The Challenge
Alongside health effects for the mother, there is mounting evidence that the quality of air inhaled during pregnancy also has implications for the developing baby. Invisible fine particles (PM2.5), which are a fraction of a hair’s breadth, can cross from inhaled air into the bloodstream via the lungs. From there they can cross the placenta and enter the baby’s circulation, irritating the inside of blood vessels and restricting growth.

The challenge lies in studying how inhaled PM2.5 affects fetal growth. A “perfect” (but impossible!) study would involve mothers being randomised to spend their entire pregnancy in an environment where they inhaled either high or low concentrations of PM2.5.

Instead, researchers from the Universities of Aberdeen and Edinburgh used routinely collected air quality measurements and linked these to fetal ultrasound scan measurements, which also allowed them to examine the combined effect of pollution and smoking.

The Research
The Aberdeen Maternity and Neonatal Databank (AMND) holds records of delivered babies at Aberdeen Maternity Hospital including fetal ultrasound scan measurements and other details about the mother such as smoking status. The researchers linked these records to air quality data provided by the United Kingdom Department for the Environment, Food and Rural Affairs (DEFRA).

They examined fetal size in the first, second and third stages of pregnancy in relation to air quality exposure. The team were particularly interested in head size of the unborn and new born baby, since evidence from other sources suggests this may be particularly susceptible to poor air quality.

Their analysis considered the following factors as possible confounders: mother’s age at delivery, parental social class, parity, sex of the baby, maternal height and weight in early pregnancy, maternal smoking and the year of scan.

The Results
In the whole sample (13,775 pregnancies), PM2.5 exposure was associated with reductions in head growth from second trimester through to birth. The highest exposures were associated with a 2 mm reduction in head size in late pregnancy but measurements of fetal limb length and abdominal circumference were not affected. Similar relationships were present for other pollutant exposures (NO2 and PM10). Significantly, the researchers found that air quality effects were only apparent among non-smoking mothers. Among mothers who smoked, air quality effects disappeared.

The Impact
This work adds further evidence that the environment a mother is exposed to is important to fetal growth, and in particular to head size. Work elsewhere suggests that maternal smoking is linked to a reduction in fetal head size of approximately 1-2mm, and therefore the present results suggest that the highest concentrations of air pollution may have an effect on the baby’s head growth which is comparable to maternal smoking.

Air quality in North East Scotland is generally very good but even at these low levels of air pollution, there was an association with a slowing of fetal growth, and this suggests that there may be no “safe” exposure.

The main driver for fetal head size is brain growth and what remains to be seen is what the implications of ambient air exposures during pregnancy are for later child development.

For more information about this study visit: http://www.sciencedirect.com/science/article/pii/S016041201730315X

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