Adverse effects of exposure to air pollutants during fetal development and early life
With focus on pre-eclampsia, preterm delivery, and childhood asthma
David Olsson

Akademisk avhandling

som med vederbörligt tillstånd av Rektor vid Umeå universitet för avläggande av medicine doktorsexamen framläggs till offentligt förvar i Betula, byggnad 6M, Tisdagen den 28 oktober, kl. 09:00. Avhandlingen kommer att förvaras på engelska.

Fakultetsopponent: Professor, Beate Ritz, University of California, Los Angeles, USA.
Adverse effects of exposure to air pollutants during fetal development and early life – with focus on pre-eclampsia, preterm delivery, and childhood asthma

**Abstract**

**Background** Air pollution exposure has been shown to have adverse effects on several health outcomes, and numerous studies have reported associations with cardiovascular morbidity, respiratory disease, and mortality. Over the last decade, an increasing number of studies have investigated possible associations with pregnancy outcomes, including preterm delivery. High levels of vehicle exhaust in residential neighborhoods have been associated with respiratory effects, including childhood asthma, and preterm birth is also associated with childhood asthma.

The first aim of this thesis was to investigate possible associations between air pollution exposure and pregnancy outcomes – primarily preterm delivery but also small for gestational age (SGA) and pre-eclampsia – in a large Swedish population (Papers I–III). The second aim was to study any association between exposure to high levels of vehicle exhaust during pregnancy and infancy and prescribed asthma medication in childhood (Paper IV).

**Methods** The study cohorts were constructed by matching other individual data to the Swedish Medical Birth Register. In the first two studies, air pollution data from monitoring stations were used, and in the third and fourth studies traffic intensity and dispersion model data were used.

Preterm delivery was defined as giving birth before 37 weeks of gestation. SGA was defined as having a birth weight below the 10th percentile for a given duration of gestation. Pre-eclampsia was defined as having any of the ICD-10 diagnosis codes O11 (pre-existing hypertension with pre-eclampsia), O13 (gestational hypertension without significant proteinuria), O14 (gestational hypertension with significant proteinuria), or O15 (eclampsia). Childhood asthma medication was defined as having been prescribed asthma medication between the ages of five and six years.

**Results** We observed an association between ozone exposure during the first trimester and preterm delivery. First trimester ozone exposure was also associated with pre-eclampsia. The modeled concentration of nitrogen oxides at the home address was quite strongly associated with pre-eclampsia, but critical time windows were not possible to investigate due to high correlations. We did not observe any association between air pollution exposure and SGA. High levels of vehicle exhaust at the home address, estimated by nitrogen oxides and traffic intensity, were associated with a lower risk of asthma medication.

**Conclusion** Air pollution exposure during pregnancy was associated with preterm delivery and pre-eclampsia. We did not observe any association between air pollution levels and intrauterine growth measured as SGA. No harmful effect of air pollution exposure during pregnancy or infancy on the risk of being prescribed asthma medication between five and six years of age was observed.

**Keywords**

Vehicle emissions, ozone, pregnancy, asthma