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CLEAN AIR RESEARCH PROGRAM

RESEARCH EXPLORES LINKS BETWEEN AIR POLLUTANTS AND ASTHMA

Issue:

It is estimated that over 20 million Americans suffer from asthma. This includes almost two million emergency department visits, 5,000 deaths, and a financial cost of $14 billion each year.

Asthma has been identified as a serious and growing health problem by the U.S. Department of Health and Human Services. Air pollution, both outdoor and indoor, is a significant risk factor for the exacerbation of asthma. In addition, because asthmatics may have difficulty clearing pollutants from their airways, they may be at an increased risk of non-respiratory effects of air pollutants such adverse effects on cardiac health.

Though it has been firmly established that air pollution can initiate asthma attacks, its role in causing asthma in the first place is still unclear. At greatest risk may be individuals who are exposed to pollutants in the womb or at a young age. The elderly who have asthma on top of already age-related loss of function may also be at greater risk. The Office of Research and Development (ORD) in the U.S. Environmental Protection Agency has a research program dedicated to resolving these uncertainties about asthma.

Scientific Objective:

ORD conducts asthma research in its Clean Air Research and Human Health Research Programs. Research is conducted in several main areas:

- Induction and exacerbation of asthma
- Susceptibility factors contributing to asthma
- Risk assessment issues related to induction, exacerbation, and susceptibility

ORD addresses key issues to understand the role of pollutants on asthma, including:

- Determining the critical time window of exposure that predisposes one to asthma
- Understanding the key biological pathways by which air pollutants cause asthma
- Identifying the factors that make asthmatics more vulnerable to the effects of air pollutants

A major epidemiological research project sponsored by ORD is the Detroit Children's Health study, which is providing data on the association between exposure of air pollutants, particularly particulate matter (PM), and adverse health outcomes. The study is examining whether long-term, early-life exposures to mobile-source emissions, particularly diesel exhaust particles, play a key role in the

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induction of allergic asthma in school children.

Asthma research is also focused on:

- Exploring the association between exposure to mobile sources in the womb or early in life and its role in induction of asthma in children and in the elderly
- Exploring the mechanisms by which air pollutants impact respiratory and cardiac health in asthmatics
- Understanding the effects of outdoor air pollution on moderate and severe asthma subjects
- Understanding the acute effects of exposure to different sizes of particulate matter (PM) on cardiopulmonary function, biomarkers of inflammation, and other factors in mild to moderate asthmatics
- Identifying biomarkers unique to elderly asthmatics, which differs from younger asthmatics following air pollutant exposure

Application and Impact:
Asthma research at ORD is leading to the development of new scientific methods, models, and data that is helping to assess the risks of asthma from exposure to air pollutants.

The research has contributed to the development by EPA of regulatory standards for two high-priority air pollutants--ozone and particulate matter. Studies have also supported health assessments for diesel emissions.

Among other contributions, research showed that residual oil fly ash from oil combustion in power plants causes immune system changes that make mice more sensitive to dust mite allergens. Residual oil fly ash often contains nickel as well as vanadium and iron. Each metal could cause the mice to develop a stronger allergy to dust mites. This may help explain why some geographic regions have higher rates of asthma.

REFERENCES

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