

NTP symposium examines indoor air pollution from biomass fuels

By Audrey Pinto and Eddy Ball

An interdisciplinary team of speakers surveyed the state of the science, policy, and future directions of research on adverse health effects of indoor solid fuel combustion, during a symposium Aug. 18 at NIEHS, moderated by NTP toxicologist [Cynthia Rider, Ph.D.](#)

Organized and hosted by NTP, the meeting attracted NIEHS grantees and scientists from the U.S. Environmental Protection Agency (EPA) and RTI International, as well as researchers funded by nonprofits and other agencies. Attendees are dedicated to improving the health of the estimated 3 billion people worldwide who burn biomass, such as wood, dried dung, peat, and other organic solids, in indoor cookstoves and fire pits, to cook their traditional food and heat their homes (see [fact sheet](#)

(<http://www.who.int/mediacentre/factsheets/fs292/en/>)

).

As NIEHS and NTP Director Linda Birnbaum, Ph.D., said in her welcome and introduction, some 4 million people die prematurely each year from cancer and other diseases directly caused or worsened by exposure to indoor air pollution from biomass combustion. She described a complex exposure, involving mixtures that are not completely understood, and improved cookstove interventions that are not always effective or adopted by the people who need them.

According to Birnbaum, the problem directly relates to priority themes and goals of the NIEHS strategic plan and crosses several disciplines with implications for human rights, gender inequities, community engagement, and health disparities. "I think it's especially an issue for women and children," she said.

A real commitment, but much more is needed

Birnbaum was followed by Claudia Thompson, Ph.D., who described the impressive NIEHS grants portfolio on cookstoves and the NIEHS-WHO Collaborating Centre for Environmental Health Sciences emphasis on translation and capacity building in developing countries.

Elaborating on themes introduced by Birnbaum and Thompson, keynote speaker [Sumi Mehta, Ph.D.](#), (<http://www.cleancookstoves.org/the-alliance/secretariat-and-advisors/bios/sumi-mehta.html>) director of programs for the 1,000-partner Global Alliance for Clean Cookstoves (GACC), described the group's goal of supplying 100 million households with improved cookstoves by 2020 through what she called an integrated market approach.

Mehta pointed to some of the gaps in knowledge and performance that must be addressed, including the discrepancy between lab performance and field performance of new technology, as well as the importance of demonstrating that adoption of improved cookstoves can actually save lives. There remain important co-exposures, such as kerosene lighting and second-hand smoke, that need to be better understood.

Linked Video

[Watch a video of Mehta's comments about on the efforts of GACC to address the health effects of indoor air pollution \(03:09\)](#)

Analyzing exposures

Work on better understanding exposures is well underway at EPA and NTP. [David DeMarini, Ph.D.](#),

(<http://yosemite.epa.gov/rtpspeakings/rtpspeakings.nsf/byTopic/6455BE6FA6DAC34585257433005B8FAA?OpenDocument>)

a genetic toxicologist with EPA, addressed "Mutagenicity Emission Factors of Cookstoves: Health Effects Implications Relative to Other Combustion Emissions," as part of the morning session's four EPA cookstove research presentations.

Regarding test data from natural draft (ND) and forced draft (FD) cookstoves with analysis of fine particulate matter (PM 2.5) for 32 polycyclic aromatic hydrocarbons, DeMarini said, "It does reinforce how bad all of the stoves are compared to propane." He found that even FD, the safest and most efficient of the biomass stoves, is far from safe. "FD has a mutagen factor based on fuel energy similar to that of diesel, a known carcinogen," he said.



Rider is project leader on the NTP PAC mixtures assessment study. Along with moderating the meeting and introducing speakers, she also reported on her group's research. (Photo courtesy of Steve McCaw)



"Some of the [indoor] exposures make Beijing look clean," Birnbaum said as she described the conditions in homes using firepits and makeshift stoves. (Photo courtesy of Steve McCaw)



Just as Birnbaum had in her remarks, Thompson pointed to the major funding provided by NIEHS to advance the NIH cookstove initiative. Her slide underscored the importance of global health in the NIEHS mission and strategic plan. (Photo courtesy of Steve McCaw)

"Even the best stoves are not safe without adequate ventilation," DeMarini cautioned. He said the ND, or rocket, stove is no better than the three-stone fire pit in use in many households, noting that vastly less pollution is produced by liquid and gas stoves, which perform as much as 100 times better than stoves burning solid fuels.

In her afternoon talk, Rider explained that the NTP polycyclic aromatic compound (PAC) mixtures assessment [program](http://ntp.niehs.nih.gov/ntp/about_ntp/bsc/2012/december/pahresearchconcept_508be.pdf) (http://ntp.niehs.nih.gov/ntp/about_ntp/bsc/2012/december/pahresearchconcept_508be.pdf) is contributing data toward developing a methodology for risk assessment of whole mixtures of PACs. "We want to assess emission samples from cookstoves and woodstoves collected by field researchers," she said. "This unique approach creates an unprecedented opportunity for multidisciplinary cooperation to better understand and inform communities of potential health risks of PAC exposure."

Lessons from the field

[Tony Ward, Ph.D.](#),

(<https://cehsweb.health.umt.edu/users/tony-ward>)

an environmental health scientist at the University of Montana, discussed a successful [outreach project](#)

(http://www.woodstovechangeout.org/fileadmin/PDF/Libby_Report-Final.pdf)

in Libby, Montana. "[People] were breathing in high levels of particulate matter outdoors and inside their homes during the winter months," explained Ward. A unique community-based partnership provided Libby residents with EPA-certified wood-burning stoves, significantly reducing pollution levels.

[Marc Jeuland, Ph.D.](#),

(<http://sites.globalhealth.duke.edu/jeulandresearch/>)

an environmental economist at Duke University, and [Pam Jagger, Ph.D.](#),

(<http://www.cpc.unc.edu/people/fellows/bio?person=pjagger>)

an applied political economist at The University of North Carolina at Chapel Hill, working in India and Malawi, respectively, explained the challenges of getting rural villagers to adopt improved cookstoves (see [text box](#)). Both researchers suggested that continuous community involvement and marketing campaigns might boost improved cookstove use.

Next generation of researchers

The final speakers, [Eleanne van Vliet](#)

(<http://www.mailman.columbia.edu/academic-departments/environmental-health/current-students/eleanne-van-vliet-mph-%E2%80%99906-phd-%E2%80%9911>)

a Dr.P.H. student at Columbia University, and Lucia Pruneda-Alvarez, a Ph.D. student at the Universidad Autonoma de San Luis Potosi, shared preliminary findings on the health effects of biomass fuels and PACs among Ghanian and Mexican women and children.

In concluding the meeting, a common theme emerged - there are tremendous challenges ahead that will require multidisciplinary, innovative approaches to improve the health of affected populations.

(Audrey Pinto, Ph.D., is technical editor for the journal Environmental Health Perspectives.)



According to Mehta, the key to success is a multifaceted, market-based approach that addresses the challenges associated with traditional cookstoves, encourages innovation, and establishes a global market. (Photo courtesy of Steve McCaw)



Early in the meeting, North Carolina State University engineering professor Andrew Grieshop, Ph.D., described the poor results of an intervention study in India. "It didn't work for people, so they didn't use it," he said. "This was not meeting their family's needs." (Photo courtesy of Steve McCaw)



As part of the four-member EPA contingent, research engineer Jim Jetter, center, described his group's work in the agency's state-of-the-art cookstove testing facility in Research Triangle Park, North Carolina. (Photo courtesy of Steve McCaw)



Following the meeting's 15 presentations was a panel discussion on moving environmental research forward that included, from left, Jeuland, Mehta, Grieshop, Jetter, and EPA research biologist Janice Dye, D.V.M., Ph.D. (Photo courtesy of Steve McCaw)



NIEHS Health Science Administrator Kimberly Gray, Ph.D., served as moderator for the panel discussion and helped the panelists as they articulated the meeting's take-home messages. (Photo courtesy of Steve McCaw)

Challenges and barriers

The complexity of human nature is never more apparent than when public health attention turns to behavior change, particularly age-old behaviors centered around food and cooking.

In the afternoon sessions, the scientists discussed some of the barriers to successful adoption of improved technologies among many low-income and rural communities.

- Perception - people in rural communities are not aware of the health benefits of reducing indoor and outdoor air pollution. As Jagger observed, "The doctors in Malawi have no idea that air pollution is a major cause of disease in their country."
- Infrastructure - supply and demand depends on whether rural communities have access to stoves and a reliable source of electricity.
- Socioeconomic status - many people in rural communities are very poor, so the cost of improved cookstoves is prohibitive, especially if it involves structural changes to houses to provide effective chimneys.

Take-home messages

Improved cookstove adoption is positively related to perceptions of health and time savings.

Peer pressure and social norms as perceived through the actions of neighbors may be important.

Continuous involvement of heads of households must be maintained.

A combination of supply-chain improvements and carefully designed social marketing and promotion campaigns, and possibly incentives, to reduce the up-front cost of stoves may improve adoption and use of improved cookstoves in some areas.

As Jeuland concluded, "The key to real results and health benefits is reducing exposures. We must expand our scope to address what the communities want to do. In the end, we may be expecting a lot from a little stove."

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