

Air pollution may increase mortality risk after heart transplant

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Heart transplant recipients who live in areas where particulate matter (PM_{2.5}) air pollution levels reached above national limits for clean air had a 26% higher risk of mortality due to infection, according to a study

published today in the *Journal of the American College of Cardiology*.

More than 2,000 heart transplantations are performed in the United States annually. Despite medical advancements, post-transplantation mortality remains high, reaching 50% by 11 years post-surgery. Air pollution has been linked to heightened cardiovascular mortality for patients with heart disease or a history of heart failure. Heart transplant recipients represent a particularly vulnerable population to [air pollution exposure](#).

The study included data from a total of 21,800 patients from the United Network for Organ Sharing/Organ Procurement and Transplantation Network (UNOS/OPTN). All adults over age 18 who underwent heart transplantation between 2004 and 2015 were included. The patients were average age of 52, where 75% were male, 69% white and 39% had heart failure due to prior ischemic heart disease. The study authors analyzed the patients' residential ZIP codes to determine [air pollution exposure](#) levels based on location.

The study authors compared the PM_{2.5} levels in the air (commonly produced from [power plants](#), motor vehicles or airplanes) of each patient's ZIP code against the U.S. National Ambient Air Quality Standards applied to outdoor air throughout the country. Approximately 21.9% of [heart](#) transplant recipients were living in areas where PM_{2.5} levels exceeded NAAQS limits for [clean air](#). ZIP codes that had higher air pollution had larger populations, higher percentages of minorities, a larger number of households and higher unemployment rates.

Heart transplant recipients who had long-term exposure to air pollution over several years had a 26% heightened risk for mortality due to infection for every 10 µg/m³ increase in PM_{2.5} levels. After a follow-up of 4.8 years, 23.9% of patients died. The association between air pollution and mortality was consistent across all examined subgroups.

"Given the fact that organ transplantation adds a tremendous cost to society, we had an interest in understanding if previously unknown environmental detriments adversely affected the outcomes of these patients," said Sanjay Rajagopalan, MD, professor of medicine at Case Western Reserve University School of Medicine and the study's senior author. "Long-term exposure to air pollution appears to pose amplified risks for [heart transplant recipients](#). We found an association between PM_{2.5} and mortality in these transplant patients."

Heart transplant recipients are vulnerable to infections due to immunosuppression caused by organ transplantation. The study authors found that air pollution exposure resulted in inflammatory responses and increases in [blood pressure](#) and insulin resistance, as well as a weakened immune system.

"This study makes an important contribution to our understanding of the health effects of air pollution," said C. Arden Pope III, Ph.D., professor of economics at Brigham Young University, in an accompanying editorial comment. "It used a straightforward approach to evaluate health effects of air pollution in a unique cohort of individuals in a vulnerable health state. It provides intriguing evidence that exposure to air pollution substantially contributes to mortality risk in cardiac transplant patients."

This study has several limitations. As a retrospective study, the authors could not ascertain quality of data in all patients, as well as the possibility of exposure misclassification, and an inability to adjust for the impact of variables that associate strongly with both air [pollution](#) exposure and outcomes, especially concerning race. However, the study authors support the need for further studies of this population.

More information: *Journal of the American College of Cardiology* (2019). [DOI: 10.1016/j.jacc.2019.09.066](https://doi.org/10.1016/j.jacc.2019.09.066)

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