Air Pollution in Urban Areas

Kerisha Martin, RN, AAS

Comprehensive Client Care for Urban Health Issues

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Professor Margaret Rafferty, DNP, MPH, RN, PMHCNS-BC

**Introduction**

Air pollution is a serious public health concern. It has become a global challenge due to the vast number of people affected on a daily basis, and because of its adverse effects on general health and wellbeing. Whenever we breathe, we risk inhaling dangerous chemicals that have found their way into the air that may, in the long term, jeopardize our health. According to Mead, 2008, “Air pollution is composed of many environmental factors, such as carbon monoxide, nitrates, sulfur dioxide, ozone, lead, second hand tobacco smoke, and particulate matter. Particulate matter (PM) means solid and liquid particles within the air. Particulate matter can be generated from vehicle emissions, tire fragmentation and road dust, power generation and industrial combustion, smelting and other metal processing, construction and demolition activities, residential wood burning, windblown soil, pollens, molds, forest fires, volcanic emissions and sea spray.” Most of these pollutants may be found in most urban areas, such as New York City (NYC), and these factors contribute to many health disparities, accounting for a high incidence in cardiovascular and respiratory diseases and mortality rates.

A report conducted by Ying Zhou, a research fellow at the Harvard School of Public Health, noted that “The combination of high population density and high traffic volume in urban areas such as New York City means that the health impact of traffic pollution can potentially be much larger than similar sources in less populated areas” (No authors listed, 2004). Many people flock to the city in search of employment and easy access to community resources such as better healthcare facilities and schools. However, based on research evidence, urban life may not be the healthiest of options, due to the high exposure from industry and traffic related air pollution. In fact, the article goes on to say that traffic pollutants in New York’s urban streets can be up to one thousand times higher than exposure of a similar amount of emissions in other urban settings.

**Racial and Health Disparities**

Koch, 2011, reported that more than two million people die each year from breathing in tiny particles present in air pollution, according to data from nearly 1,100 cities across 91 countries released by the World Health Organization (WHO). The [WHO, calling its compilation of public air quality data "unprecedented](http://www.who.int/mediacentre/news/releases/2011/air_pollution_20110926/en/index.html)," said these tiny particles, known as PM10 because they are ten millimeters or less, can penetrate the lungs, enter the bloodstream and cause heart disease, lung cancer, asthma and acute lower respiratory infections. The WHO recommends PM10 not exceed 20 micrograms per cubic meter as an annual average, but the data shows it has reached 121 micrograms in Beijing and exceeded 200 in several cities in India and Pakistan. The global average was 71.” According to Holmes, Lindsey, and Qiu (2009), particulate matter and ground-level ozone are the most commonly exceeded criteria pollutants, both of which have been linked to adverse health effects among physically active people.

Air pollution affects all residents of urban populations from pedestrians, cyclists, and day time office workers, to susceptible groups such as, the young, elderly, and immuno-compromised, especially children. “Compared to adults, children spend at least fifty percent more time outdoors” according to Ruangdej, Suwanwaiphatthana, and Tumer-Henson, (2010). Childhood is a critical growth period of lung growth and development, so due to their size and undeveloped body systems, children are more vulnerable to toxins, PM and other air pollutants. In effect, they spend more time outdoors, inhaling more toxins due to their faster breathing rates. Another important finding identified by Ruangdej, Suwanwaiphatthana, and Tumer-Henson, (2010), is that outdoor play and recreational activities expose children to air pollutants from sources such automobiles, power plants, industry and other combustion sources, which has been linked to respiratory illness exacerbation, infant mortality, the development of asthma, atopy and reduction in lung development in children. In addition, “The presence of pollutants in the outdoor air contributes to numerous health effects ranging from irritation and odor to acute and long term lung impairments, such as chronic bronchitis, asthma, chronic obstructive disease (COPD), lung cancer, and cardiovascular problems” (Ruangdej, Suwanwaiphatthana , and Turner-Henson, 2010).

Different types of pollutants are responsible for different health issues. Small particles (PM) in the air are more toxic because they are easily dissolved into the bloodstream and respiratory system as mentioned before. Several epidemiological studies, according to Ruangdej, Suwanwaiphatthana, and Tumer-Henson, (2010), indicated that exposure is associated with reduced lung function, asthma attacks, increased incidence of health provider visits for respiratory illness, and emergency department visits. Fine particulate matter has also been shown to be related to high incidence of cardiovascular hospitalizations and mortality in New York City. In a recent study conducted by Ito, Nadas, Mathes, Matte, Ross, and Thurston (2011), it was concluded that local combustion sources, including traffic and residential oil burning, may be important sources affecting cardiovascular disease adverse effects in NYC. Long term exposure to nitrogen dioxide may cause lung cancer, carbon monoxide from motor vehicle exhaust can lead to acute poisoning, lead exposure causes irreversible neurological damage while sulfur dioxide irritate the throat and lungs, aggravating symptoms of asthma and bronchitis. These are all the major air pollutants.

**Stakeholders**

The stake holders affecting or affected by air pollution include the citizens of urban areas as well

as their visitors. Residents include individuals, all racial and ethnic groups, adults, children, the

elderly and entire families. Patients who suffer from health problems related to air pollution are

stake holders as well. All members of the healthcare system including healthcare providers, such

as doctors, nurses, and members of the healthcare team in all healthcare institutions. These

encompass hospitals, rehab facilities and clinics. Insurance companies also play a part in caring

for those affected by this global problem in terms of funding their medical care.

**Healthy People**

One of the topics and objectives of Healthy People 2020 is the focus on environmental health. It states that a healthy environmental is essential to quality of life and life expectancy. The goal is to promote health for all through a healthy environment. “Globally, nearly 25 percent of all deaths and the total disease burden can be attributed to environmental factors. This includes exposure to hazardous substances in air, water, soil and food (Healthy People.gov, 2011). One of the themes under this topic is Outdoor Air Quality which again links poor air quality to premature death, cancer and long-term cardiovascular and respiratory disparities. Although progress has been made to reduce air pollution, the challenge still remains due to the large number of people that reside in urban areas, approximately 127 million of whom currently live in United States counties that exceeded national air quality standards. In addition, constant economic development such as construction of residential and commercial buildings, constant vehicle emissions and dispersing of harmful fumes into the atmosphere from factories and industrial activities, are all contributors to poor air quality within these areas.

**Model Programs**

The [Clean Air Act](http://www.epa.gov/air/caa/) provides the principal framework for national, state, tribal, and local efforts to protect air quality. It conducts periodic reviews of the National Ambient Air Quality Standards (NAAQS) for the six common pollutants that are considered harmful to public health and the environment. Under the Clean Air Act, EPA establishes primary air quality standards to protect public health, including the health of "sensitive" populations such as people with asthma, children, and older adults. EPA also sets secondary standards to protect public welfare. This includes protecting ecosystems, including plants and animals, from harm, as well as protecting against decreased visibility and damage to crops, vegetation, and buildings (U.S. Environmental Protection Agency, 2011). Improvements in air quality are the result of effective implementation of clean air laws and regulations, as well as efficient industrial technologies. Under the Clean Air Act, EPA has a number of responsibilities, including: conducting periodic reviews of the (NAAQS) for the six common pollutants that are considered harmful to public health and the environment. They ensure that these air quality standards are met (in cooperation with the state, tribal, and local governments) through national standards and strategies to control air pollutant emissions from vehicles, factories, and other sources. It aims at reducing emissions of pollutants that cause acid rain and air pollutants which can reduce visibility across large regional areas, including many of the nation's most treasured parks and wilderness areas. The program ensures that sources of toxic air pollutants that may cause cancer and other adverse human health and environmental effects are well controlled and that the risks to public health and the environment are substantially reduced. It limits the use of chemicals that damage the stratospheric ozone layer in order to prevent increased levels of harmful ultraviolet radiation. Also, EPA estimates nationwide emissions of ambient air pollutants and the pollutants they are formed from (their precursors). These estimates are based on actual monitored readings or engineering calculations of the amounts and types of pollutants emitted by vehicles, factories, and other sources. Emission estimates are based on many factors, including levels of industrial activity, technological developments, fuel consumption, vehicle miles traveled, and other activities that cause air pollution. (U.S. Environmental Protection Agency, 2011).

The National Oceanic and Atmospheric Administration (NOAA) is another agency that works closely with the EPA in regulating air quality. In May 2011, Air Quality Awareness week was observed. The NOAA website provided educational information on air pollution, how it affects air quality, how to protect oneself from poor air quality and what steps can be taken to make the air cleaner. Also involved in monitoring air pollution is the Department of Environmental Conservation (DEC). The Ambient Air Quality Monitoring is New York’s program for tracking air quality. To protect humans and the environment from damage by air pollution, DEC continually measures levels of pollutants in the air. DEC regularly reports the results of these measurements-in the case of ozone, which at high levels can be a threat to human health, the results and predicted pollution levels are reported in real time, on DEC's website and through broadcast media (New York State Department of Environmental Conservation, 2011).

**Professional Organizations**

The American Lung Association is instrumental in advocating for more effective policies that will be responsible for ensuring that the air we breathe is clean. One of their goals is to improve the air we breathe so it will not cause or worsen lung disease. “For 12 years, the American Lung Association has analyzed data from state air quality monitors to compile the State of the Air report. The American Lung Association has led the fight for healthy air for over 20 years. Their primary weapon is advocacy. They work to influence public policy and ensure enforcement of laws that help clean up the air. Whether in the courtroom or on [Capitol Hill](http://www.lungusa.org/get-involved/advocate/), they constantly work to make the air we all share cleaner and healthier.” In 2011, they launched the Healthy Air Campaign to defend the clean air act from changes to the EPA guidelines by congress. They are also instrumental in advocating for legal authority and funding necessary for the EPA to continue to protect the public from air pollution (American Lung Association, 2011).

The American Academy of Pediatrics (AAP) is a non-profit organization of more than 60,000 primary care pediatricians and specialists advocating for children’s health. In a recent testimony before the Committee on Environment and Public Works regarding the Clean Air Act and public health., the AAP discussed that “According to the EPA’s report, complying with the Clean Air Act will cost about 65 billion dollars per year, but the benefits are projected at two trillion dollars per year, most of which is saved through reduced morbidity and mortality. He states that the Clean Air Act’s tremendous cost savings represent not just economics, they represent children: fewer children suffering from asthma attacks, fewer hospitalizations, less respiratory tract illnesses, improved lung capacity and function for growing children, and healthier infants and newborns” (American Pediatric Association, 2011). There are many other organizations involved in the effort to ensure that regulations are in place and effective in reducing air pollution.

**Policy Recommendations**

The AAP recommends in the strongest terms possible that the Clean Air Act should not be weakened in any way that decreases the protection of children’s health. Weakening standards

will almost certainly result in increased emergency room visits and hospital admissions for

children with respiratory issues, resulting in increased direct costs for medical care, and

increased indirect costs from lost productivity due to missed school and work. Weakening

standards will result in adults with increased chronic lung disease as they age (American Association of Pediatrics, 2011). The organization also proposes that children’s exposure to diesel exhaust particles should be decreased. Idling of diesel vehicles in places where children live and congregate should be minimized. Ongoing programs to fund conversion of diesel school bus fleets to cleaner alternative fuels and technologies should be pursued and supported. Federal and state governments’ policies should encourage reductions in mobile and stationary sources of air pollution, including increased support for mass transit, carpooling, retiring or retrofitting old power plants that do not meet current pollution-control standards, and programs that support marked improvements in fuel emissions of gasoline- and diesel-powered vehicles. Additionally, the development of alternative fuel fleets, low-sulfur diesel, and other “low emission” strategies should be promoted. Before promoting new alternative fuels, these alternative fuel sources should be critically evaluated and determined by governmental authorities to have a good safety profile. The World Health Organization (WHO) recommends revised limits for the concentration of selected air pollutants: particulate matter (PM), ozone (O3), nitrogen dioxide (NO2) and sulfur dioxide (SO2), applicable across all WHO regions.

In addition, there are certain interventions geared towards individuals that can help decrease the adverse effects of air pollution on public health. Allen, Barn, Brauer, Carlsten, Eeden, Giles, Hajat, Kaunfman, Kosatsky, Kunzil, Mittleman, Noonan, Romieu, Smargiassi, and Steib, (2011), suggested the implementation of established primary, secondary, and tertiary interventions, for example, controlling hypertension, lowering lipids, reducing obesity, promoting physical activity and smoking cessation, for diseases affected by air pollution will serve to reduce the overall burden of disease associated with air pollution exposure. They went on to suggest that supplementation with antioxidants such as vitamins C and E and omega-3 fatty acids, as well as vitamins B6 and B12 can mitigate selected cardiovascular and respiratory impacts of ozone and PM. Arguably one of the most important steps to take is to modify activity, location, and level to reduce dose and exposure to pollutants. In the same article by Allen, et al (2011), it explains that air quality advisories and ongoing air quality information programs typically recommend changing the timing, duration or intensity of outdoor activity to reduce short-term exposure and effective dose, whereas, optimal location of home, work, and school is the primary focus of advice related to long term exposure. Finally, although some people independently adjust their outside physical activities in response to poor air quality, the need for continuing education about the deleterious effects of air pollution remains. Healthcare providers may wish to include risk modification strategies when recommending exercise regimes, especially for those individuals with respiratory-related risk factors (Holmes, Lindsey, and Qiu, 2009).

**Summary**

Air pollution continues to be a major problem affecting individuals, groups, urban areas, cities, states and entire regions. There is a wealth of research to validate the severe health impacts that air pollution has on the health and well-being of the population as well as the environment on a whole. It is found in the 2005 Air Quality guidelines that there are serious risks to health from exposure to PM and ozone in many cities of developed and developing countries. It is possible to derive a quantitative relationship between the pollution levels and specific health outcomes (increased mortality or morbidity). This allows invaluable insights into the health improvements that could be expected if air pollution is reduced. Even relatively low concentrations of air pollutants have been related to a range of adverse health effects. Poor indoor air quality may pose a risk to the health of over half of the world’s population. In homes where biomass fuels and coal are used for cooking and heating, PM levels may be ten to fifty times higher than the guideline values. Significant reduction of exposure to air pollution can be achieved through lowering the concentrations of several of the most common air pollutants emitted during the combustion of fossil fuels. Such measures will also reduce greenhouse gases and contribute to the mitigation of global warming (Environmental Protection Agency, 2011).

From a public health perspective, researching the health implications of environmental decisions and urban planning should be priority. This is according to Allen et al, (2011). They suggest that researching the health implications of the built environment and urban planning decisions should be a priority for public health. Specifically, further investigation of outcomes associated with living, working and exercising in close proximity to major roadways and urban areas is needed. Steps have to taken at both a community and individual level in order to safeguard our own health as well as those of generations to come.

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