

Research explores air pollution, built environment and early cardiovascular disease

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Early exposure to polluted air, including in the womb, can have early and lasting effects on heart health. So reports a new University at Albany led study that surveyed the landscape of research on air pollution, the built

environment and cardiovascular health indicators, with a particular eye to risk factors associated with early-stage heart disease and related conditions.

The review, recently published in the journal *Circulation Research*, draws special attention to the ways that aspects of the built environment and early exposure to air pollution can cause early symptom onset, rapid symptom progression and/or elevated risk of developing cardiovascular disease later in life.

"We have long known that breathing polluted air and living in areas with unfavorable built environment features are harmful to our health," said lead author Kai Zhang, Empire Innovation associate professor at UAlbany's School of Public Health (SPH).

"Yet, many studies in this area have tended to focus on individuals with existing cardiovascular diseases and risk factors that are specific to them. Since we know that numerous social and environmental factors operate together in ways that harm the cardiovascular system, it is important that we take a holistic view of these factors that influence early-stage cardiovascular diseases."

Anatomy of air pollution

When air pollution enters the lungs—whether from regional sources like industry and fossil fuel-fired power plants or local sources like traffic and household pollutants—it can cause local inflammation and oxidative stress. Beyond the lungs, inhaled pollutants can spread to the brain, where they can disrupt hormonal processes including those that regulate [heart rate](#), blood pressure, respiration and digestion—all of which play a role in metabolic health.

"The ubiquity of polluted air is part of what makes it such a dangerous

public health risk," Zhang said. "Serious health effects often develop over time with prolonged exposure that might date back to pregnancy. And the reality is, in many parts of the world, people are constantly breathing polluted air throughout most of their life. This is an insidious problem, with complications that build over the life course."

Prolonged exposure to air pollution has been linked to kidney disease, [abnormal heart rhythms](#) and hardened arteries—a condition wherein plaques accumulate in the veins, raising blood pressure while forming blockages that could lead to heart attack or stroke.

Air pollution exposure has also been linked to [high cholesterol](#) and cardiometabolic disorders such as diabetes and metabolic syndrome, which can lead to the development of overweight/obesity. All of these conditions contribute to cardiovascular disease.

The study underscores that while the duration of exposure is medically important, poor health effects are not only experienced in middle age or later.

"Children are at especially high risk of experiencing the ill effects of air pollution because their baseline respiratory rates are higher than adults, plus they tend to spend more time being active outdoors," said Zhang.

"Children are also more prone to mouth breathing, which draws pollutants deeper into their lungs. This means that their smaller, developing systems are receiving higher amounts of harmful pollutants.

"In multiple studies of children and adolescents, exposure to air pollution has been strongly linked to elevated [blood pressure](#) and diabetes. Studies have also found that the children of mothers who were exposed to polluted air during pregnancy are at higher risk of experiencing hyperlipidemia, hypertension and obesity early in life, with faster symptom progression."

Environment shapes risk

Many aspects of the built environment, as well as our social interactions and other behaviors, all contribute to cardiovascular health.

Understanding the combined effects of these factors on early-stage cardiovascular diseases is critical to improving cardiovascular health globally.

"For example, in urban neighborhoods located adjacent to industrial polluters, accessible green space is often scarce, which could limit opportunities for safe recreation," Zhang said. "Persistent exposure to [poor air quality](#) and low physical activity are harmful individually, and together, their effects compound. In this study, we brought together research that has examined factors like these to identify patterns and identify research gaps."

The study authors identified four primary categories of factors that influence [heart health](#). These included:

- Social determinants of health such as neighborhood features, facilities in the surrounding environment like recreational opportunities, access to health care, [economic stability](#), education and social and community context;
- Environmental exposures such as relative levels of air pollution, built environment and green space;
- Behaviors and lifestyle factors including sleep quality, physical activity, smoking and drinking; and
- Psychological factors that include things like social interactions, stress, anxiety and depression.

"As urban dwellers navigate their lives, they encounter multiple environmental exposures, such as [air pollution](#), built environments and

green space scarcity, which can all contribute to the onset of early [cardiovascular disease](#) and associated risk factors," Zhang said.

"While select [environmental factors](#) have undergone scrutiny through [epidemiological studies](#), the broader relationship between the environment and early-stage cardiovascular diseases remains inadequately defined.

"In this review, we offer a concise synthesis of studies investigating multifaceted environmental influences, encompassing the built physical environment. We deliberate upon current challenges in this field and propose promising avenues for future research. Moreover, we shed light on the clinical implications stemming from these findings and advocate for multilevel interventions aimed at promoting cardiovascular well-being among children and young adults."

Provided by University at Albany

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