

# Air Pollution and Neonatal Blood Pressure

## Examining Earlier Exposures

Ambient air pollution has been associated in some studies (but not all) with increased blood pressure in adults<sup>1</sup> and children.<sup>2,3</sup> A study in this issue of *EHP* examines even earlier exposures during gestation, an important period of cardiovascular growth and development.<sup>4</sup> The results show a small but significant increase in newborn systolic blood pressure associated with exposure in the third trimester to black carbon (BC) and, to a lesser extent, fine particulate matter (PM<sub>2.5</sub>).

Researchers from Harvard Medical School and the Harvard T.H. Chan School of Public Health used data from 1,131 mother–infant pairs enrolled in Project Viva, a Boston-based cohort study designed to investigate how diet and environmental factors may affect maternal and newborn health.<sup>5</sup> The study considered potential effects of several air pollutants, including PM<sub>2.5</sub>, BC (a traffic-related component of particulate pollution), nitrogen oxides, nitrogen dioxide, ozone, and carbon monoxide.

The authors used stationary monitoring data to estimate mothers' average air pollutant exposures for each trimester and for the 90-day period immediately preceding birth. On the day of birth, newborn systolic blood pressure was measured up to five times, 1 minute apart. Mixed-effect models were adjusted for maternal age, maternal systolic blood pressure during the third trimester, newborn age (in hours), and newborn birth weight, all factors that had predicted newborn blood pressure in an earlier study.<sup>5</sup> Models were also adjusted for sociodemographic variables and time trend.

“The most striking and significant findings are the third-trimester associations between pollutants and newborn blood pressure,” says lead author Lenie van Rossem, an assistant professor at University Medical Center Utrecht in the Netherlands. Specifically, the researchers found that increased estimated exposures to outdoor PM<sub>2.5</sub> and BC in the third trimester—but not in the first and second trimesters—were associated with higher newborn systolic blood pressure.

Interestingly, increased ozone exposure in the third trimester was associated with lower systolic blood pressure in newborns, whereas exposure in the second trimester was associated with higher blood pressure. Increased estimated exposures to carbon monoxide or nitrogen oxides during the second trimester also were associated with lower newborn systolic blood pressure.<sup>4</sup> One possible explanation for these results is that gaseous pollutants such as ozone, nitrogen oxides, and carbon monoxide may affect blood pressure through a different biological pathway than particulate pollutants.

“I was interested, though not entirely surprised, to find that higher shorter-term as well as ninety-day averaged pollution was associated with higher newborn blood pressure,” van Rossem says. This finding, which was more consistently true for BC than for PM<sub>2.5</sub>, suggests that both short- and longer-term exposure to PM<sub>2.5</sub> may impact neonatal blood pressure.

“The one area of the study that potentially concerns me is the characterization of exposure to the various pollutants,” says Charles J. Weschler, an adjunct professor with the Environmental and Occupational Health Sciences Institute at Rutgers University. For the most part, he explains, exposure to the studied pollutants occurs indoors, whereas the authors used outdoor concentrations as the bases for their estimates. “I am not saying this is a serious flaw,” Weschler says. “I am simply saying that we should be cautious interpreting the results, because the exposures are only rough estimates of what each mother and fetus were actually exposed to.”

Van Rossem agrees, saying, “Although we have applied very sophisticated measurements to estimate spatiotemporally resolved

BC and PM<sub>2.5</sub> outside the residence of each participating family, individual personal measurement of pollution was not feasible.”

The study has notable strengths in its exposure modeling as well as taking blood pressure measurements in infants, “which is not easy,” says Robert D. Brook, a professor of medicine at the University of Michigan who was not involved in the work. However, the implications of the findings are far from clear. “We just don't know what an increase in blood pressure of a few mmHg means, if anything, in a newborn,” Brook says. It could indicate that infants are “programmed” before birth to have higher blood pressure later in life, he says, or it could be a short-term effect that lasts only a few days or months after birth, then goes away with no further consequence. Followup later in life is needed to determine how the observed associations play out over time.

Wendee Nicole has written for *Discover*, *Scientific American*, and other publications.

### REFERENCES

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In a new study, increased prenatal exposures to black carbon and PM<sub>2.5</sub> were associated with increased systolic blood pressure in newborns. However, it's unclear whether this presages any long-term health impact.

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