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National Institute of Environmental Health Sciences
Your Environment. Your Health.

Assessing Exposures and Health Effects Related to Indoor Biomass Fuel Burning

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EPA/RTP Cookstove Conference
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Global challenge

- Around 3 billion people cook and heat their homes using open fires and simple stoves burning biomass (wood, animal dung and crop waste) and coal.
- Over 4 million people die prematurely from illness attributable to the household air pollution from cooking with solid fuels.
- More than 50% of premature deaths among children under 5 are due to pneumonia caused by particulate matter (soot) inhaled from household air pollution.
- 3.8 million premature deaths annually from noncommunicable diseases including stroke, ischaemic heart disease, chronic obstructive pulmonary disease (COPD) and lung cancer are attributed to exposure to household air pollution.



Priority area for NIEHS

- WHO Collaborating Centre for Environmental Health Sciences
 - Indoor Air Pollution
- NIEHS Strategic Plan
 - Theme 2: Exposure Research
 - Theme 4: Health Disparities and Global Environmental Health
 - Goal 4: Understand how combined environmental exposures affect disease pathogenesis
 - Goal 6: Establish environmental health disparities research to understand disproportionate risk of disease



2011 NIEHS-NICHD-FIC Indoor Air Pollution Workshop

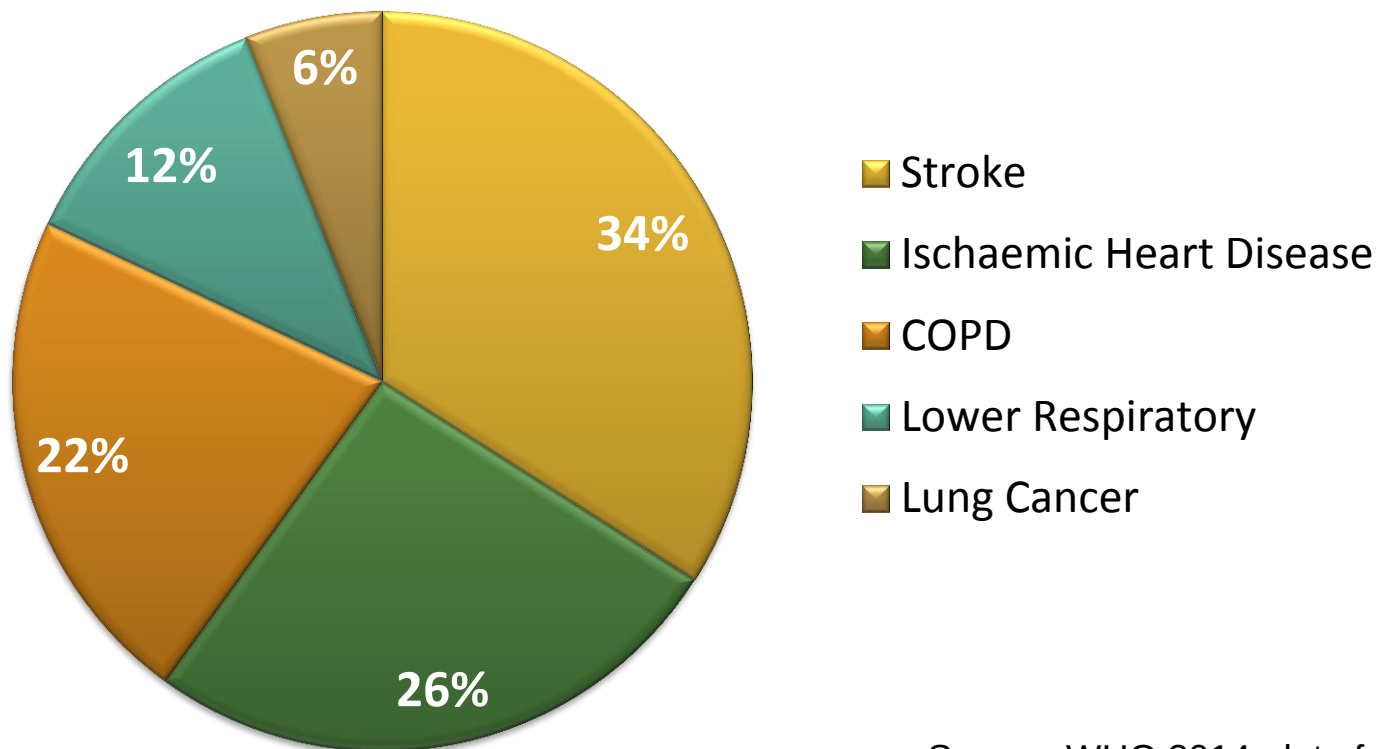
- Title: Health Burden of Indoor Air Pollution on Women and Children in Developing Countries
- Goal: Bring together experts to develop research priorities for reducing health risks from cookstove use to women and children
- Key issues
 - Cancer
 - Cardiovascular outcomes
 - Infection
 - Respiratory disease
 - Exposure assessment and biomarkers
 - Pregnancy and neonatal outcomes
 - Burns and eye injuries
 - Behavioral and empowerment



Pilar Nores de Garcia, the first lady of Peru, addressed the conference

Stroke is the Top Health Problem Related to Household Air Pollution

By disease, global deaths attributable to HAP:



Source: WHO 2014, data from 2012

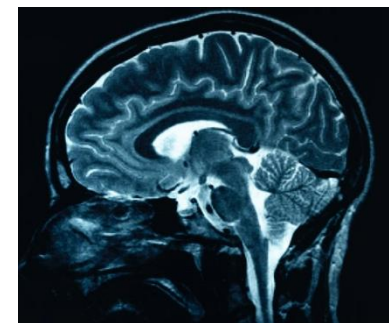
Consideration of vulnerable populations

- Pregnant women
 - How do the complex series of immunological changes during pregnancy affect susceptibility to pollutant exposure and effects?
- In utero exposure of fetus to pollutants
 - Potential organizational effects from pollutants could lead to permanent changes
- Exposure of child during sensitive developmental windows
 - Susceptibility changes over time and could lead to different health outcomes from a single exposure



Understanding complex exposures

- Chemical stressors
 - Polycyclic aromatic compounds (PACs), volatile organic compounds (VOCs), carbon monoxide, nitrogen dioxide, particulate matter, dioxins
- Physical stressors
 - Heat, challenges associated with collection of biomass for burning, viral load, nutritional status
- Psychosocial stressors
 - Poverty, environmental degradation, lack of access to health care, lack of empowerment



Relevant NIEHS initiatives

- NIEHS-funded research on cookstoves and indoor air pollution has helped people in the U.S., Guatemala, Ecuador, Nepal, Pakistan, and Ghana
- Polycyclic aromatic compound mixtures assessment program will assess the toxicity of cookstove emission samples from collaborators using an *in vitro* testing battery
- Environmental Health Perspectives has facilitated communication of findings from important cookstove research including commentaries, reviews, and research articles
- More broadly – greater understanding of interactions between complex environmental exposures and adverse health outcomes will contribute to elucidating the true health impact of indoor pollution from biomass burning



Impact of biomass fuels on pregnancy outcomes in central East India

Blair J Wylie^{1,2,3,4*}, Brent A Coull^{4,5}, Davidson H Hamer^{2,3,6,7}, Mrigendra P Singh⁸, Darby Jack⁹, Kojo Yeboah-Antwi², Lora Sabin², Neeru Singh¹⁰ and William B MacLeod^{2,3}

Effects of Woodsmoke Exposure on Airway Inflammation in Rural Guatemalan Women

Michael J. Guarnieri , Janet V. Diaz , Chandreyi Basu, Anaite Diaz, Daniel Pope, Kirk R. Smith, Tone Smith-Sivertsen, Nigel Bruce, Colin Solomon, John McCracken, John R. Balmes

Published: March 13, 2014 • DOI: 10.1371/journal.pone.0088455

Indoor Air. 2013 Apr;23(2):105-14. doi: 10.1111/ina.12003. Epub 2012 Sep 18.

Impact of a cleaner-burning cookstove intervention on blood pressure in Nicaraguan women.

Clark ML¹, Bachand AM, Heiderscheidt JM, Yoder SA, Luna B, Volckens J, Koehler KA, Conway S, Reynolds SJ, Peel JL.

Designs of two randomized, community-based trials to assess the impact of alternative cookstove installation on respiratory illness among young children and reproductive outcomes in rural Nepal

James M Tielsch^{1*}, Joanne Katz², Scott L Zeger³, Subarna K Khatri⁴, Laxman Shrestha⁵, Patrick Breysse⁶, William Checkley⁷, Luke C Mullany² and Steven C LeClerq^{2,4}

2014 NIEHS Cookstove Symposium

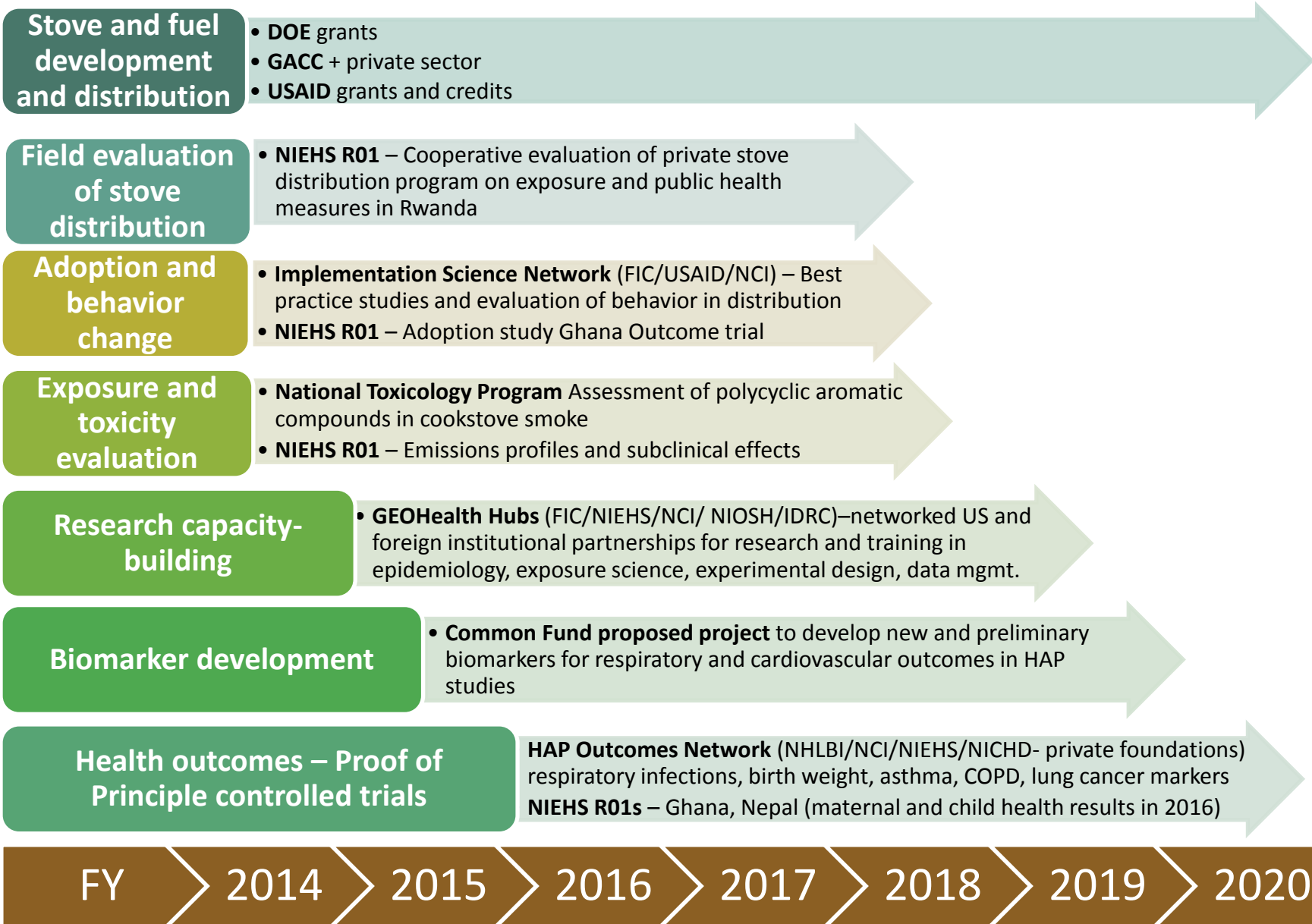
- Title: Assessing Exposures and Health Effects Related to Indoor Biomass Fuel Burning
- Goal: Bring together researchers working in the area of indoor biomass fuel burning emissions and health effects to discuss the latest science, policy, and future directions
- Cross-cutting themes:
 - Importance of multidisciplinary collaboration
 - Emissions from fuel burning are complex mixtures that require dedicated exposure and toxicity assessment approaches
 - Vulnerable populations (i.e., intersection of poverty and exposure)
 - Complexity of social, cultural, and economic factors that affect adoption behavior
 - Lab-to-field translation is critical
 - Dose-response considerations





Moving forward

- Understanding exposures from cookstoves
 - Which chemicals pose the greatest health risk?
- Accounting for combined exposures
 - What are the other important sources of pollution that might interact?
 - How do nonchemical stressors affect health outcomes?
- Better understanding of how environmental factors lead to disease
 - Improved interventions based on greatest potential impact
- Cross-disciplinary attention
 - Exposure science, toxicologists, epidemiologists, risk assessors
- Training the next generation of environmental scientists





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Thank you!



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National Toxicology Program
U.S. Department of Health and Human Services

NIEHS Strategic Plan Website
<http://www.niehs.nih.gov/strategicplan>

