Extend past GIU with more incentives
  - To reach a total of 50 million below poverty line households in 3 years
  - Plus 50 million other households
  - 1.2 billion USD devoted by Indian Gov
  - 250 million USD/year from middle class
  - 10,000 new distributors being hired
  - A huge enterprise!
Conceptual Indian Energy Ladder

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Decreasing Household Air Pollution

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Solid Fuels

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Kerosene

Liquefied Petroleum Gas

Coal

Electricity

Natural Gas

Conceptual Indian Energy Ladder?
India: What happened?

Millions

- Population
- Solid Fuel
- Clean Fuel

India: What happened?

In 35 years, “improved” biomass stoves had almost no impact on health. At the same time more than 400 million Indians took up clean fuels, mainly LPG.
India: What If?

A Chulha Trap or a Clean Fuel Gap?

9% instead of 5.5%/yr for 20 years
Of course

• Just providing affordable access to LPG or other clean fuel does not mean people instantly switch 100%.

• However, since 60% of world uses gas and/or electricity it argues strongly that the others will eventually follow.

• Is clearly what is needed in long term – why not sooner rather than later using techniques learned from other health sectors?
Subsidy or?

• In order for public support of clean fuels to be termed social investments, they need to be far better targeted than in the past.
• Give it up helps, but far more targeting is needed
• Insufficient income tax coverage to use this metric
• Use of modern asset-based indicators from national surveys offer some hope
• Embrace modern IT to do so
  – JAM: bank accounts, ID card, mobile phone
What have we learned?

• Health sector used to promoting usage – indeed it is common – latrines, TB drugs, bednets, condoms, low salt foods, etc. Access is just the start

• Smart subsidies to focus on specific financial barriers that can be termed social investment

• Conditional cash transfer – pay for the behavior desired
Collaborative Clean Air Policy Centre

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Many thanks

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