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Researchers find shared molecular response to tobacco smoke and indoor air pollution

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Exposure to certain household air pollutants may cause some of the same molecular changes as smoking cigarettes.

A study in the journal *Carcinogenesis* reports non-smoking women living in rural China who burn smoky (bituminous) coal for heating and cooking had gene expression patterns in buccal (cheek) epithelial cells similar to those present in the cheek cells of active cigarette smokers. The study, conducted by investigators at Boston University School of Medicine (BUSM), the U.S. National Cancer Institute (NCI), and others, is the first to identify genomic alterations that result from exposure to smoky coal.

Approximately three billion people in the world use coal and biomass

(charcoal, wood, animal dung and crop waste) for cooking and heating. "Lung cancer rates among non-smoking women in China's rural counties, where smoky coal is used extensively, are among the highest in the world," noted Qing Lan, MD, PhD, MPH, senior investigator at the NCI, and co-senior author of the study.

Avrum Spira, MD, MS, professor of medicine, pathology and laboratory medicine at BUSM and co-senior and co-corresponding author of the study, has previously shown that tobacco smoke induces gene expression changes throughout the epithelium of the respiratory tract. Since smoky coal is also an established risk factor for lung cancer and other non-malignant respiratory diseases, the researchers were interested to examine whether smoky coal had a similar effect on the respiratory tract.

"While lung cancer in this population has been linked to the usage of smoky coal, as compared to smokeless (anthracite) coal, the molecular changes experienced by those exposed to these indoor air pollutants remained unclear," said Nathaniel Rothman, MD, MPH, MHS, senior investigator at the NCI, and a co-author of the study.

To understand the physiologic effects of this exposure Spira and his collaborators at NCI analyzed buccal epithelial cells collected from healthy, non-smoking female residents of Xuanwei and Fuyuan county who burned smoky and smokeless coal. Genome-wide gene-expression profiles were examined and changes associated with coal type were compared. The researchers identified 282 genes as differentially expressed in the buccal epithelium of women exposed to smoky versus smokeless coal.

"We then compared our smoky coal gene-expression signature to gene-expression changes observed in tobacco users and found that smoky coal emissions elicited similar physiologic effects. These results shed new

light on the molecular mechanisms associated with smoky coal exposure and may provide a biological basis for the increased risk of lung cancer," explained Spira, who is also director of the Boston University Cancer Center and a pulmonologist at Boston Medical Center. "We hope genomic profiling of the biologic response to solid fuel emissions will ultimately lead to the development of clinically relevant biomarkers," he added.

"Ultimately, this and other studies of the health effects from indoor air pollution due to smoky combustion highlight the importance of switching to cleaner fuels," concluded Lan.

Provided by Boston University Medical Center