

Researchers find e-cigarette use disrupts the nasal microbiome

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A participant partaking in nasal epithelial lining fluid collection. Credit: UNC Center for Environmental Medicine, Asthma and Lung Biology

The nose plays more roles than merely allowing us to smell and shaping our facial profiles. It also acts as a gatekeeper for the respiratory tract,

capable of preventing bacteria and other pathogens from leaving the nasal passage and taking up residence in the lungs.

Similar to the microbiome in the [gastrointestinal tract](#) and the skin, the precious balance between beneficial bacterial, fungal, and viral colonies in the nose can be disrupted. This imbalance, termed dysbiosis, can lead to an overgrowth of harmful bacteria and can predispose people to [respiratory diseases](#), such as [chronic obstructive pulmonary disease](#) and asthma.

Elise Hickman, Ph.D., a former student in the lab of inhalation toxicologist Ilona Jaspers, Ph.D., director of the UNC Center for Environmental Medicine, Asthma, and Lung Biology at the UNC School of Medicine, discovered that e-cigarette and cigarette use can cause an imbalance in the nasal microbiome.

Their study, [published](#) in *Nicotine and Tobacco Research*, could be important in understanding the immunological implications of vaping and smoking.

"We found that the composition of the nasal microbiome varies depending on sex, e-cigarette versus cigarette use, and how much of a nicotine biomarker is found in the blood," said Hickman, who is now a postdoctoral researcher at the Department of Environmental Sciences and Engineering at the UNC Gillings School of Public Health.

"Our findings warrant further investigation into why and how [e-cigarette use](#) dysregulates the [immune system](#) in the nasal microbiome and causes imbalance in the respiratory microbiome."

The Jaspers lab's previous research showed that e-cigarette use can affect the daily operations of the immune system in the nose and make one more susceptible to viral infections such as influenza. Knowing that

the respiratory microbiome supports respiratory immune defense, Hickman and Jaspers wanted to know if dysbiosis in the nasal microbiome, which is often related to lower airway disease, could be caused by e-cigarette or cigarette use.

Teaming up with Matt Wolfgang, Ph.D., and Cristian Roca from the Marsico Lung Institute/UNC Cystic Fibrosis Center, Hickman and Jaspers collected and analyzed nasal epithelial lining fluid samples from 20 non-smokers, 28 e-cigarette users, and 19 smokers. They then used genetic sequencing to identify the type and quantity of bacteria in the nasal microbiome.

Researchers identified different bacteria, some harmful and some protective, depending on whether people used e-cigarettes, smoked regular cigarettes, or neither. *Staphylococcus aureus*, a bacterium that can cause pneumonia and other life-threatening infections, was found in greater numbers in both e-cigarette users and smokers compared to non-smokers. *Lactobacillus iners*—a beneficial bacterium that can protect against respiratory disease—was found more often in smokers than non-smokers.

Surprisingly, researchers found that there were differences in the microbiomes of male and female e-cigarette users. Hickman and Jaspers also found that there were differences in nasal bacteria between people who had high and low levels of cotinine, a metabolite and indicator of nicotine exposure.

"Taken together, our data identified unique, sex-dependent host immune dysfunction associated with e-cigarette use in the [nasal mucosa](#)," said Jaspers, who is also a UNC Lineberger Comprehensive Cancer Center member researching inhaled toxicants and their effects on the respiratory mucosa.

This research adds to the increasing number of studies demonstrating respiratory health effects associated with e-[cigarette use](#). Considering that there is a growing body of research showing that changes in the nasal microbiome can be related to lung disease and health, dysbiosis in the balance of harmful and protective bacteria in the nose of e-cigarette users should be of concern.

More information: Elise Hickman et al, E-Cigarette Use, Cigarette Smoking, and Sex Are Associated With Nasal Microbiome Dysbiosis, *Nicotine and Tobacco Research* (2024). [DOI: 10.1093/ntr/ntae176](https://doi.org/10.1093/ntr/ntae176)

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