Medical Xpress

Tobacco smoke exposure may increase heavy metal levels in children's saliva

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Credit: AI-generated image (disclaimer)

Secondhand tobacco smoke continues to be a major source of indoor air pollution that causes more than 41,000 nonsmoking adults to die every year in the United States, according to the Centers for Disease Control and Prevention.

The exposure is even more dire for children, who can be more affected by less smoke. It can increase frequency and severity of asthma attacks, respiratory infections, cancer, sudden infant death syndrome and behavioral problems. Now, for the first time, Penn State-led research has shown exposure to tobacco smoke increases the presence of heavy metals in children's saliva.

The human body needs trace amounts of essential elements such as copper and zinc to promote healthy bone development and other metabolic processes. Too much of these metals, and other non-essential heavy metals found in tobacco smoke like lead, can dysregulate biological functions and lead to health and behavioral problems.

Published recently in the *Journal of Exposure Science & Environmental Epidemiology*, the study on the correlation between smoke exposure and salivary heavy metal levels was led by Lisa Gatzke-Kopp, professor of human development and family studies and Social Science Research Institute co-funded faculty member. She is also the principal investigator at the Child Brain Development Lab, which is focused on preventive intervention programs to improve childhood development. As part of this work, she became interested in the effects of second- and thirdhand smoke, such as surface residue, on children.

"Tobacco smoke contains thousands of chemical compounds, most of which are harmful to humans," Gatzke-Kopp said. "While increases in smoke-free policies and awareness of environmental tobacco smoke (ETS) hazards have contributed to a substantial reduction in exposure in ETS in recent years, some children continue to experience extremely high levels of exposure."

ETS is typically measured by the levels of cotinine, a nicotine metabolite, in children's blood or saliva. Gatzke-Kopp and her research team found significant associations between salivary cotinine and

salivary levels of essential trace metals such as copper and zinc and of non-essential metals such as lead. Children with higher levels of cotinine also had higher levels of heavy metals in their saliva.

The work is part of the Family Life Project, a prospective, population-based longitudinal study by multiple universities, including Penn State. The researchers recruited approximately 1,300 families at the time of their child's birth in 2003 and 2004 to study the development of children growing up in rural areas in Pennsylvania and North Carolina. For the current project, researchers took a subset of 238 children 7.5 years of age and under and measured levels of cotinine and metals in their saliva.

"We were surprised by the levels of heavy metals in children at this age," Gatzke-Kopp said. "Our findings suggest that environmental tobacco smoke exposure may be one source of increased children's exposure to heavy metals."

While vaping has been cast as a healthier alternative to tobacco-based products, previous studies of common products used for vaping report varying levels of toxic metals in the liquids.

"In these studies, metals were detected in the aerosolized vapors, indicating that they, along with the nicotine, are also capable of being transmitted as second- and thirdhand smoke," Gatzke-Kopp said.

Now that researchers have determined that metal levels in saliva correlates to smoke exposure, Gatzke-Kopp said, it may be possible that a simple saliva test could serve as a non-invasive tool for assessing environmental and occupational exposures to trace metals. The issue, however, is that currently there are no official guidelines for appropriate metal levels in human saliva.

"In the future, established guidelines for saliva tests could provide the

basis for further comparisons between salivary metals and behavioral, cognitive or other clinical measures," Gatzke-Kopp explained. "Saliva tests are non-invasive and easy to get from a child, and, as this work shows, there is a lot of value in monitoring via saliva."

More information: Lisa M. Gatzke-Kopp et al, Environmental tobacco smoke exposure is associated with increased levels of metals in children's saliva, *Journal of Exposure Science & Environmental Epidemiology* (2023). DOI: 10.1038/s41370-023-00554-w

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