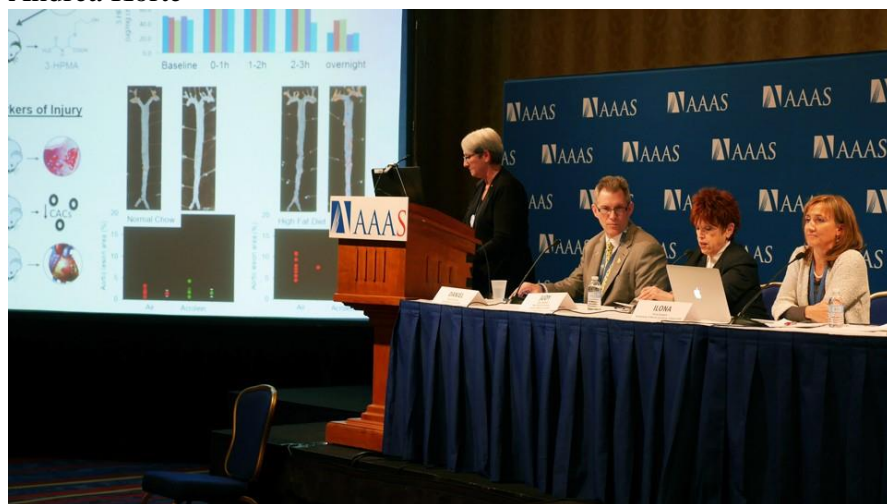# Alternative Tobacco Products May Be Just As Dangerous As Cigarettes

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Lynne Friedmann (left) moderates a panel of researchers, Daniel Conklin, Judith Zelikoff, and Ilona Jaspers, who revealed new data on the health effects of alternative tobacco products. | Ashley Gilleland/AAAS

E-cigarettes may not be safer than traditional tobacco cigarettes, according to new results presented by a trio of researchers at an 11 February press briefing at the 2016 AAAS Annual Meeting.

The researchers announced results from human and animal studies that found biomarkers of harmful cardiac, pulmonary, and reproductive effects from exposure to alternative tobacco products—a growing market of constantly evolving products including electronic cigarettes, hookah, and smokeless tobacco like snuff and gutkha.

Research has already shown that immune response provided by nasal mucous membranes is compromised in cigarette smokers, which causes them to be more susceptible to the outcomes of a viral infection, said Ilona Jaspers, deputy director of the Center for Environmental Medicine Asthma and Lung Biology at the University of North Carolina at Chapel Hill, but her new research revealed even more immune suppression effects in e-cigarette users than in smokers of traditional cigarettes.

Her analysis of nasal samples from cigarette smokers, e-cigarette users, and non-smokers for a panel of 600 different genes related to immune response found 53 genes suppressed in cigarette smokers. Those same genes were suppressed in e-cigarette users, along with 305 other suppressed genes, Jaspers said.

Animal studies also found that alternative tobacco products without nicotine produced similar or stronger effects than products that include nicotine.

Judith Zelikoff of NYU Langone Medical Center studied pre- and post-natal exposure to mice of commercially available e-cigarette vapors and aerosols with and without nicotine, finding changes to frontal cortex gene expression associated with mental health and activity issues, some of which are associated with schizophrenia, she said. While nicotine and non-nicotine products both produced changes, e-cigarette products without nicotine resulted in even more gene expression changes than products with nicotine, Zelikoff said.

The use of alternative tobacco products, regardless of nicotine content, may pose a risk to developing fetuses, Zelikoff said.

"Because of the concept that e-cigarettes are safer than commonly used cigarettes, you may have pregnant women—and the data show this—taking e-cigarettes during pregnancy so as not to smoke, because the risk factors and the dangers of smoking cigarettes while pregnant are well-known," Zelikoff said.

"That's a frightening possibility, given the findings that are emerging," she added.

Zelikoff's studies found mice exposed in utero to gutkha had a larger number of cardiovascular risk factors. Adult offspring exposed in utero had increased liver fibrosis and inflammation, with both male and female mice affected.

The third researcher, Daniel Conklin of the University of Louisville, tracked biomarkers of exposure to new and emerging tobacco products as well as biomarkers of cardiovascular harm and injury.

While cigarette smoke contains more than 8,000 chemicals, current and published research in humans and in animals suggests that the molecule acrolein likely contributes significantly to the cardiovascular toxicity of traditional tobacco cigarette smoke, Conklin said. E-cigarette aerosols contain many of the same toxic aldehydes—acid aldehyde, formaldehyde, and acrolein—that are present in tobacco smoke, he said.

"We conclude that toxic aldehydes present in electronic cigarette aerosols are potentially a cause for concern and could adverse impact the cardiovascular health of users," Conklin said.

Conklin cited a range of supporting research, which has found that exposure to e-cigarette aerosols or tobacco smoke increases the levels of toxic aldehyde metabolites found in the urine in mice. Conklin also said that chronic exposures to smokeless tobacco extracts, mainstream cigarette smoke, acrolein, or e-cigarette aerosol enhanced atherosclerotic lesion formation in a mouse model of atherosclerosis.

Additives to alternative tobacco products—like flavoring agents—also showed effects in studies.

Jaspers followed up her nasal sample analysis with lab studies of immune cells commonly present in nasal mucosa. The cells, which were exposed to different flavors of liquids added to e-cigarettes, repeatedly showed the most significant immune suppressive effects came from strongly cinnamon-flavored liquids.

Jaspers clarified that while U.S. Food and Drug Administration may classify flavoring agents as "generally recognized as safe" for oral consumption, the agents may not show the same results when the products are inhaled.

While research abounds on the negative health effects of traditional tobacco cigarettes, the researchers called for further toxicology research on the effects of popular alternative tobacco products, particularly considering the constant evolution of existing products and the emergence of new products.

"Of course more studies need to be done in this area, because research especially in toxicology of e-cigarettes and their potential toxicity, the science is lagging behind the product manufacture, and we need to catch up in that area," Zelikoff said.