

Contribution of household biomass burning to ambient air pollution in low- and middle-income countries: knowns and unknowns

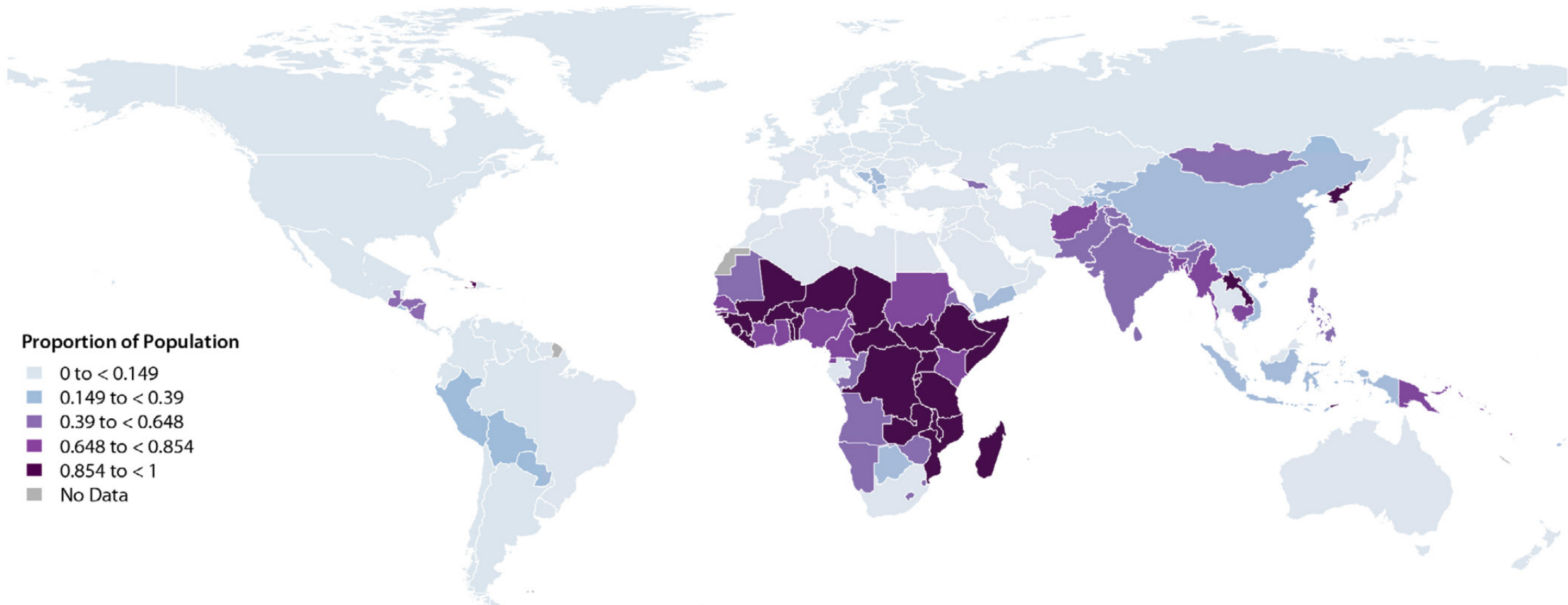


Household Air Pollution (HAP)

- ~3 billion people cook using polluting open fires or stoves fueled by biomass fuels (e.g. wood, dung), kerosene, or coal.
- Associated with ~2.6 - 3.8 million premature deaths annually.
- HAP is a complex mixture, but particulate matter (e.g. $PM_{2.5}$) is a major deleterious component.



Proportion of population directly exposed to household air pollution from burning of solid fuels in 2016



Work at the NIH on Household Air Pollution

Two main areas:

1. Health effects

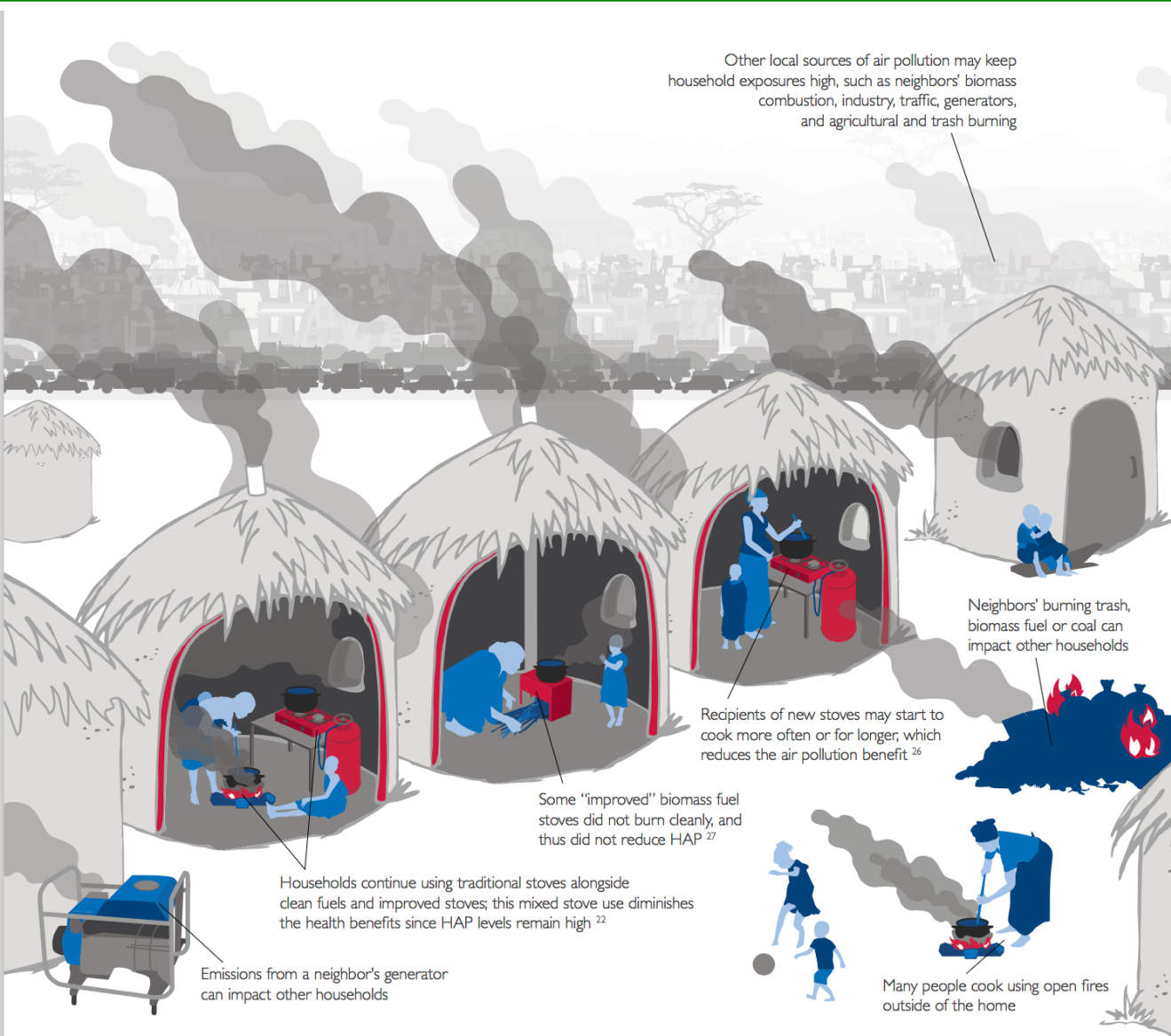
- Mechanisms; interventions

2. Implementation Science

- “IS...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.”



A stereotypical rural village...



Focus of research on exposure to HAP is typically at the household level (where exposures to cooking smoke are highest)

BUT: the smoke also goes outside (and what's outside comes inside) – and health effects are understood to respond to cumulative exposure.

New Recognition of the contribution of HAP to Ambient AP

India:

“ One of the most surprising sources of Delhi's air pollution is the smoke coming from the millions of cooking and space heating fires outside of the city limits

HAP: not just a rural problem

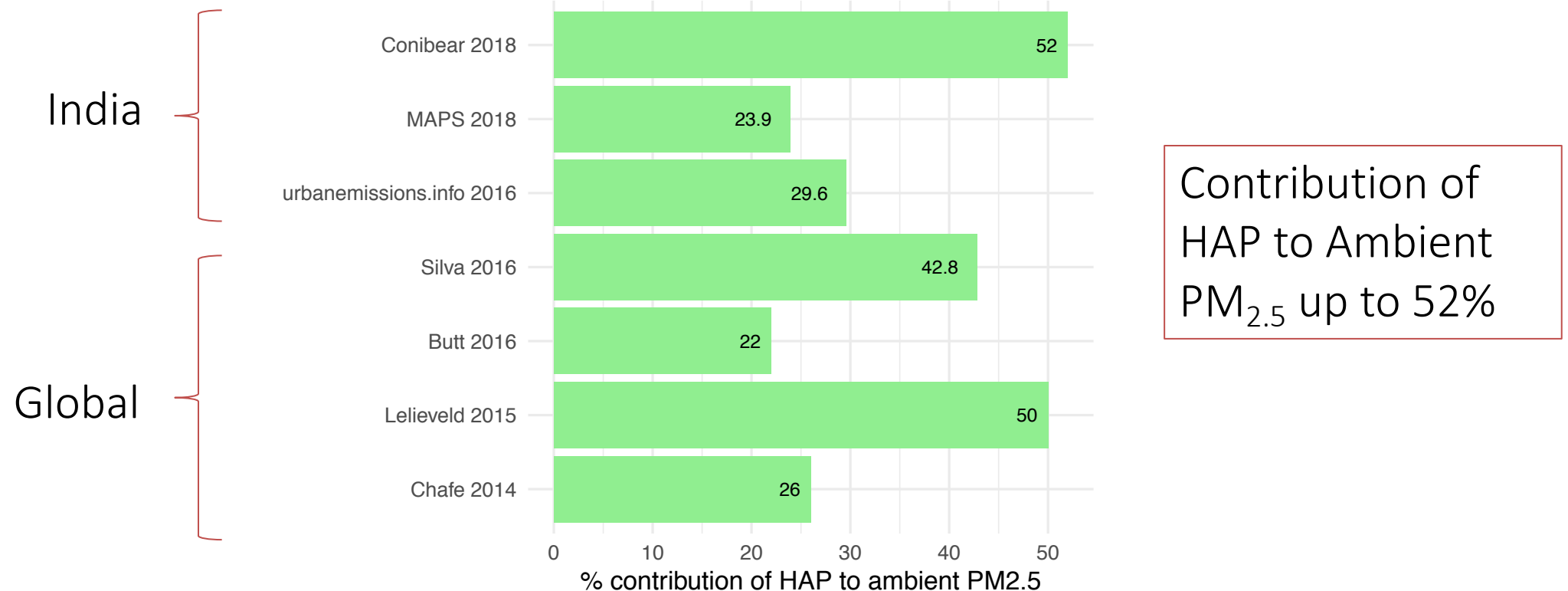
Dr. Sarath Guttikunda, Director of UrbanEmissions



Photo credit: Maggie Clark

Prior work quantifying the HAP-to-ambient contribution

According to Chowdury et al. 2019, only seven studies, three focused on India



Adapted from Chowdury et al. 2019

Why is this important to quantify?

1. For scientific reasons: e.g. evaluation of potential effects of HAP interventions in different settings.
2. Getting urban folks interested in what is otherwise largely a “rural” problem
3. Potential policy lever to improve both household and ambient in one effort?
(Would require government-relevant – i.e. national and regional – estimates)

Indian annual ambient air quality standard is achievable by completely mitigating emissions from household sources

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What is standing in our way?

- “Residential and commercial” category is broad - lack of detailed national emission inventories hampers refining it further (Chafe et al., others)
- Lack of observational data, i.e. detailed characterization of the chemical, physical, and optical properties of aerosol in regions impacted by residential emissions, particularly in the developing world (Butt et al.)
- Difficult to distinguish rural from urban contexts due to coarse resolution of models, e.g. (Butt et al.).
- To date, poor understanding of how HAP from one home affects local/neighborhood air pollution – only limited understanding from computational fluid dynamics models (e.g. Ruiz Garcia et al).
- Etc.

But can anything better be done now with available data and models?

Thank you!

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