News Release

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Poster session time: 8:15-4:00 p.m. May 16
Location: CC-Area C, Hall G (First Level), Morial Convention Center

Higher Blood Pressure Found in People Living in Urban Areas

ATS 2010, NEW ORLEANS— People who live in urban areas where particulate air pollution is high tend to have higher blood pressure than those who live in less polluted areas, according to researchers from the University of Dusiburg-Essen in Germany.

The researchers used data from the Heinz Nixdorf Recall Study, an ongoing population-based cohort study of almost 5,000 individuals that focuses on the development of heart disease. They analysed the effects of air pollution exposure on blood pressure between 2000 and 2003.

While some earlier studies have shown that acute increases in particulate air pollution, such as day-to-day fluctuations, can raise blood pressure, little was known about medium- and long-term exposure. "Our results show that living in areas with higher levels of particle air pollution is associated with higher blood pressure," said Barbara Hoffman, M.D., M.P.H., head of the Unit of Environmental and Clinical Epidemiology, University of Duisburg-Essen, and senior author of the study.

The results will be presented at the ATS 2010 International Conference in New Orleans.

The authors used a dispersion and chemistry transport model to estimate long-term exposure to particulate pollution. For the blood pressure measurement, they used an

automated oscillometric device that detects the blood's movement through the brachial artery and converts the movements into a digital reading.

They found that average arterial blood pressure rose by 1.7 mmHg for an increase of 2.4 μg/m³ in the exposure level to fine particulate matter (under 2.5 μm), which mostly originates from combustion sources in urban areas (traffic, heating, industry, power plants). They found a similar association for coarser particulate matter under 10 μm, which contains more earth crust material and roadway pollution.

"Both, systolic and diastolic blood pressure, are higher in people who live in more polluted areas, even if we take important factors that also influence blood pressure like age, gender, smoking, weight, etc. into account. Blood pressure increases were stronger in women than in men," explained Dr. Hoffman.

High blood pressure increases the risk for atherosclerosis, a hardening of the arteries, which leads to cardiovascular diseases like heart attacks and strokes. "Our results might explain why people who live in more polluted areas are at a higher risk to suffer and die from these diseases," said Dr. Hoffman.

It has also been shown that chronic noise exposure, for example from living close to major roads, is associated with higher blood pressure or with diseases of the heart.

"In our study, air pollution levels represent averaged background concentrations which were not related to nearness to busy streets," said Dr. Hoffman. "Therefore, the observed increase in blood pressure is not likely due to noise exposure.

"This finding points out that air pollution does not only trigger life threatening events like heart attacks and strokes, but that it may also influence the underlying processes, which lead to chronic cardiovascular diseases. It is therefore necessary to further our attempts to prevent chronic exposure to high air pollution as much as possible."

Dr. Hoffman and colleagues intend to study whether living in areas with higher levels of air pollution leads to a faster progression of atherosclerosis of the coronary arteries, which supply the heart with fresh blood, and of the carotid arteries, which supply the brain with fresh blood.

Several large studies in Europe and the United States are already under way and are expected to shed more light on the chronic effects of living in polluted areas.

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"Long-Term Urban Background Particulate Air Pollution Increases Arterial Blood Pressure" (Session A48, Sunday, May 16, 8:15-4:00 p.m., CC-Area C, Hall G (First Level), Morial Convention Center; Abstract 3412)

**Please note that numbers in this release may differ slightly from those in the abstract. Many of these investigations are ongoing; the release represents the most up-to-date data available at press time.*

Long-term Urban Background Particulate Air Pollution Increases Arterial Blood Pressure

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Rationale

Recent studies show an association between short-term air pollution levels and acute changes in blood pressure (BP). Most of these studies have been performed on selected populations. Up to date, only one study has investigated medium-term effects up to 60 days on BP in the general population. We aim to investigate the association of residential long-term particulate matter (PM) exposure on arterial BP in an urban population of Western Germany, independently of short-term effects.

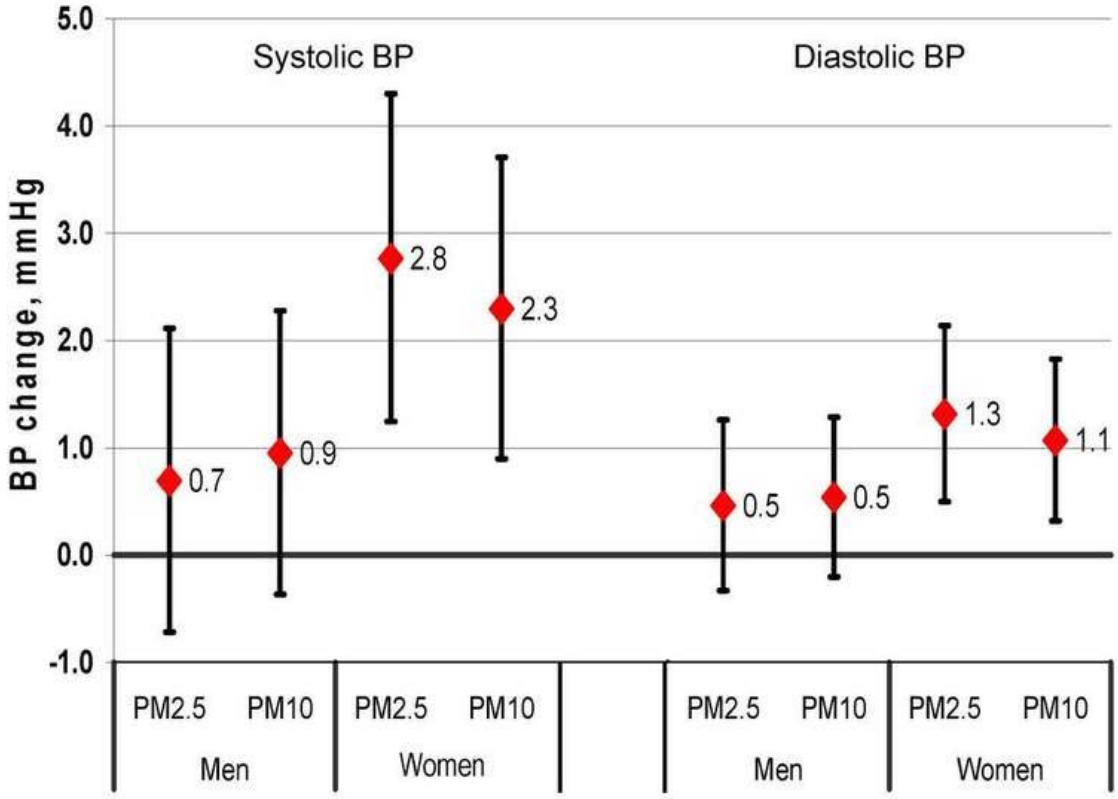
Methods

We used baseline data (2000-2003) from the Heinz Nixdorf Recall Study, a population-based cohort study (n=4814). The yearly average exposure to $PM_{2.5}$ and PM_{10} (µg/m³) was assessed using a dispersion and chemistry transport model. Arterial BP was measured according to the standardized protocol of the World Health Organization, using an automated oscillometric device. Linear regression and generalized additive models were used, adjusting for meteorology, time trend, short-term exposure to PM, and personal characteristics.

Results

We included 4352 participants with non-missing information on exposure, outcome, and covariates. Mean yearly concentrations of $PM_{2.5}$ and PM_{10} were 16.7 µg/m³ (interquartile range (IQR) 2.4 µg/m³) and 20.7 µg/m³ (IQR 4.0 µg/m³), respectively. Mean systolic BP was 132.7 mmHg, mean diastolic BP was 81.2 mmHg.
We found increases in arterial BP in association with an interquartile raise in yearly exposure to PM, higher after adjustment for covariates. For $PM_{2.5}$ (multivariate model), mean systolic BP increased by 1.7 mmHg (95%CI: 0.7-2.7 mmHg), diastolic BP by 0.8 mmHg (95%CI: 0.3-1.4 mmHg). Results for PM_{10} were similar: increase of 1.6 mmHg (95%CI: 0.6-2.6 mmHg) in mean systolic BP, and of 0.8 mmHg (95%CI: 0.3-1.3 mmHg) in mean diastolic BP. Stronger effects were found in women (Figure 1).

Figure 1. Absolute change in arterial BP by gender (mmHg, 95% CI) for an interquartile increase in mean annual exposure to PM2.5 and PM10.



1. Adjusted for short-term exposure, temperature, season, age, gender, education, economical activity, body-mass index, smoking, environmental tobacco smoke, alcohol consumption, cardiovascular disease, diabetes, antihypertensive medication, sport activity. 2. Mean values of systolic and diastolic BP in men: 137.6 mmHg and 83.7 mmHg; in women: 127.8 mmHg and 78.7 mmHg, respectively.

Conclusions

Even small variations in long-term exposure to fine and coarse PM may increase arterial BP, independently of short-term levels of air pollution. This effect can already be observed at PM levels below current regulatory standards. Our finding has substantial public health relevance, due to the important role of BP as a risk factor for atherogenesis and cardiovascular disease.