

## Researchers draw more links between vaping, smoking, young people, and coronavirus

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What do vapers, smokers, and non-smokers with chronic conditions such as high blood pressure or diabetes have in common? They all are at higher risk for COVID-19.



The <u>scientific explanation</u> behind this is complex and not yet certain—but it may boil down to an enzyme known as ACE2, that lives on the surface of many cells in the lungs and serves as the entry point for the coronavirus.

Evidence shows that people with chronic inflammatory illnesses, vulnerable older adults, and those who smoke or vape, all have an abundance of ACE2 receptor proteins to serve as a gateway to the deadly virus.

A research team at the University of Rochester Medical Center, led by Irfan Rahman, Ph.D., published a series of studies during the pandemic that focus on the vital role of ACE2—which is already at the center of many other scientific investigations—to shape a clearer picture of the critical cellular mechanisms that regulate the deadly virus and its link to vaping.

While Rochester investigators are working in lock step with scientists around the world, Rahman's special interest is on the growing problem of young people who test positive and may be spreading coronavirus at alarming rates. Even some older children and teens who have higher levels of the ACE2 receptor seem to be more vulnerable to the virus.

"Our next step is to investigate whether ACE2 is normally low in young people, hence their relatively low infection and mortality rates from COVID-19, but to find out if ACE2 is increased by smoking or vaping rendering them more susceptible to the virus," said Rahman, Dean's Professor of Environmental Medicine , Medicine (Pulmonary), and Public Health Sciences. "This would be in contrast to older people with lung diseases such as COPD and pulmonary fibrosis, who we already know are at higher risk for severe viral illnesses and death."

A post-doctoral scientist in Rahman's lab, Gangandeep Kaur, Ph.D., had



prior experience investigating tuberculosis and thus led the new effort to study ties between vaping and coronavirus. The team has published several key peer-reviewed articles relevant to the issue:

- Smoking, combined with aging, alters more than 20 genes involved in lung cell function and results in a spike in ACE2 receptors and three other proteins associated with the coronavirus, according to a Rahman study in *Frontiers in Pharmacology*. This strengthens the observations of other researchers, that smokers and people with chronic lung diseases such as COPD are more prone to coronavirus infection.
- Because vaping and smoking tend to be long-term habits, URMC researchers investigated the chronic effects of nicotine exposure on lung tissue in mice, keeping an eye open for links to known COVID-19 proteins. They discovered other receptors with a direct relationship to ACE2, which also have a significant role in regulating the inflammatory response in the lungs and cause a higher expression of ACE2. This was reported in the Respiratory Research journal and may provide a gene target for the treatment of lung inflammation caused by smoking or vaping.
- In a June review article written by Rahman and Guiseppe Lungarella, M.D., of the University of Siena, Italy, where COVID-19 swept through the country earlier than in the U.S., they draw additional connections between ACE2 receptors, smokers, and coronavirus. For example, their analysis shows: In Wuhan, China, patients who smoked did worse; fatality rates were higher for men, who have more ACE2 receptors, than in women; and that ACE2 is linked to known nicotine receptors. Kaur, the postdoctoral fellow, is also a co-author.

The review suggests that health care providers should ask patients about their smoking and vaping history, to better identify people who could be at higher risk for coronavirus complications,



according to the Journal of Inflammation article. Currently, the Rahman lab is examining blood and saliva samples of young people who have been infected with COVID-19 to evaluate ACE2 levels and see if the ACE2 protein can be a biomarker for a rapid coronavirus test.

• In other recent studies, Rahman and URMC scientists disclosed the 40 chemicals used in flavoring e-liquids and vaping pods, detailing their harmful effects on lung tissue; and demonstrated that <u>vaping</u> is associated with wheezing, which is often a precursor to emphysema, reflux disease, heart disease, lung cancer and sleep apnea.

**More information:** Krishna P. Maremanda et al, Age-Dependent Assessment of Genes Involved in Cellular Senescence, Telomere, and Mitochondrial Pathways in Human Lung Tissue of Smokers, COPD, and IPF: Associations With SARS-CoV-2 COVID-19 ACE2-TMPRSS2-Furin-DPP4 Axis, *Frontiers in Pharmacology* (2020). DOI: 10.3389/fphar.2020.584637

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