

Air Pollution and Breast Cancer in Postmenopausal Women: Evidence across Cohorts

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Air pollution contains complex mixtures of potentially toxic gases and particles. In 2013, the World Health Organization's International Agency for Research on Cancer classified outdoor air pollution as a whole, and particulate matter specifically, as carcinogenic to humans, largely on the basis of studies linking it with lung and bladder tumors.¹ Some researchers suspect that air pollution contributes to breast cancer as well, but the supporting evidence is mixed and weaker by comparison.^{2,3,4,5} Now a European meta-analysis published in *Environmental Health Perspectives* concludes that certain constituents of air pollution may in fact elevate the risk of breast cancer in postmenopausal women.⁶

“The evidence is moderate but suggestive of an association,” says Zorana J. Andersen, an associate professor at the University of Copenhagen and the study's corresponding author. “For each unit increase in exposure we see a corresponding increase in breast cancer risk.”

For their meta-analysis, Andersen and more than 50 coauthors pooled data for 74,750 postmenopausal women. The women were part of 15 established cohorts in nine countries, each of which participates in the long-term European Study of Cohorts for Air Pollution Effects (ESCAPE). This study was launched by the European Union in 2008 and focuses on many other health indicators in addition to cancer.

At multiple locations within cities and regions, ESCAPE investigators sampled for criteria air pollutants—these included nitrogen dioxide (NO₂), nitrogen oxides (NO_x), and particulate matter ≤2.5 μm and ≤10 μm in diameter (PM_{2.5} and PM₁₀, respectively). Then they estimated the women's exposures to those pollutants at the home where they lived at baseline.

Combining results from all 15 cohorts based on a fully adjusted model indicated positive but statistically nonsignificant associations between postmenopausal breast cancer and exposure to PM₁₀, PM_{2.5}, PM_{coarse} (the fraction of particulate matter between 2.5 μm and 10 μm in diameter), and NO₂. The researchers did find a statistically significant positive association with NO_x, with each 20-μg/m³ increase in estimated NO_x exposures associated with a 4% increase in breast cancer risk across cohorts. Vehicular traffic is the main source of NO_x.⁷

The new meta-analysis accounted for shortcomings that probably led to inconsistent findings in earlier research, according to Dan Lawson Crouse, a research associate at the University of New Brunswick who was not involved in the meta-analysis. For example, the earlier studies focused on limited populations in defined locations, Crouse says, even though the chemical makeup and carcinogenicity of air pollution varies from place to place depending on the nature of local sources. Moreover, Andersen



After pooling data from 15 cohorts, researchers found an association between exposure to NO_x, a traffic-related pollutant, and increased risk of breast cancer in postmenopausal women. Mounting evidence suggests that a woman's teenage years may be a critical window of exposure to air pollution with respect to later risk of breast cancer. Image: © aldomurillo/iStockphoto.

adds, because researchers tend to model air pollution exposures in different ways, it can be difficult to combine disparate data sets to generate stronger conclusions.

Robert Hiatt, a professor in the Department of Epidemiology and Biostatistics at the University of California, San Francisco, applauds the study's size and meta-analytical framework. He adds, "While the results are not hugely strong in terms of risk, they are significant for NO_x, which is worth paying attention to." Hiatt was not involved with the current meta-analysis.

Andersen acknowledges that the study has some limitations, especially the fact that it did not account for exposures at younger ages. Mounting evidence, Andersen says, suggests that teenage girls are especially vulnerable to pollution effects that might contribute to breast cancer later in life. "What we really need now are studies with early exposure," she says. "We might find that's when air pollution exposures matter most."

Charles W. Schmidt, MS, an award-winning science writer from Portland, Maine, writes for *Scientific American*, *Science*, various *Nature* publications, and many other magazines, research journals, and websites.

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