RSNA Press Release

Air Pollution Linked to More Severe Heart Disease

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At A Glance

- Even relatively low levels of long-term exposure to air pollution are associated with more severe coronary artery disease in women and men.
- In women, ambient fine particulate matter is linked to a higher risk of obstructive heart disease, a more severe form of artery narrowing.
- The findings underscore the need for ongoing efforts to improve air quality to protect heart health.

CHICAGO– Long-term exposure to common air pollutants is associated with more advanced coronary artery disease—with notable differences between women and men—according to a large-scale study of more than 11,000 adults being presented today at the annual meeting of the Radiological Society of North America (RSNA).

Felipe Castillo Aravena, M.D.

Kate Hanneman, M.D., M.P.H.

The findings show that even levels of pollution below or near regulatory standards and typical urban exposures are associated with early signs of heart disease—often before symptoms appear—and underscore the importance of improving air quality to reduce cardiovascular disease risk.

Air pollution is a pressing global health issue, contributing to an estimated 2.46 million cardiovascular deaths in 2021, according to a study based on Global Burden of Disease data. It is one of the greatest environmental risks to health and plays a major role in causing heart attacks and stroke, according to the World Health Organization.

For the retrospective study, cardiac CT was used to evaluate the relationship between long-term exposures to two common pollutants found in urban air, ambient fine particulate matter ($PM_{2.5}$) and nitrogen dioxide (NO_2). $PM_{2.5}$ sources include vehicle exhaust, industrial emissions and wildfire smoke, and at about 30 times smaller than a human hair, these tiny particles can penetrate deep into the lungs and bloodstream. NO_2 is a harmful gas produced mainly by burning fossil fuels in vehicles, power plants and industrial processes.

“Even at low exposure levels, air pollution is associated with more plaque in the coronary arteries,” said Felipe Castillo Aravena, M.D., study lead author and cardiothoracic imaging fellow in the Department of Medical Imaging, Temerty Faculty of Medicine, University of Toronto, and University Health Network (UHN). “Overall, higher long-term exposure to air pollution was associated with more coronary artery disease on cardiac CT in both women and men. In women, long-term exposure to fine particulate matter was linked to higher calcium scores and more severe narrowing of the arteries. In men, higher long-term exposure to fine particulate matter was associated with higher calcium scores and higher plaque burden.”

Nitrogen dioxide exposure was associated with coronary artery disease in both men and women.

Researchers analyzed data from adults who had undergone cardiac CT exams from 2012 through 2023 across three major hospitals in Toronto. They linked patients’ residential postal codes with air quality data to estimate each person’s average exposure to air pollution over the 10-year period prior to CT. Three markers of coronary artery disease were assessed: calcium score, total plaque burden and obstructive stenosis (artery narrowing).

For each increase in long-term $PM_{2.5}$ of 1 microgram per cubic meter, there was an 11% increase in calcium build-up in the coronary arteries, 13% greater odds of more plaque and 23% greater odds of obstructive disease. Exposure to nitrogen dioxide showed similar trends, though with smaller effect sizes for every 1 part per billion

increase.

Additional research is needed to understand the exact mechanisms and establish causality, but biological, social, and behavioral differences, along with plaque characteristics, may be contributors to the differences seen in women and men, Dr. Castillo said.

“This is one of the largest studies to link long-term gaseous and particulate air pollution at contemporary exposure levels with multiple markers of coronary artery disease assessed by cardiac CT,” said study senior author Kate Hanneman, M.D., M.P.H., a cardiac radiologist, associate professor and vice chair of research at the University of Toronto and UHN. “Heart disease is the number one cause of death globally. The results of this study add to the growing body of evidence that air pollution is a modifiable cardiovascular risk factor and reinforce the need for further research to understand why these associations differ between men and women.”

Additional co-authors are Chloe DesRoche, M.D., M.Sc., Scott Delaney, Sc.D., J.D., M.P.H., Rachel Nethery, Ph.D., Paaladinesh Thavendiranathan, M.D., S.M., and Heather Ross, M.D., M.H.Sc.

Note: Copies of RSNA 2025 news releases and electronic images will be available online at *RSNA.org/press25*.

RSNA is an association of radiologists, radiation oncologists, medical physicists and related scientists promoting excellence in patient care and health care delivery through education, research and technologic innovation. The Society is based in Oak Brook, Illinois. (*RSNA.org*)

Editor’s note: The data in these releases may differ from those in the published abstract and those presented at the meeting, as researchers continue to update their data right up until the meeting. To ensure you are using the most up-to-date information, please call the RSNA Newsroom at 1-312-791-6610.

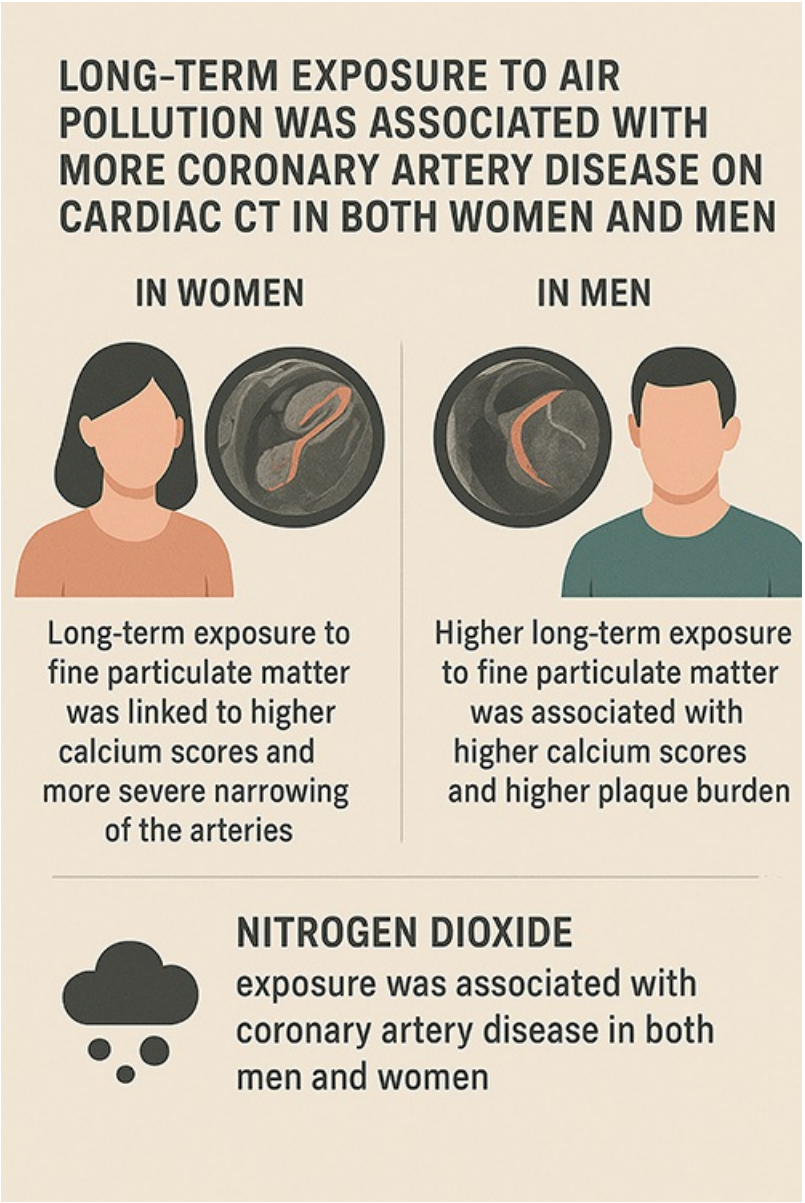
For patient-friendly information on cardiac CT, visit *RadiologyInfo.org*.

Video (MP4):

Video. Felipe Castillo Aravena, M.D., discusses his research on how long-term exposure to common air pollutants is associated with more advanced coronary artery disease—with notable differences between women and men. Download

Images (JPG, TIF):

Infographic



Infographic 2

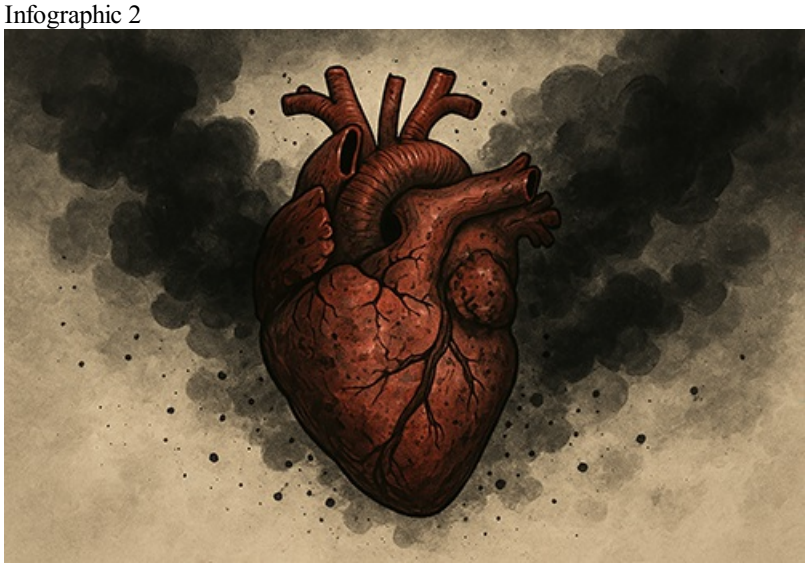


Figure. AI-generated stylized illustration

Resources:

Resources.

Abstract