

Study finds link between ambient ozone exposure, carotid wall thickness

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A UB-led study is the first to report an association between long-term exposure to ozone and atherosclerosis, the process of plaque buildup in the artery walls. Credit: University at Buffalo

Long-term exposure to ambient ozone appears to accelerate arterial conditions that progress into cardiovascular disease and stroke, according to a new University at Buffalo study.

It's the first epidemiological study to provide evidence that [ozone](#) might advance subclinical arterial disease—injuries that occur to the artery

walls prior to a heart attack or stroke—and provides insight into the relationship between [ozone exposure](#) and [cardiovascular disease](#) risk.

"This may indicate that the association between [long-term exposure](#) to ozone and cardiovascular mortality that has been observed in some studies is due to arterial injury and acceleration of atherosclerosis," said study lead author Meng Wang, assistant professor of epidemiology and environmental health in the UB School of Public Health and Health Professions.

The paper was published in May in the journal *Environmental Health Perspectives*.

The longitudinal study followed nearly 7,000 people aged 45 to 84 from six U.S. regions: Winston-Salem, North Carolina; New York City; Baltimore; St. Paul, Minnesota; Chicago; and Los Angeles. Participants were enrolled in the Multi-Ethnic Study of Atherosclerosis (MESA) and have been followed for over a decade.

Atherosclerosis refers to the build-up of plaque, or fatty deposits, in the artery walls, which, over time, restricts blood flow through the arteries. This can cause blood clots, resulting in a [heart attack](#) or stroke, depending on which artery—coronary or carotid, respectively—the plaque accumulates in.

The study found that chronic [exposure](#) to ozone was associated with a progression of thickening of the main artery that supplies blood to the head and neck. It also revealed a higher risk of carotid plaque, a later stage of arterial injury that occurs when there's widespread plaque buildup in the intima and media, the innermost two layers of an artery wall.

"We used statistical models to capture whether there are significant

associations between ozone exposure and these outcomes," said Wang, who is also a faculty member in the UB RENEW (Research and Education in eNergy, Environment and Water) Institute. "Based on this model, it suggests that there is an association between long-term exposure to ozone and progression of atherosclerosis."

While the study finds an association between air pollution and [atherosclerosis](#), researchers aren't clear on why. "We can show that there is an association between ozone exposure and this outcome, but the biological mechanism for this association is not well understood," Wang said.

The study is unique in its focus on ozone exposure rather than particulate matter.

Particle pollution comes from a variety of human and natural activities. Examples include vehicle exhaust, fossil fuel burning and agricultural and industrial operations and processes. Smog is a harmful byproduct of such activities.

That shouldn't be confused with the ozone layer in Earth's upper atmosphere, which shields us from much of the sun's ultraviolet radiation.

Ground-level ozone, however, causes serious health problems. When breathed in, it aggressively attacks lung tissue by chemically reacting with it, according to the American Lung Association.

Wang's study—which includes researchers from the University of Washington and the University of Wisconsin-Madison—has policy implications for the U.S., where the Environmental Protection Agency in 2015 lowered the federal health standards for ozone.

"Most attention to air quality in the United States has focused on particulate matter air pollution," Wang said. "However, ozone concentrations within metropolitan areas are not positively correlated with particulate matter pollution. In addition, mean ozone levels—as reported in this paper—are not declining in the United States, probably due to the worsening of climate change."

The EPA reports that [particulate matter](#) concentrations have decreased across the nation as efforts are made to reduce vehicle emissions and use clean energy.

Ozone, however, is much trickier, Wang notes. "For policy in the U.S., the focus should be on how to effectively control ozone concentration, which may be harder because it's a secondary pollutant," he said. "With climate change getting worse, this issue may become amplified."

More information: Meng Wang et al. Long-Term Exposure to Ambient Ozone and Progression of Subclinical Arterial Disease: The Multi-Ethnic Study of Atherosclerosis and Air Pollution, *Environmental Health Perspectives* (2019). [DOI: 10.1289/EHP3325](https://doi.org/10.1289/EHP3325)

Provided by University at Buffalo

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