Exposure to Air Pollution Increases the Incidence of Hypertension and Diabetes in Black Women Living in Los Angeles

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COMMENTS

Multiple epidemiological studies have established a statistical association between exposure to air pollutants and incident cardiovascular (CV) disease. As part of the Black Women's Health Study (BWHS), investigators examined the association between chronic exposure to air pollution and the risk of incident diabetes mellitus and hypertension.[1] This analysis suggests that exposure to chronic air pollutants, particularly those associated with automobile traffic, is related to an increased risk of both type 2 diabetes mellitus and hypertension.

Although the explanation for the apparent association between air pollution and CV disease remains unknown, most previous research has focused on the hypothesis that short-term exposure to air pollution may lead to acute increases in platelet activation, vascular reactivity, and potential plaque rupture. Another intriguing possibility is that there may also be a long-term effect on traditional CV risk factors such as diabetes and hypertension.

This appears to be the first study that examined the potential relationship between hypertension and ambient air pollution. While this analysis is clearly not definitive, the results suggest that ambient air pollutants, particularly those caused by automobile traffic, may be an unrecognized risk factor for the development of hypertension. Given the fact that hypertension is present in nearly 1 in 3 adult Americans, even if exposure to air pollution produces only a modest increase in the relative risk for hypertension, the absolute population attributable risk may be substantial.

STUDY METHODOLOGY

As part of the large scale BWHS, investigators set out to assess the risk of incident hypertension and diabetes mellitus associated with exposure to common air pollutants, including fine particulate matter with an aerodynamic diameter of <2.5 μg (PM2.5) and nitrogen oxides (NOx), a marker of traffic-related air pollution. BWHS is a prospective observational cohort study of 59,000 self-described black women, aged 21 to 69, living in Los Angeles when the study started. The participants were mostly recruited as subscribers to *Essence*, a popular African American magazine.

At baseline, and periodically over about 10 years of follow-up, participants completed questionnaires on demographics, lifestyle issues, and medical conditions. For the purpose of this analysis, incident hypertension and diabetes were self-reported.

Estimates were created of exposure to pollutants based on each patient's home address. To estimate PM2.5, data from 23 state and local monitoring stations were analyzed (using a kriging model) during the year 2000 (in the middle of the study period). Estimates of NOx were made based on direct field measurements at 183 locations over a 2-week period (using a land regression model).

Subsequently, validated statistical models were used to estimate the incident rate ratios (IRR) for both hypertension and diabetes mellitus. The IRRs for both hypertension and diabetes mellitus were subsequently adjusted for age, body mass index, years of education, household income, number of people supported by household income, smoking status, alcohol consumption, hours of exercise per week, a neighborhood socioeconomic status score, neighborhood noise level, and family history of diabetes.

This type of methodology cannot prove cause and effect, and there may be multiple confounding variables that were not adequately captured in the questionnaires. However, based on the lack of previous research in this area and the difficulty in obtaining this type of data, it appears that the investigators have provided methodology rigorous enough to develop a clear hypothesis.

STUDY RESULTS

Over the 10 years of follow-up, there were 531 incident cases of hypertension. In models that considered the two types of pollutants separately, the relative risk for developing hypertension was increased by 48% for every 10-unit increase in PM2.5 and by 14% for increased intraquartile range of NOx. When both pollutants were modeled together, the association with PM2.5 was attenuated, but the affect of NOx was not. There was no suggestion that the interaction between NOx and incident hypertension was affected by noise level.

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IMPLICATIONS AND CONCLUSIONS

While certainly not definitive, this report is the first strong indication that the previously observed association between pollution exposure and CV events may at least in part be mediated by an increased risk of incident hypertension. While the magnitude of the association seen here was not large, given the absolute incidence of hypertension and the widespread exposure to air pollution present in most US metropolitan cities, even a 15% increase in the relative risk of hypertension may represent a very substantial absolute number of incident hypertension cases.

We should keep in mind that this study does have significant limitations. But, these data should encourage other groups to attempt to replicate these findings in other demographic groups and other geographic locations. Future studies would also benefit from having blood pressure measured directly as part of the methodology rather than a diagnosis of hypertension being self-reported.

The finding that increased levels of air pollution, particularly those associated with motor vehicle traffic, may be associated with an increased risk of incident hypertension has important potential public health implications that should be explored in future research.

Reference

1. Coogan PF, White LF, Jerrett MJ, et al. Air pollution and incidence of hypertension and diabetes in black women living in Los Angeles. *Circulation*. 2012;125:767–772.