



Research: The Effects of Environmental Air Pollutants in the Progression of Cardiovascular Disease

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Disease/Condition: Cardiovascular Disease

Cardiovascular disease (CVD) is the leading cause of death in the United States with atherosclerosis (artery disease or fatty plaque build-up in the walls of the arteries) contributing to approximately half, and stroke one-third, of all cardiovascular-related deaths. Several epidemiological studies have reported a causative relationship between environmental air pollution and increased rates of cardiovascular morbidity and mortality; however, the underlying mechanisms of CVD progression are unknown. Lovelace Respiratory Research Institute is currently using state-of-the-art exposure systems to mimic human inhalational exposures to common environmental air pollutants (such as vehicle emissions) in an effort to determine what is happening at the tissue and cellular level that results in air pollution causing and/or worsening CVD.

Using animal models of atherosclerosis, we have determined that key vascular factors that are known to be associated with increased occurrence of heart attack and strokes in humans are significantly upregulated through exposure to vehicular engine emissions. These factors include oxidized low density lipoprotein (cholesterol), matrix metalloproteinase-9 or proteins that degrade or destroy components of our tissues, endothelin, and proteins that constrict blood vessels and raise blood pressure. Recent study findings, supported by a National Institute of Environmental Health Sciences (NIEHS) award, suggest that the effects of these factors in contributing to a cardiovascular event are mediated, in part, through the lectin-like oxLDL receptor (LOX-1) in the blood vessels. Additionally, in conjunction with the Human Studies Division at the Environmental Protection Agency, we have also found the soluble form of LOX-1, a cholesterol receptor in the arteries that is released and circulates through the blood, is increased in human plasma samples after a short-term exposure to vehicle emissions. Thus, this receptor may serve as a novel target for drug therapies to prevent the increased occurrence of heart attack or stroke on days of high pollution. These study findings were submitted for publication to *Circulation Research* in April 2010.