

Exposure to PM_{2.5} is Associated with Elevated Blood Pressure and Incident Hypertension in Delhi

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What did we do?

In this recently published paper, we investigated the association between exposure to ambient particulate matter (PM_{2.5}) a marker of air pollution with blood pressure and incident hypertension in Delhi. The study was carried out in a cohort of ~5300 individuals recruited across different parts of Delhi and followed for 7 years (2010-2016) with annual questionnaire surveys and alternate year biological sample collection. The paper assessed daily ambient PM_{2.5} using a machine learning based predictive model that included myriad data sources such as ground monitor data (from the CPCB and DPCC), satellite observations, meteorology, land use variables and emissions inventories. Blood pressure was assessed longitudinally at three time points within the cohort over the 7-year period.

What did we find?

We found strong effects of long- and short-term exposure on systolic and diastolic blood pressure (BP) as well as risk of developing hypertension. We observed higher average systolic BP (1.8 mm Hg and 3.3 mm Hg per interquartile range differences (~9-15 µg/m³ of PM_{2.5}) in monthly and annual exposures, respectively. Positive but less pronounced associations were observed for diastolic blood pressure. Average PM_{2.5} over durations of 1 year, 1.5 years and 2 years increased the risk of developing hypertension by 1.5× (50% higher risk) 1.6× (60% higher risk), and 1.2× (20% higher risk), respectively. These results were also found to be stronger in study participants with higher waist-to-hip ratios, which is an indicator of central obesity.

What is the significance of the findings? The study conducted by Indian scientists at the Centre for Chronic Disease Control and Public Health Foundation of India in collaboration with the Harvard T.H. Chan School of Public Health on a locally recruited representative population presents strong evidence of the harmful effects of PM_{2.5} exposures on cardiovascular diseases (CVDs) in India. This is one of the first studies conducted in an Indian setting with such detailed data on ambient air pollution exposure and health outcomes. Our results also have shown the significant clinical and public health benefits associated with reducing ambient PM_{2.5}.

What gaps in knowledge do these findings fill? The existing evidence for effects of air pollution on health mainly originates from countries with low pollution levels. This study shows the effects of air pollution at some of the highest global levels, and in a large population studied longitudinally. The novelty of the detailed and high-resolution exposure assessment makes it possible for us to retrospectively assess exposure for multiple years both in short and long term. The longitudinal nature of the study presents evidence that is robust and fills a gap in the existing evidence base (the need for long-term evidence and local studies) in India as identified in 2016 by the Union Government Ministry of Health and Family Welfare's Steering Committee on Air Pollution. Finally, these findings have salient policy implications by which we see an approximate reduction of 15% in hypertension prevalence given the attainment of national ambient air quality standards in Delhi.

What gaps remain? The study was limited to Delhi, although we are currently carrying out a similar analysis for Chennai. Similarly designed studies will need to be conducted across the country to assess the relevant population health effects in those regions, in so far as they may be different from Delhi due to varying PM_{2.5} constituents and levels of exposure.

What is the take home message for clinicians? Reducing exposure to ambient air pollution has a large impact in controlling blood pressure, reducing risk of developing hypertension and future CVD, and ensuring overall well-being. This is particularly important in reducing the burden of disease in our country, and therefore informing patients about the harmful effects of air pollution must form part of a suite of harm-reduction strategies for CVD. Till we reach the safe levels of air quality, people with high risk of arrhythmias, worsening heart failure or stroke such as those with severe heart failure should be specially protected by avoiding exposure to high levels of outdoor PM_{2.5} by not going out on these days or through the use of protective N95 masks if feasible.

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