

Mexico City air pollution adversely affects the hearts of young people

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A post-mortem study of the hearts of 21 young people in Mexico City has found that the heart begins to show the adverse effects of air pollution at a young age and that tiny bits of inactivated bacteria that hitch a ride on pollutants may make the problem worse.

The study is part of a growing body of research showing that [air pollution](#) can damage the heart and lead to increased risk of heart disease and heart attacks. But this study contrasted two different areas of the same city, showing that different types of pollutants can produce different effects.

Rodolfo Villarreal, Juan Palacios, Keith Parker and Lilian Calderon carried out the study, "Gene inflammatory expression profiling in right versus left ventricles in young urbanites: What is the long-term impact of myocardial inflammation in the setting of air pollution?" They will present their findings in a poster session on Wednesday, April 28 at the Experimental Biology 2010 conference to take place April 24-28 in Anaheim, Calif. The researchers are from the University of Montana (Palacios, Parker, Calderon), the Instituto Nacional de Pediatria in Mexico City (Calderon) and the Big Sky High School in Missoula, Montana (Villarreal). The American Society for Investigative Pathology is sponsoring the poster presentation.

Particulate matter more dangerous

The researchers examined the hearts of 21 young adults, average age 18, who had lived in Mexico City before dying in accidents. Mexico City has some of the worst air pollution in North America and has high concentrations of microscopic pollutants, known as [particle pollution](#), or particulate matter. Particulate matter that is less than 2.5 micrometers wide - the kind of particle pollutants that are found in smoke and haze - are more likely to gain entrance to the body than larger particles, which can be filtered out in the nose. Once inside, the particles can travel to various parts of the body, including to the heart, where they can cause damage or disease.

Endotoxins are bits of dead bacteria that can gain entrance to the body by attaching to particulate matter. The bacteria are from a variety of sources, including feces and soil. The bacterial bits that hitchhike on particulate matter are remnants of the bacterial cell wall and are composed of lipopolysaccharides.

The body reacts to the particulate matter and endotoxins by mounting an inflammatory response, which is the body's attempt to remove foreign invaders. Because the pollution is chronic, this can lead to chronic inflammation in the affected organs, such as the heart.

Air monitoring in metropolitan Mexico City has shown that pollution characteristics differ between north Mexico City and south Mexico City. Residents in the south side are exposed to higher levels of endotoxins than residents of north Mexico City. The research team's previous research found that mice exposed to air from south Mexico City had higher levels of inflammation in the heart muscle than mice exposed to north Mexico City air. They hypothesized that the difference could be linked to the difference in endotoxin levels.

Does air pollution inflame the human heart?

The researchers wanted to see if the residents of north and south Mexico City were also affected differently, as the mice had been. They studied heart samples of young people who had died in accidents - six from south Mexico City and 15 from north Mexico City. Their average age at the time of death was 18 years, with most falling in the range of 13 to 23 years.

The study found that residents of both north and south Mexico City showed signs of inflammation in the heart. But residents in the south had a stronger inflammatory response, as shown by elevated levels of:

- IL-1 β
- TNF- α
- CD14

IL-1 β and TNF- α have been implicated in heart disease and sepsis and are believed to play a role in the death of heart muscle cells.

The study also found differences in how the left and right ventricles responded to the pollution for both groups. But south Mexico City residents had higher levels of TNF- α for both the right and left ventricles compared to northern subjects. In addition, IL-1 β and CD14 targeted the right ventricle significantly more in the southern subjects.

The south residents also had significantly more IL-10 in both ventricles compared to the north residents. This makes sense, because the body uses IL-10 to slow down the inflammatory response once it has started and the [inflammatory response](#) was more intense in those from the south.

New understanding of air pollution and heart

The researchers concluded that:

- polluted air can create inflammation, even in the hearts of young individuals
- the right ventricle responds differently than the left
- endotoxins play a role in the inflammation

It is not clear why the right and left ventricles are affected differently, but it may be related to the difference between the ventricles. Cardiac chambers differ in their functions and consequently exhibit differences in their form. For example, the [left ventricle](#), having to pump oxygenated blood to the body, has more tiny blood vessels, called capillaries. The right ventricle pumps deoxygenated blood to the lungs and does not have to pump as vigorously in comparison to its counterpart. These differences might contribute to the sharp differences in inflammation between ventricles in these highly exposed people.

The researchers note that this inflammation to the heart does not appear to create any immediate harm.

"However, as people age, this chronic inflammation may become a factor in heart disease," said Villarreal. "The bottom line is, the air we breathe affects our [heart](#) health. The more research is conducted in this field, the more it is becoming clear we need to address the issue of air quality and its intricate ties to our health."

Provided by Federation of American Societies for Experimental Biology

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