U.S. Environmental Protection Agency:
Air Quality and Respiratory Diseases

Researchers at The Johns Hopkins Bloomberg School of Public Health found that hospital admission rates for cardiovascular and respiratory diseases were significantly associated with short-term, fine particle exposure in air in individuals over 65 years of age.

Lead Agency:

U.S. Environmental Protection Agency

Agency Mission:

The mission of the U.S. Environmental Protection Agency (EPA) is to protect public health and safeguard the natural environment.

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Partner Agency:

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General Description:

A large study, funded by the EPA and published in the *Journal of the American Medical Association* in 2006, looked at Medicare recipients across the country and found that short-term exposure to fine particles or particulate matter (PM) is related to a greater risk of hospitalizations. Researchers at The Johns Hopkins Bloomberg School of Public Health found that hospital admission rates for cardiovascular and respiratory diseases were significantly associated with short-term, fine PM exposure in individuals over 65 years of age. The study used Medicare data for 11.5 million people living in 204 urban counties in the United States. This is one of the first studies to use an expanded, nationwide, monitoring network for ambient particulate matter less than 2.5 μm in diameter ($PM_{2.5}$). Interestingly, the average ambient concentration of fine PM in the locations during the study period was lower than the PM levels that existed during many previous studies. Region-specific differences in PM-associated deaths between the eastern and western United States also were reported.

Researchers compiled a data set of daily hospitalization admission rates for cardiovascular and respiratory disease and injuries between 1999 and 2002 from the billing claims of Medicare participants across the United States. The data were paired with ambient $PM_{2.5}$ concentrations in the same county on the date of hospitalization and up to two days prior. The resulting data set encompassed 204 urban counties in the United States and 11.5 million Medicare participants living within an average of 5.9 miles of a $PM_{2.5}$ monitor. Hospital admission rates increased in relation to increases in $PM_{2.5}$ concentration on the same or immediately preceding days for all outcomes studied except injuries. The health outcomes found to be associated with $PM_{2.5}$ concentration were cerebrovascular disease including stroke, peripheral vascular disease, ischemic heart disease (where the blood supply to heart muscle is reduced), heart rhythm, heart failure, chronic obstructive pulmonary disease, and respiratory tract infection.

The study investigators also compared the mortality risks associated with fine particulate air pollution across seven regions of the United States. The risk for air pollution-related cardiovascular disease was highest in counties located in the eastern United States. In contrast, the risk of hospitalization for respiratory causes was consistent across all the counties. The regional differences seen by the researchers have focused their efforts to identify what factors are responsible. This is a complex question and may involve regional differences in the composition of PM in the atmosphere from specific sources of PM.

The research was conducted as part of a four-year project funded through a grant from the EPA to the Johns Hopkins University Bloomberg School of Public Health. The project started in 2003 and examined the effect of annual average and daily $PM_{2.5}$ concentration on illness and death among Medicare recipients. The study researchers are continuing to follow the Medicare study population as part of the Johns Hopkins Particulate Matter Center, one of five research centers established by the EPA to study particulate air pollution and health effects.

Excellence: What makes this project exceptional?

This was one of the first studies to show the effects of fine particles on Medicare recipients across the nation, comprising nearly all members of the U.S. population over the age of 65 years.
The size of the Medicare population allowed the researchers to assess risks pertaining to specific cardiovascular diagnoses. The findings have led to more specific investigations concerning the biologic pathways that are affected by exposure to particulate matter.

Significance: How is this research relevant to older persons, populations and/or an aging society?

For the first time, nationwide Medicare data were analyzed to assess the health effects of fine particulate matter (PM). EPA-funded grantees from Johns Hopkins University found that increases in hospital admission rates for cardiovascular and respiratory diseases were

significantly associated with short-term changes in ambient levels of PM2.5. When the risk estimates were evaluated for individuals in different age categories, the oldest group, aged 75 years and older, was at highest risk for several outcomes including ischemic heart disease, heart rhythm disturbances, heart failure, and chronic obstructive pulmonary disease.

Effectiveness: What is the impact and/or application of this research to older persons?

This research indicates that older people, especially people with pre-existing health conditions, should be very cautious about their time spent outside on days when the air quality is poor. It reinforces the need for alerts on days with large amounts of fine particle pollution in the air. It also underscores the need to rigorously enforce and periodically re-evaluate the National Ambient Air Quality Standards for particulate matter.

Innovativeness: Why is this research exciting or newsworthy?

For the first time, nationwide Medicare data were analyzed to assess the health effects of fine particulate matter (PM). EPA-funded grantees from Johns Hopkins University found that increases in hospital admission rates for cardiovascular and respiratory diseases were significantly associated with short-term changes in ambient levels of PM2.5. When the risk estimates were evaluated for individuals in different age categories, the oldest group, aged 75 years and older, was at highest risk for several outcomes including ischemic heart disease, heart rhythm disturbances, heart failure, and chronic obstructive pulmonary disease.