

Vaping may destroy good bacteria and increase cavities, gum disease, and cellular changes that cause cancer

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Undergraduate researchers Maanya Pradeep, (left) Jasmine Almeda, (middle) are mentored by Claudia Andl (right) to learn lab skills and get hands-on research experience. Credit: University of Central Florida

A University of Central Florida College of Medicine researcher is discovering that vaping creates chemical reactions in the mouth that can destroy good bacteria while increasing germs that cause cavities, gum disease and cellular changes that can lead to cancer.

Despite laws that outlaw selling e-cigarettes to minors, one in 10 young people under 18 use vapes, according to the FDA and CDC, and a quarter of those use the digital smoking devices daily. Meanwhile, an estimated 20 million adults smoke e-cigarettes, many in an attempt to quit smoking tobacco. Claudia Andl, an associate professor in the Burnett School of Biomedical Sciences, focuses her research on throat and [mouth cancer](#) and has broadened her efforts to help medicine better understand the dangers of vaping.

Andl's research is focused on how vape devices affect bacterial communities that live in the mouth. Bacteria are often associated with illness. But there are many forms of "good" bacteria, which form a protective biofilm over the mouth and interfere with the harmful bacteria that cause [tooth decay](#) and periodontitis, or gum disease. She says the combination of high heat and chemicals from vape ingredients often interfere with this natural bacterial balance.

"In our research, we focused on a specific bacterium, Streptococcus mutans, commonly associated with tooth decay. Then we looked at how e-cigarette vape affects that bacterium and others common to the environment in the mouth," Dr. Andl explained. "It turns out the antimicrobial effect of the e-cigarette liquid creates an environment where the healthy bacteria have trouble growing, but the bad bacteria are not affected and are left with more room to take over."

This change in environment can be dangerous for oral health. Tooth decay can lead to inflammation and [gum disease](#), which causes the gums to retract and the teeth to loosen and, if untreated, fall out.

Changes in the mouth's bacterial environment may also increase risks for cancer, another aspect of Andl's research. While the vaping-cancer link has been suspected for some time, it has been difficult to prove—in part because cancers take so long to develop and vaping has been a recent trend, especially among [young people](#) who may not develop cancer for years.

She is investigating the bacteria *Staphylococcus aureus*, which resides on the skin but can cause serious illness and death if it enters the blood stream through cuts and minor abrasions. The bacteria is also found in oral tumors.

Normally, when individuals have healthy immune systems, the body recognizes the bacteria and kills it. But Andl's research shows that vaping suppresses the signaling that activates immune system, allowing the Staph bacteria to grow.

"When there is no signal saying 'Hey, go kill the bad guy,' Staph can colonize the oral cavity, leading to long-term inflammation and that inflammation is associated with cancer," she says. "We know that people who vape are effectively immunocompromised in a way, and do not respond well to infections, so they could ultimately have more bacteria colonize in their mouth and make them sick."

In addition, she is investigating whether vaping encourages cells to take on characteristics that increase their likelihood of becoming cancerous. She is looking at different cell markers that are known to contribute to cancer to see if chemicals in vaping encourage cells in the mouth to acquire what she calls "the hallmarks of cancer."

"There are different characteristics that cells develop if they are likely to become cancer at some point," she says. "For example, they keep dividing. They grow and grow and grow, and eventually one cell

becomes many, like a tumor. So, if we could show that different cell markers known to contribute to cancer are induced and upregulated after exposure to the e-cigarette vape, we have more direct evidence."

Andl says she hopes her research, published in [Cells](#) and [Microbiology Spectrum](#), will help the medical community continue to fight against vaping—especially for the young.

"I hope this will bring more awareness that vaping does harm and carries a risk," says Andl, who has two teenagers, one in high school and the other a college freshman. "Especially for those middle and high schoolers who still have a long lifetime to develop [cancer](#). They should understand the risks they are taking now."

For Jasmine Almeda, an undergraduate researcher working with Andl, this research is especially important as [vaping](#) continues to gain popularity among her generation.

"It is so important to further investigate the potential carcinogenic risks of e-cigarette devices, especially with their recent rise in popularity," she says. "E-cigarettes have been phasing out conventional cigarettes, however, their long-term effects have not been researched much due to them becoming more popular only in the past decade or two."

Provided by University of Central Florida

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