

What is the clinical meaning of fetal growth restriction

Why should we study it?

Birth Weight Is Inversely Associated With Incident Coronary Heart Disease and Stroke Among Individuals Born in the 1950s

Findings From the Aberdeen Children of the 1950s Prospective Cohort Study

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TABLE 2. Rates of CHD and Stroke by Birth-Weight Category Distribution

	Rate per 10 000 (95% CI) by Birth-Weight Category				Sex-Adjusted HR (95% CI) per kg (n=10 803)	HR (95% CI) per Birth Weight z Score (n=9700)
	<3250 g (n=4052)	3250–3749 g (n=5305)	3750–4249 g (n=1199)	≥4250 g (n=247)		
CHD	15.0 (12.7–17.9)	11.9 (10.1–14.2)	7.2 (4.6–11.6)	7.4 (2.8–26.2)	0.63 (0.51–0.78) <i>P</i> <0.001	0.83 (0.73–0.94) <i>P</i> =0.004
Stroke	7.0 (5.5–9.1)	3.2 (2.4–4.5)	1.9 (0.8–5.6)	1.8 (0.26–13.0)	0.41 (0.29–0.59) <i>P</i> <0.001	0.74 (0.60–0.92) <i>P</i> =0.007
CHD or stroke	21.1 (18.3–24.4)	14.9 (12.8–17.3)	9.0 (6.2–13.8)	9.2 (3.9–27.3)	0.57 (0.47–0.69) <i>P</i> <0.001	0.81 (0.73–0.91) <i>P</i> <0.001

n=10 803.

Circulation 2005; 112: 1414-1418

Aortic wall thickness in newborns with intrauterine growth restriction

Lancet 2005; 365: 1484-86 Michael R Skilton, Nick Evans, Kaye A Griffiths, Jason A Harmer, David S Celermajer

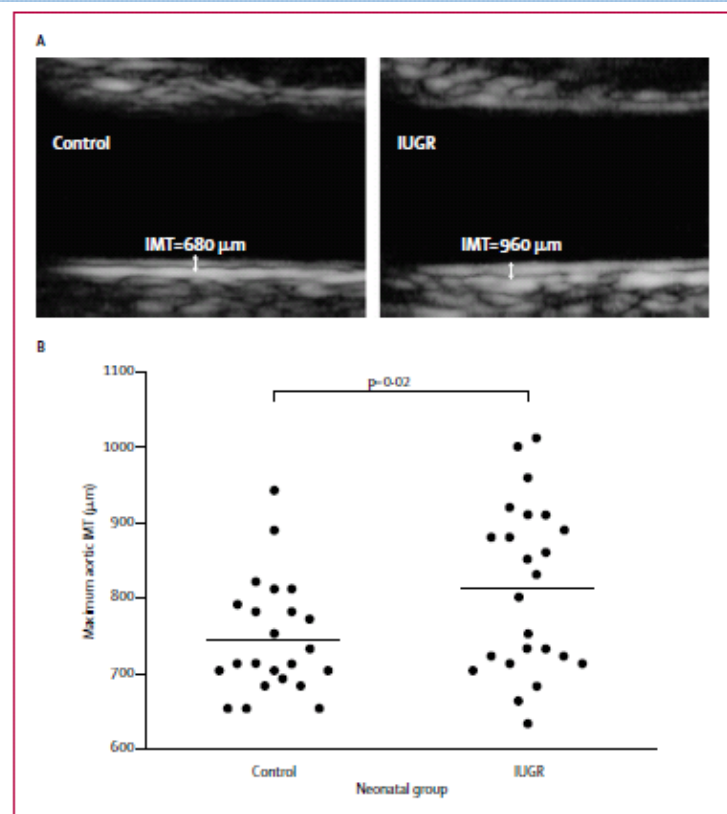
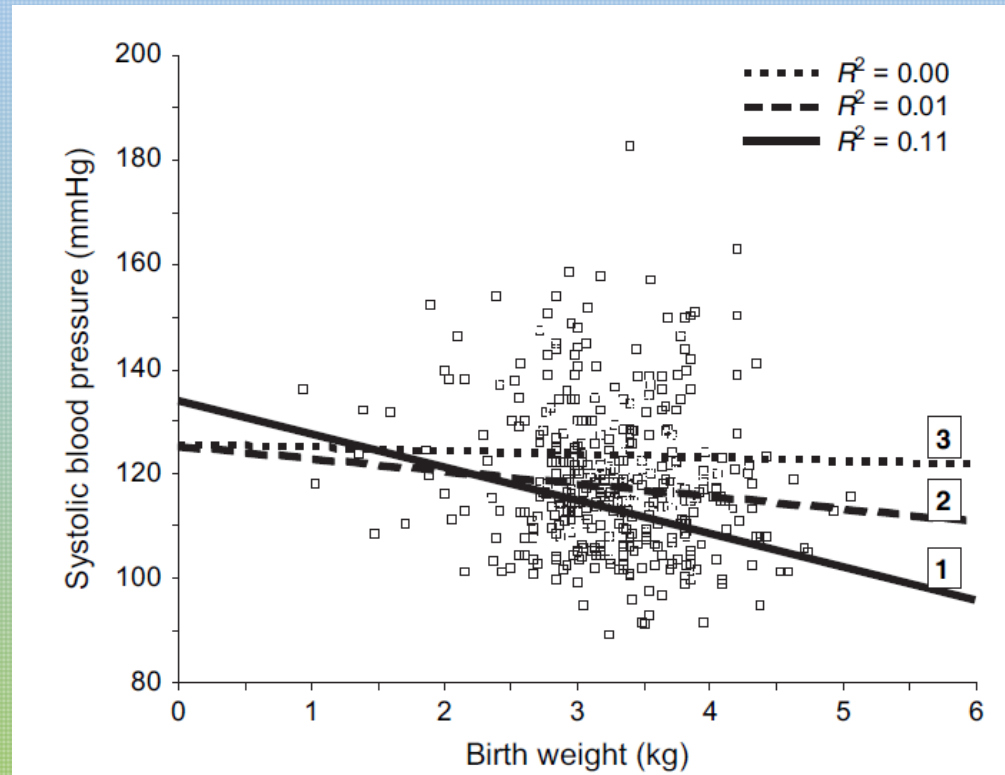


Figure: (A) Examples of ultrasound images of abdominal aorta and (B) maximum aortic intima-media thicknesses (IMT). Horizontal lines show averages. IUGR=intrauterine growth restricted.

Lancet 2005; 365: 1484-1486

Blood pressure and birth weight



Am J Epidemiol 2007; 166: 413–420

Aims

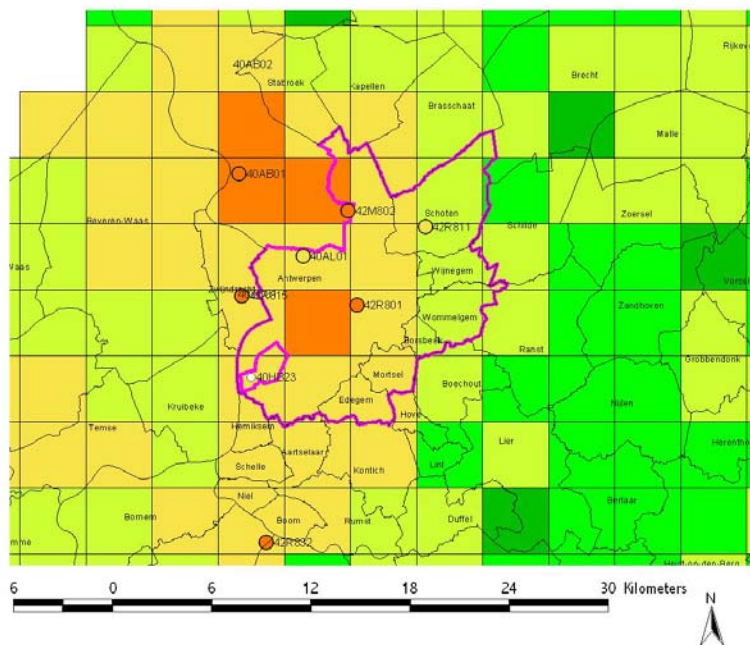
- To study the risk of fetal growth restriction in association with outdoor PM₁₀ concentrations at the mothers' residence.
- To study potential effect modification by gestational duration.
- To assess the shape of the association
- To compare the effects on birth weight with biomass exposure (developmental countries), ETS and maternal smoking during pregnancy.

Methods (1)

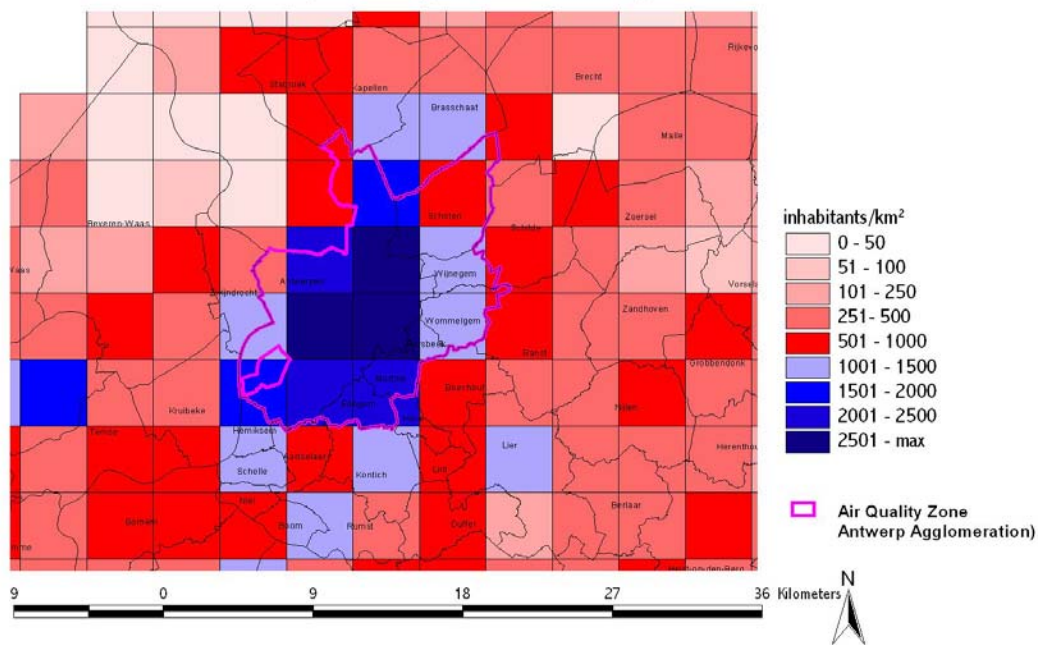
- SPE data on 345,081 singleton newborns
- Interpolation method and population weighted on the level of municipality.
- Calculation of exposure for each trimester, period (14 days) around conception and 80 days before conception
- Polynomial models to study the shape of the association
- Systematic comparison with ETS, smoking, biomass.

Exposure interpolation and weighing

Annual mean PM10 (2004)



Antwerpen : Population Density



Methods (2)

Based on meta-analytic data comparison estimates for biomass, ETS exposure and maternal smoking were plotted against estimated average daily dose of fine particulate matter from these exposures.

Characteristics

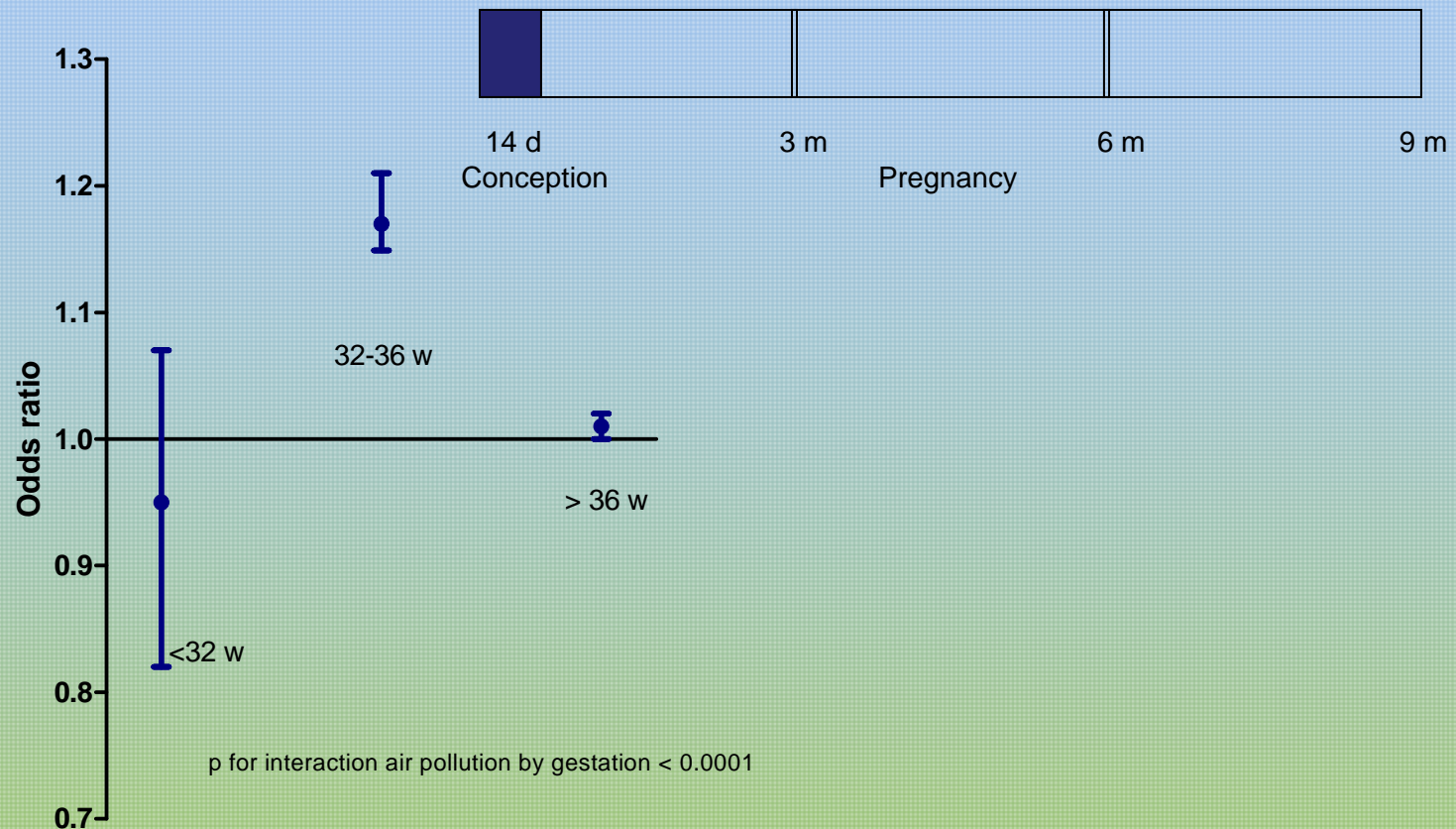
Characteristic	Mean birth weight (g)
Gender	
Male	3267
Female	3397
Season	
Cold	3328
Warm	3338
SES	
Low	3323
Medium	3340
High	3360
Parity	
1	3263
2	3392
3	3408
≥ 4	3382
Gestation age (weeks)	
< 32	1296
32-36	2332
> 36	3371
Maternal age (years)	
< 20	3149
20-24	3243
25-29	3326
30-34	3375
35-39	3359

Birth weight changes calculated for a 10 µg/m³ increase

Period	Estimate (95% CI)			Gestation	Estimate (95% CI)		
Conception (14 days)	-5.74	-7.27	-4.22	<32	0.11	-16.2	16.5
				32-36	-13.1	-23.3	-2.83
				>36	-5.59	-7.14	-4.04
Trimester 1	-12.6	-15.0	-10.3	<32	21.2	-6.49	48.8
				32-36	-38.6	-54.5	-22.8
				>36	-12.3	-14.7	-10.0
Trimester 2	-14.2	-16.6	-11.9	<32	16.5	-11.4	44.5
				32-36	-33.0	-49.4	-16.5
				>36	-14.1	-16.5	-11.7
Trimester 3	-13.0	-15.5	-10.5	<32	8.30	-11.1	27.7
				32-36	-18.7	-33.9	-3.46
				>36	-13.4	-15.9	-10.9
Overall Pregnancy	-17.8	-20.6	-15.1	<32	21.4	-8.7	51.5
				32-36	-17.8	-20.6	-15.1
				>36	-17.7	-20.6	-15.0

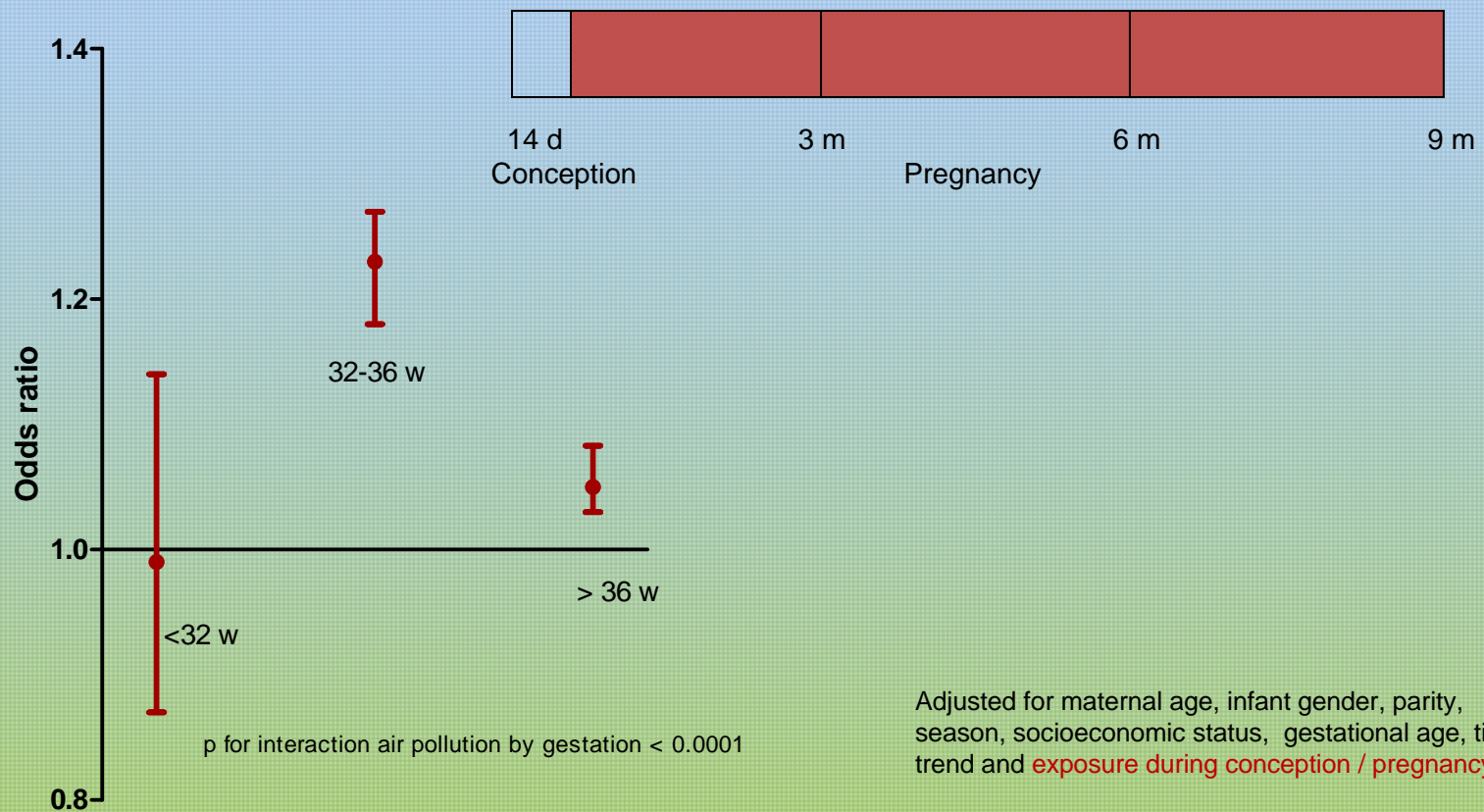
Adjusted for maternal age, infant gender, parity, season, socioeconomic status, gestational age, time trend

Odds ratio for small for gestational age calculated for a $10 \mu\text{g}/\text{m}^3$ increase in exposure around conception and during pregnancy



Adjusted for maternal age, infant gender, parity, season, socioeconomic status, gestational age, time trend

Independent odds ratios for small for gestational age calculated for a $10 \mu\text{g}/\text{m}^3$ increase in exposure around conception and during pregnancy



Does PM exposure during conception or pregnancy the risk of preterm delivery?

No significant association (also no trend)

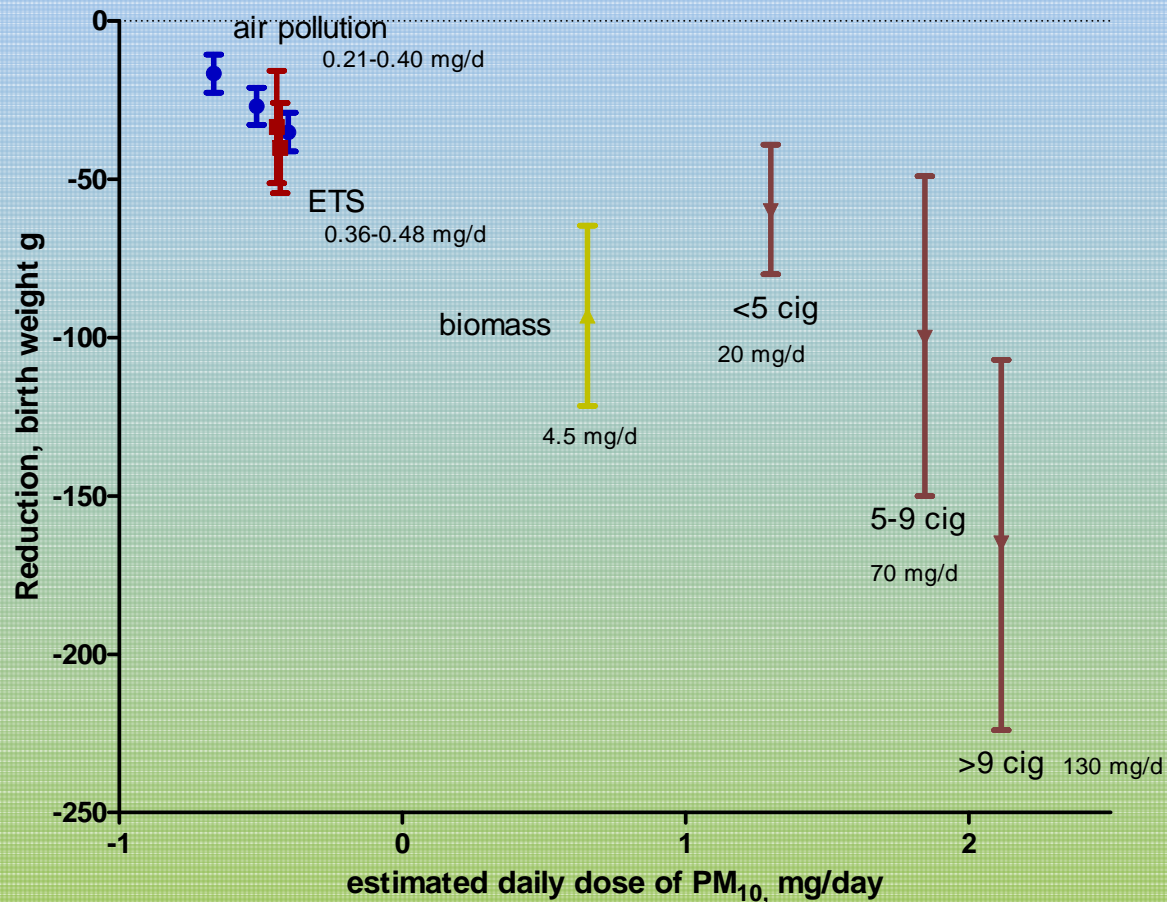
Perspective: comparison with other exposures



Systematic review of other smoke related exposures

- Biomass: *Pope et al. Epidemiol Rev. 2010;32:70-81.*
- ETS: *Salmasi et al. Acta Obstet Gynecol Scand. 2010;89:423-41.*
- Maternal smoking: *Jaddoe et al. Paediatr Perinat Epidemiol. 2008;22:162-71.*
- We plotted decreases in birth weight against estimated average daily dose of fine particulate matter from air pollution along with comparison estimates of ETS, biomass and cigarette smoke.
- Assumptions 18 m³/day, dose cigarette 12 mg PM₁₀ (Pope et al. *Circulation* 2009;120:941-948)

Comparison with smoking, ETS and biomass exposure



The baseline estimated dialy dose assumes an inhalation rate of 18 m³/day and a dose of 12 mg per cigarette.

Conclusions

- We noted associations between fetal growth restrictions and particulate air pollution
- Especially in preterm born infants.
- Effects not explained by preterm delivery
- Assuming causality; lowering PM₁₀ exposure by 10 µg/m³ would avoid 19% of SGA neonates born between 32-36 weeks of pregnancy and 5% of SGA children born ad term.
- Effects in highest exposure group in the range of ETS