



The Health Consequences of Air Pollution

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Pollution and the Cardiovascular System

***The signature physiologic consequence of air pollution is the same as cigarette smoke: a low grade arterial inflammation, arteriolar narrowing, and vascular prothrombotic changes. As with cigarette smoke the effect can be almost immediate and chronic exposure to even low concentrations of pollution are associated with an acceleration of atherosclerosis and significant arteriolar narrowing and stiffness. Breathing more ozone in childhood increases arterial wall thickness in young adults**

***Simultaneously high concentrations of multiple pollutants have a synergistic effect on hospitalizations for cardiac disease.**

***Air pollution causes average blood pressure to increase within minutes. All organs are affected. Blood pressure rises are found in even in children.**

***Air pollution can alter electrical signaling within the heart. Rates of arrhythmias, heart attacks and strokes increase with air pollution and are the primary cause for increased community mortality rates. Those rates increase within hours after exposure and stay elevated for as long as 30 days after the exposure has ended.**

***In patients who suffer from heart failure, air pollution reduces cardiac function**

***Particulate pollution concentrations typical of the Wasatch Front increase mortality rates about 10% according to the formula recommended by the American Heart Association published in May, 2010. A subsequent study suggests that number should be 14%. That means between 1,000 and 2,000 Utahns die prematurely every year due to our air pollution. Approximately 210,000 premature deaths occur annually in the US from combustion emissions. The average pollution related premature death represents about ten years of lost life.**

***Particulate pollution from coal and diesel combustion are likely much more potent in triggering heart and vascular disease than most other sources.**

***Mortality plotted against air pollution concentrations shows no safe threshold, even at low levels, well below EPA national ambient air quality standards (NAAQS). Furthermore this curve is not linear. The steepest part of the curve is at low doses, i.e. small air pollution reductions have even greater public health benefit when the concentrations are already**

low. Even at what are considered ‘background’ levels of particulate pollution there are increased risks for cardiopulmonary mortality compared to clean, filtered air.

***Air pollution impairs exercise capability, even in the very fittest of individuals. Even in young, healthy adults air pollution increases biomarkers of inflammation and thrombosis and increases blood pressure and heart rate.**

***Air pollution shortens life expectancy and accelerates the aging process. The residents of the average American city lose 1-3 years of life expectancy, in Northern China residents lose 5.5 years.**

***The increase in mortality risk persists for decades after exposure.**

***There are very likely genetic differences in human susceptibility to the arterial inflammation provoked by air pollution**

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Pollution and the Brain

- * The systemic inflammation caused by air pollution also affects the brain**
- * Air pollution components reach the brain and can penetrate deeply into the parenchyma.**
- * Many of the compounds adsorbed to particulate matter are neurotoxic.**
- * Air pollution causes CNS oxidative stress, neuroinflammation, neuronal damage, neuronal loss, loss of brain mass, cortical stress measured by EEG, enhancement of Alzheimer type-abnormal filamentous proteins, BBB changes, and cerebrovascular damage. Many of these changes can be found in children and young adults.**
- * Greater air pollution exposure is associated with lower intelligence, poorer motor function, attention deficits and behavioral problems in children, decreased cognition and accelerated dementia in adults, higher rates of strokes,**

multiple sclerosis, autism, impaired olfactory sense, Parkinson's, and other neurodegenerative diseases, depression, anxiety, and suicide

*** Prenatal exposure to air pollution is particularly harmful to fetal brain development, even causing loss of white matter involving the left hemisphere which results in impaired cognition and behavioral disorders in childhood.**

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Pollution and Chromosomal/Fetal Development

- *Babies are essentially born pre-polluted by the air breathed by the mother during pregnancy. Particulate matter and the chemicals attached to them can cross the placenta and interfere with fetal development**
- * Pregnant women exposed to more air pollution give birth to babies with significantly more chromosomal aberrations including shorter telomeres and epigenetic changes which can be passed on to multiple subsequent generations.**
- * Exposure even to brief episodes of pollution at critical stages in the development of the human embryo can cause a person to experience an increased likelihood of multiple chronic diseases including those of the heart, lungs, immune system and brain and even obesity, diabetes, cancer and shortened life expectancy.**
- * Air pollution breathed by a pregnant mother causes epigenetic changes in the womb, which is associated with higher rates of asthma and decreased lung function in those children 5 years later.**
- * Exposure to intermittent air pollution is associated with sperm DNA damage and consequent increase in the rates of male infertility, miscarriages and other adverse reproductive outcomes.**
- * Children living near petrochemical industries are exposed to high PAH levels, contributing to DNA damage. Industrial pollution is even more genotoxic than traffic pollution.**

***Regarding birth weights and poor neurologic outcomes, males are generally more affected by prenatal air pollution than females.**

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Epigenetics and environmental chemicals

Baccarelli, Andrea; Bollati, Valentina

[http://www.newsweek.com/2010/10/30/how-your-experiences-change-your-sperm-and-](http://www.newsweek.com/2010/10/30/how-your-experiences-change-your-sperm-and-eggs.html)

[eggs.html](http://www.newsweek.com/2010/10/30/how-your-experiences-change-your-sperm-and-eggs.html)

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Pollution and the Lung

*** Air pollution permanently inhibits lung growth in children. In fact prenatal exposure can reduce fetal lung development, impairing lung function in childhood.**

*** Brief exposure to ozone and particulate matter reduce lung function even in young healthy adults and the reduction can last for a week after the pollution exposure is over.**

*** Air pollution causes lung cancer.**

- * Long term ozone exposure causes an increase in overall mortality in addition to that from particulate matter. Most of the mortality is respiratory.**
- * Air pollution exacerbates virtually all pulmonary diseases and likely plays a causative role in reactive airways disease.**
- * Air pollution is associated with increased rates of hospitalization and death from respiratory diseases from neonates to the elderly**
- * The correlation between the above health outcomes and ozone are still found at concentrations between one half and one third the current EPA NAAQS**
- *Early life exposure to pesticides is associated with decreased lung function**

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Pollution and Birth Outcomes

*** Air pollution causes morphologic changes in the placenta, and disrupts the vasculature in the umbilical cord, inhibiting blood transfer to the fetus**

*** Pregnant women exposed to more air pollution have multiple adverse pregnancy outcomes including higher blood pressure, higher rates of pre- eclampsia, intrauterine growth retardation, premature births, premature rupture of membranes, low birth wt. syndrome, still births, gestational diabetes, and neonates with smaller head circumference.**

***Air pollution is associated with higher rates of birth defects including neural tube and cardiac birth defects.**

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Air Pollution and Cancer

***Air pollution is associated with higher rates of breast, lung, prostate, cervical, brain, nasal, pharyngeal, liver and stomach cancer, and childhood leukemia. Pre-natal pollution exposure is associated with increased rates of multiple childhood cancers. Air pollution is associated with decreased survival in breast cancer patients. The World Health Organization has declared air pollution the most important environmental cause of cancer, more important than second hand cigarette smoke. The WHO placed it in the same category as asbestos and ionizing radiation**

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Air Pollution and Metabolic Disorders

*** More exposure to air pollution decreases insulin sensitivity, glucose tolerance, increases rates of Type I and Type II diabetes, and promotes obesity and metabolic syndrome.**

***Prenatal exposure has a particularly strong association with childhood obesity.**

***Good cholesterol (HDL) is decreased, and bad cholesterol (LDL) is increased with more air pollution**

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Miscellaneous Health Consequences

*** Immune suppression, inflammatory bowel disease, bacterial and viral infections, lupus, juvenile arthritis, infant mortality, sleep apnea, obesity and suicide are elevated in populations exposed to more air pollution.**

***Air pollution can induce liver toxicity, accelerate liver inflammation and steatosis.**

***Air pollution causes systemic oxidative stress, triggers the inflammatory chemical cascade, endothelial cell death, cytotoxicity, macrophage infiltration, and increases lipid deposition. Particulate matter penetrates intracellular structures.**

*** Air pollution accelerates the aging process and shortens the lengths of telomeres even in newborns.**

***Air pollution increases infant mortality and SIDS**

*** Wood smoke is uniquely toxic, the most toxic type of air pollution that most people are ever exposed to.**

***Even short term air pollution decreases fertility**

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