

Researchers discover links between city walkability and air pollution exposure

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A new study compares neighborhoods' walkability (degree of ease for walking) with local levels of air pollution and finds that some neighborhoods might be good for walking, but have poor air quality. Researchers involved in the study include University of Minnesota faculty member Julian Marshall and University of British Columbia faculty Michael Brauer and Lawrence Frank.

The findings highlight the need for urban design to consider both walkability and [air pollution](#), recognizing that neighborhoods with high levels of one pollutant may have low levels of another pollutant.

The study, done for the city of Vancouver, British Columbia, is the first of its kind to compare the two environmental attributes, and suggests potential environmental health effects of neighborhood location, layout and design for cities around the globe.

The research study is published in the November 2009 issue of *Environmental Health Perspectives*, the peer-reviewed journal of the United States' National Institute of Environmental Health Sciences, part of the U.S. Department of Health and Human Services.

The research team found that, on average, neighborhoods downtown are more walkable and have high levels of some pollutants, while suburban locations are less walkable and have high levels of different pollutants. Neighborhoods that fare well for pollution and walkability tend to be a few miles away from the downtown area. These "win-win" urban

residential neighborhoods--which avoid the downtown and the suburban air pollution plus exhibit good walkability--are rare, containing only about two percent of the population studied. Census data indicate that these neighborhoods are relatively high-income, suggesting that they are desirable places to live. Neighborhoods that fare poorly for both pollution and walkability tend to be in the suburbs and are generally middle-income.

"Research has shown that exposure to air pollution adversely affects human health by triggering or exacerbating a number of health issues such as asthma and heart disease," said Marshall, a civil engineering faculty member in the University of Minnesota's Institute of Technology. "Likewise, physical inactivity is linked to an array of negative health effects including heart disease and diabetes. Neighborhood design can influence air pollution and walkability; more walkable neighborhoods may encourage higher daily activity levels."

In the study, researchers evaluated concentrations of nitric oxide, a marker of motor vehicle exhaust, and ozone, a pollutant formed when vehicle exhaust and other pollutants react, for 49,702 postal codes (89 percent of all postal codes) in Vancouver. The researchers assigned a walkability score by analyzing four common attributes of neighborhood design: land-use mixing, intersection density, population density and for retail areas, the relative amount of land area for shopping versus for parking.

More walkable neighborhoods tend to have mixed land uses, with destinations such as stores and shops within walking distance of people's houses. A conventional street grid and other more walkable road networks tend to have a higher intersection density, while less walkable neighborhoods often have circuitous road networks and low intersection density, thereby increasing average travel distances and reducing the likelihood that people will walk. More walkable areas generally have

higher population density. Finally, in less walkable areas, stores devote a greater fraction of their land to parking.

"The finding that nitric oxide concentrations are highest downtown, while ozone concentrations are highest in the suburbs, is not surprising," said Marshall. "Motor vehicle exhaust is most concentrated downtown, leading to the high nitric oxide concentrations downtown. In contrast, ozone takes time to form. Air masses have moved away from downtown--often, to suburban areas--by the time ozone concentrations reach their highest levels. Thus, reductions in vehicle emissions can benefit people who live near high-traffic areas and also people living in less dense areas."

Creating neighborhoods that are more walkable and that allow for alternative travel modes such as walking, biking or public transportation is one approach to reducing motor vehicle emissions, the study suggests. Another approach is reducing emissions per vehicle, for example through mandated emission standards. The research did not study conditions for individual people, but points out that high-rise buildings may allow people to live in walkable neighborhoods while being somewhat removed from street-level vehicle emissions.

The study's new findings indicate that neighborhood design is an important consideration for improving pollution levels and providing opportunities for daily physical activity. The study identified neighborhoods that are walkable yet have low levels of pollution, but those neighborhoods encompass a very small percentage of the population. Researchers hope that future investigation of those "win-win" [neighborhoods](#) will suggest urban design features that could usefully be applied elsewhere.

In the future, the researchers hope to investigate changes over time in pollution and walkability, and also study other urban areas to see how

spatial patterns may differ elsewhere.

More information: [Environmental Health Perspectives](http://www.ehponline.org/members/2009...0900595/0900595.html) --
[www.ehponline.org/members/2009 ... 0900595/0900595.html](http://www.ehponline.org/members/2009...0900595/0900595.html)

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