Air pollution at home and pregnancy outcomes

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Background: Ambient air pollution exposure has been associated with negative birth outcomes, such as preterm delivery and low birth weight. Road traffic has been the most commonly studied source, and shown to be associated with negative birth outcomes. However, many studies have used total PM2.5 or other unspecific indicators of air pollution. Ozone has often been studied without a high spatial resolution with the study area.

Aims: The main aim of this study was to study potential associations between first trimester air pollution levels (exhaust particles and ozone) and spontaneous preterm delivery (< 37 weeks of gestation) and small for gestational age, SGA, (birth weight < 10th percentile at given gestational age, adjusted for sex).

Methods: All singleton deliveries in Greater Stockholm between 2004 and 2013 were included in this study (n=251,559). Air pollution levels at the home address were modeled using a dispersion model, with traffic data and emission factors for exhaust particles and NOx as principal input. Vaginal preterm deliveries only were included in the data set for the analysis of preterm delivery.

Trimester mean ozone concentrations were calculated based on dispersion modelling of NOx concentrations (Figure 1). The NOx concentrations were converted to ozone based on the measured NOx at a central site (urban background, UB) in Stockholm and the difference between ozone at the urban background site (O3(UB) and at a rural background site, O3(RB):

$$O3 = O3(UB) - [NOx - NOx(UB)] \left[\frac{O3(RB) - O3(UB)}{NOx(UB)}\right]$$

Logistic regression was used to estimate possible associations between air pollution and the health outcomes. Potential confounders that were considered included parental and level of education, maternal smoking habits, age, parity, smoking habits and region of origin, family income, family situation and conception date.

Results First trimester exhaust particles were positively associated with SGA in both the unadjusted and adjusted models (Figure 2). The OR of SGA per IQR (210 ng/m^3) increase in exhaust particles was 1.09 (95% CI 1.07 – 1.12) in the fully adjusted model. First trimester ozone was positively associated with preterm delivery, albeit not statistically significant in the fully adjusted model. The OR of preterm birth per IQR (19 µg/m^3) increase in ozone was 1.04 (95% CI 0.99 – 1.10) in the fully adjusted model.

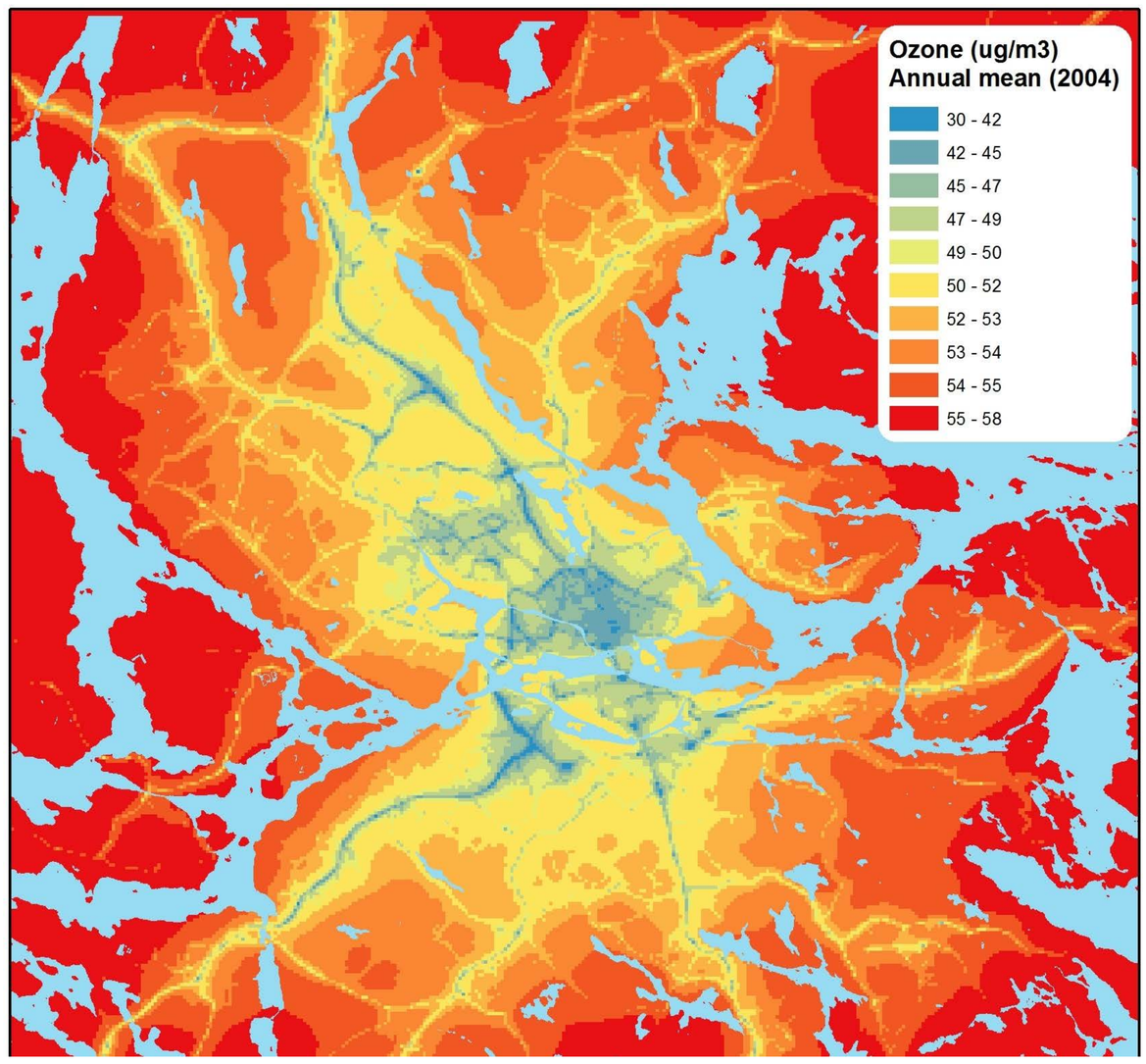

Figure 1. Dispersion of annual mean ozone levels in Stockholm, Sweden.

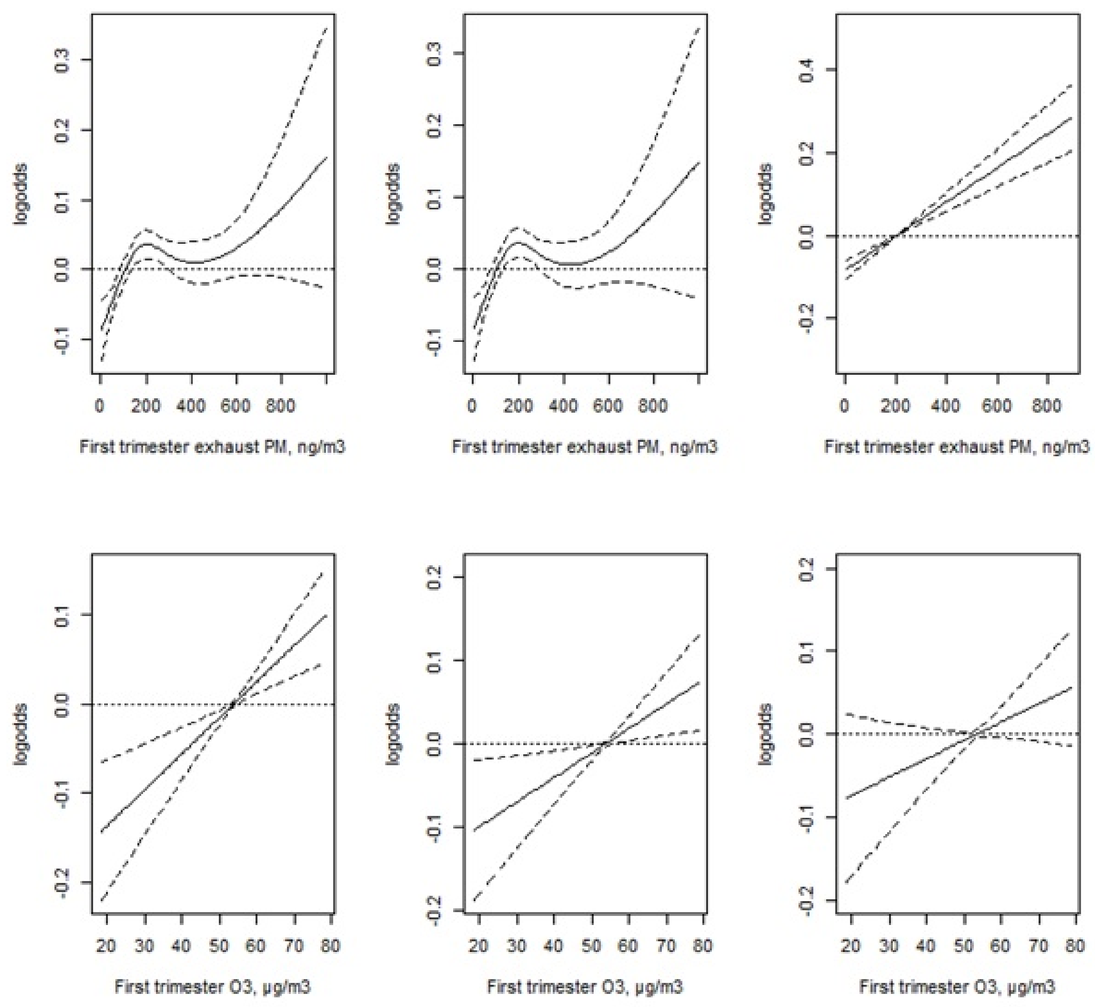

Figure 2. Associations between exhaust particles and SGA (top row), and between ozone and preterm delivery (bottom row). First column is from single pollutant models, second column two-pollutant models and third column form fully adjusted models.

Conclusions: There was a clear support of an association between exhaust particles ozone and SGA. Less clear signals were observed between ozone and preterm delivery.

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