



New Research on the Risk of Breathing Polluted Air from Freeways and High Traffic Areas

Doug Brugge, University of Connecticut

What people cannot see can be very harmful. In 2012, a report on the Global Burden of Disease found that pollution from dangerous tiny particles and droplets in the air – what scientists call “fine particulate matter” – is among the leading causes of death and severe disability. According to estimates in this report, over 3.2 million deaths per year may be attributable to people breathing dangerous particles in their general environment, and another 3.6 million deaths happen because of polluted air attributed to burning solid fuels for heating or cooking in developing countries. To put the danger in perspective: the total deaths from particulate air pollution are greater than 6.3 million deaths each year from tobacco use.

The bad health news about dangerous particles in the air is not confined to fine particulate matter which is spread broadly across metropolitan regions, however. I direct a study called the Community Assessment of Freeway Exposure and Health that looks at air pollution from even tinier particles – “ultrafine particles” – that are concentrated next to freeways and other places with a lot of motor vehicle traffic. Pockets of this kind of invisible, odorless and often overlooked air pollution may be especially dangerous for people to live and work next to busy highways. My research group is developing innovative ways to assess the hazard and protect people from exposure to health risks.

Health Dangers from Particles in the Air

Many people suppose that respiratory diseases are the main risk from breathing in polluted air, but in fact the major health risks are from cardiovascular diseases. Breathing in fine particles from vehicle emissions, power plants, or burning fuels causes inflammation that spreads throughout the body in the blood, contributing to hardening of the arteries and increased risks for heart attacks and strokes.

Most research on particle pollution in the air has so far focused on fine particles in the surrounding air. This kind of pollution is not spread evenly around the world. Very high pollution levels in China and India, for example, result in approximately two million deaths a year from exposure to fine particles. But even in countries like the United States, where pollution levels have been regulated for decades and skies are usually relatively clear, there is still a surprisingly high level of deaths from breathing dangerous fine particles. Estimates vary, but somewhere between 100,000 and 200,000 deaths per year are attributable to dangerous fine particles spewed into the air, primarily from power plants and motor vehicles.

Measurements of the health effects of ultrafine particles are less well developed – and that is what my research colleagues and I are tackling. Conventional fine particle air pollution tends to be spread evenly over wide areas – such as whole cities – but ultrafine particle pollution can be high in small, local areas, next to a highway or major roadway, for example. Pollution concentrations can move around and go up and down rapidly. Researchers have not looked as much at ultrafine particle air pollution in part because the fast-
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changing levels make it hard to pin down exactly how much people are exposed to.

Researchers often do tests on animals to see how dangerous various kinds of pollution might be for people, and ultrafine particles in the air turn out to be more toxic in animal studies than similar concentrations of fine particles. Investigations looking at people have found that when ultrafine particle pollution levels go up and down, measures of health problems also rise and fall in the weeks that follow. Particularly worrisome, people who live very close to heavy traffic and get exposed to high levels of ultrafine particle pollution also have more health problems, including heart and vascular problems, according to available studies. Air monitoring has repeatedly shown ultrafine particles are elevated next to highways and major roadways, but researchers are still working to fully connect the dots between ultrafine exposure and its health effects in people.

In the Community Assessment of Freeway Exposure and Health study, my colleagues and I are measuring exposure to ultrafine particles in the air for people living at various distances from a highway and testing for health risks. Our full findings are not yet ready to report, but we have published some early papers that demonstrate both elevated ultrafine particle levels and higher disease risks for people who live closer to highways. We expect to be able to give more precise estimates of degrees of exposure and health risks in the near future.

Addressing the Highway Air Pollution Problem

Over the past half century, air in many parts of the United States has gone from sometimes looking cloudy and soot-filled, much like the air over much of China today, to clearer skies. Over many decades, America figured out how to reduce emissions of fine particulate matter from smoke stacks and tail pipes, phasing in increasingly effective pollution-reducing technologies. But we are at earlier stages in developing awareness of the measurable dangers from ultrafine particle pollution – and finding solutions to reduce those dangers.

My research group is actively looking for workable solutions – such as installing various forms of air filtration as a possible way to protect people who live or work next to highways or heavy traffic. Early experiments on public housing units near highways have not achieved the reductions we hoped for, but we are continuing to test ideas. In addition, we are working with municipal agencies, regional planners and design experts to draft local ordinances that might be protective. So far, only California has ordinances that restrict the building of schools next to freeways, and many places might need such rules for parks, public plazas, and other community institutions as well.

The bottom line is that particulate matter in the air – including very tiny and invisible particles in air near highways – is the most important and dangerous environmental health threat. Yet the dangers are insufficiently recognized by the public and policy makers. Better evidence can educate the public and inspire new efforts to tackle serious health risks. We already know that risks from ultrafine air pollution near highways are serious – and they may turn out to be even more worrisome than we know so far. Research can help communities prepare to take action.

This brief draws upon data and research that can be found at the [Community Assessment of Freeway Exposure and Health study's site](#).