Increased air pollution linked to bad teenage behavior

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Credit: Peter Griffin/public domain

A new study linking higher levels of air pollution to increased teenage delinquency is a reminder of the importance of clean air and the need for more foliage in urban spaces, a Keck School of Medicine of USC researcher said.

Tiny pollution particles called particulate matter 2.5 (PM2.5)—30 times smaller than a strand of hair—are extremely harmful to your health, according to Diana Younan, lead author of the study.

"These tiny, toxic particles creep into your body, affecting your lungs and your heart," said Younan, a preventive medicine research associate at the Keck School of Medicine. "Studies are beginning to show exposure to various air pollutants also causes inflammation in the brain. PM2.5 is particularly harmful to developing brains because it can damage brain structure and neural networks and, as our study suggests, influence adolescent behaviors."

The study, published on Dec. 13 in the *Journal of Abnormal Psychology*, suggests that ambient air pollution may increase delinquent behavior among 9- to 18-year-olds in urban neighborhoods in Greater Los Angeles. The insidious effects are compounded by poor parent-child relationships and parental mental and social distress, researchers said.

"Previous studies by others have shown that early exposure to lead disrupts brain development and increases aggressive behavior and juvenile delinquency," Younan said. "It's possible that growing up in places with unhealthy levels of small particles outdoors may have similar negative behavioral outcomes, though more research is needed to confirm this. Both lead and PM2.5 are environmental factors that we can clean up through a concerted intervention effort and policy change."

More than just a lung and heart concern

The study followed 682 children in Greater Los Angeles for nine years starting when they were 9. Parents completed a child-behavior checklist every few years and noted if their child had engaged in 13 rule-breaking behaviors, including lying and cheating, truancy, stealing, vandalism, arson, or substance abuse. Up to four assessments were recorded per

participant.

Researchers used 25 air quality monitors to measure daily air pollution in Southern California from 2000 to 2014. They computed each participant's residential address and used mathematical modeling to estimate the ambient PM2.5 levels outside each home. About 75 percent of the participants breathed ambient air pollution that exceeded the federal recommended levels of 12 micrograms per cubic meter. Some areas had nearly double the recommended amount of these particles.

"It is widely recognized that ambient air pollution is detrimental to the respiratory and cardiovascular health of young and old alike. But in recent years, scientists have come to acknowledge the negative impact of air pollution on human brains and behaviors," said Jiu-Chiuan Chen, an associate professor of preventive medicine at the Keck School of Medicine and senior author of the study.

Environmental scientists and economists have speculated that elevated air pollution levels could increase criminal activities in communities. Interestingly, data show that both ambient PM2.5 concentration and crime rates in Southern California have been on the decline, the study stated. Future studies need to examine whether that is mere coincidence or if tightened air regulation might have contributed to the declining crime rates in many metropolitan areas, the researchers said.

"Poor people, unfortunately, are more likely to live in urban areas in less than ideal neighborhoods," Younan said. "Many affordable housing developments are built near freeways. Living so close to freeways causes health problems such as asthma and, perhaps, alters teenagers' brain structures so that they are more likely to engage in delinquent behavior."

This one-two hit may increase teenage delinquency

The study identified higher air pollution estimates near freeways and in neighborhoods with limited greenspace or foliage.

Researchers noticed more delinquent behavior from boys, African-Americans, adolescents from lower socioeconomic backgrounds and people who lived in downtrodden neighborhoods with limited greenspace when compared to their counterparts.

The bad behaviors associated with increased outdoor air pollution levels were magnified when children did not have good relationships with their parents, lived with depressed mothers or grew up in homes with higher levels of parental stress.

"If you live in an area with high air pollution, like near a freeway or in a neighborhood with little greenery, try to avoid being outside so much and keep windows closed as much as possible when the ambient PM2.5 levels are high," Younan said. "Try to compensate for air pollution by having a good indoor environment and healthy family dynamics.

"A bad parent-child relationship causes a stressful family environment, and if this goes on for too long, the teenager could be in a chronic state of stress. This could wreak havoc on the body, making teens more vulnerable to the effects of exposure to small particles. Many scientists suspect PM2.5 causes inflammation in the brain or somehow travels directly into the brain and messes with neural network connections, resulting in the observed bad behaviors."

The data was adjusted for gender, ethnicity, socioeconomic status, neighborhood socioeconomic characteristics and neighborhood quality.

More foliage and cleaner air needed

Younan and her colleagues at the USC Environmental Health Sciences

Center have collaborated with researchers and engineers from different disciplines at USC for more than two decades to investigate the insidious effects of air pollution. They found that air pollution increases obesity, that teenagers in urban communities with less foliage (such as parks) tend to be more aggressive and that older women living in areas with PM2.5 levels exceeding the U.S. Environmental Protection Agency's standard had nearly double the risk for dementia when compared to their counterparts.

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