

Online Data Supplement

**Spatiotemporal Variations in Ambient Ultrafine Particles and the Incidence of
Childhood Asthma**

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Table E1. Pearson correlation coefficients across pregnancy average of UFPs, PM_{2.5} and NO₂.

Air pollutant	UFPs	PM _{2.5}	NO ₂
UFPs	1.00		
PM _{2.5}	0.04	1.00	
NO ₂	0.01	0.41	1.00

Table E2. Hazard ratios^a (HR) and 95% confidence intervals (95% CI) for the associations between PM_{2.5} (per IQR) over specific periods and childhood asthma risk with additional adjustment for UFPs and NO₂.

Exposure period	IQR (count/cm ³)	PM _{2.5} + UFPs	PM _{2.5} + NO ₂	PM _{2.5} + UFPs + NO ₂
		HR (95% CI)	HR (95% CI) ^b	HR (95% CI) ^b
1 st trimester	10,862	1.00 (0.98 – 1.03)	0.99 (0.97 – 1.02)	0.99 (0.97 – 1.02)
2 nd trimester	10,770	1.08 (1.05 – 1.11)	1.04 (1.01 – 1.07)	1.04 (1.01 – 1.07)
3 rd trimester	10,853	1.03 (1.00 – 1.06)	1.02 (0.99 – 1.05)	1.02 (0.99 – 1.05)
Entire pregnancy	10,820	1.03 (1.00 – 1.06)	1.02 (0.99 – 1.04)	1.02 (1.00 – 1.04)
Childhood cumulative exposure	10,551	1.02 (0.99 – 1.05)	1.01 (0.99 – 1.04)	1.01 (0.99 – 1.04)

^a Model mutually adjusted for the distributed lag weekly exposures of the selected pollutants during the pregnancy period, distributed lag monthly exposures after birth to the selected pollutants, maternal age at delivery, infant sex, parity, breastfeeding status at the time of discharge, maternal smoking during pregnancy, maternal atopy, gestational age, birth weight, residential greenness exposure during pregnancy, dissemination area median family income, dissemination area proportion of population who are visible minority, dissemination area proportion of the adult female population aged 25-64 years old who completed postsecondary education, a frailty term for neighbourhood in the city of Toronto and random effects for clustering within families.

^b Includes adjustment for the other pollutant(s) in the same exposure period.
IQR, interquartile range

Table E3. Hazard ratios^a (HR) and 95% confidence intervals (95% CI) for the associations between NO₂ (per IQR) over specific periods and childhood asthma risk with additional adjustment for UFPs and PM_{2.5}.

Exposure period	IQR (count/cm ³)	NO ₂ + UFPs	NO ₂ + PM _{2.5}	NO ₂ + UFPs + PM _{2.5}
		HR (95% CI)	HR (95% CI) ^b	HR (95% CI) ^b
1 st trimester	10,862	1.01 (0.97 – 1.05)	1.00 (0.96 – 1.04)	0.99 (0.96 – 1.04)
2 nd trimester	10,770	1.11 (1.08 – 1.15)	1.06 (1.03 – 1.09)	1.05 (1.01 – 1.09)
3 rd trimester	10,853	1.01 (0.97 – 1.04)	1.01 (0.97 – 1.05)	1.01 (0.97 – 1.04)
Entire pregnancy	10,820	1.01 (0.97 – 1.04)	1.00 (0.96 – 1.05)	1.00 (0.96 – 1.04)
Childhood cumulative exposure	10,551	1.00 (0.97 – 1.03)	1.00 (0.96 – 1.04)	1.00 (0.96 – 1.04)

^a Model mutually adjusted for the distributed lag weekly exposures of the selected pollutants during the pregnancy period, distributed lag monthly exposures after birth to the selected pollutants, maternal age at delivery, infant sex, parity, breastfeeding status at the time of discharge, maternal smoking during pregnancy, maternal atopy, gestational age, birth weight, residential greenness exposure during pregnancy, dissemination area median family income, dissemination area proportion of population who are visible minority, dissemination area proportion of the adult female population aged 25-64 years old who completed postsecondary education, a frailty term for neighbourhood in the city of Toronto and random effects for clustering within families.

^b Includes adjustment for the other pollutant(s) in the same exposure period.
IQR, interquartile range

Table E4. Hazard ratios^a (HR) and 95% confidence intervals (95% CI) for the associations between UFPs (per IQR) and childhood asthma risk, stratified by selected characteristics.

Variables	1 st trimester	2 nd trimester	3 rd trimester	Entire pregnancy	Childhood exposure
	HR (95% CI)	HR (95% CI)	HR (95% CI)	HR (95% CI)	HR (95% CI)
Maternal asthma					
Yes	1.01 (0.94 – 1.08)	1.08 (1.01 – 1.15)	1.04 (0.96 – 1.11)	1.02 (0.96 – 1.09)	1.03 (0.97 – 1.09)
No	1.01 (0.97 – 1.05)	1.09 (1.06 – 1.12)	1.04 (1.00 – 1.08)	1.03 (0.99 – 1.07)	1.03 (1.00 – 1.06)
P value for effect modification	0.85	0.83	0.89	0.81	0.95
Maternal smoking during pregnancy					
Yes	1.03 (0.96 – 1.10)	1.14 (1.05 – 1.23)	1.07 (0.99 – 1.14)	1.07 (1.00 – 1.14)	1.03 (0.96 – 1.09)
No	1.01 (0.97 – 1.05)	1.09 (1.06 – 1.12)	1.04 (1.00 – 1.08)	1.03 (0.99 – 1.07)	1.03 (1.00 – 1.06)
P value for effect modification	0.65	0.51	0.45	0.40	0.75
Infant sex					
Boys	1.02 (0.95 – 1.09)	1.11 (1.08 – 1.14)	1.05 (0.98 – 1.12)	1.06 (0.99 – 1.13)	1.03 (0.97 – 1.09)
Girls	1.00 (0.96 – 1.04)	1.07 (1.03 – 1.11)	1.03 (0.99 – 1.07)	1.02 (0.98 – 1.06)	1.02 (0.99 – 1.05)
P value for effect modification	0.49	0.20	0.35	0.39	0.79
Gestational age					
< 37 weeks	1.01 (0.94 – 1.08)	1.06 (1.01 – 1.12)	1.04 (0.97 – 1.12)	1.02 (0.95 – 1.09)	1.04 (0.98 – 1.10)
≥ 37 weeks	1.02 (0.98 – 1.06)	1.09 (1.06 – 1.12)	1.04 (1.00 – 1.08)	1.03 (0.99 – 1.07)	1.03 (1.00 – 1.06)
P value for effect modification	0.78	0.18	0.71	0.66	0.63
Birth weight					
< 2500 g.	1.04 (0.97 – 1.11)	1.12 (1.06 – 1.19)	1.05 (0.98 – 1.12)	1.06 (0.99 – 1.13)	1.05 (0.98 – 1.11)
≥ 2500 g.	1.01 (0.97 – 1.05)	1.08 (1.05 – 1.11)	1.03 (0.99 – 1.07)	1.03 (0.99 – 1.06)	1.03 (0.99 – 1.06)
P value for effect modification	0.65	0.79	0.62	0.59	0.55

^a Models mutually adjusted for the distributed lag weekly exposures of the selected pollutant during the pregnancy period, distributed lag monthly exposures after birth to the selected pollutant, maternal age at delivery, infant sex (except for stratified analyses by infant sex), parity, breastfeeding status at the time of discharge, maternal smoking during pregnancy (except for stratified analyses by maternal smoking), maternal atopy (except for stratified analyses by maternal asthma), gestational age (except for stratified analyses by gestational age), birth weight (except for stratified analyses by birth weight), residential greenness exposure during pregnancy, dissemination area median family income, dissemination area proportion of population who are visible minority, dissemination area proportion of the adult female population aged 25-64 years old who completed postsecondary education, a frailty term for neighbourhood in the city of Toronto and random effects for clustering within families.

Table E5. Hazard ratios (HR) and 95% confidence intervals (95% CI) for the associations between UFPs (per IQR), PM_{2.5} (per IQR) and NO₂ (per IQR) over specific periods and childhood asthma risk, restricted to those born at term with a birth weighting over 2500 grams.

Exposure period	UFPs		PM _{2.5}		NO ₂	
	IQR (count/cm ³)	Adjusted model ^a HR (95% CI)	IQR (in µg/m ³)	Adjusted model ^a HR (95% CI)	IQR (in ppb)	Adjusted model ^a HR (95% CI)
1 st trimester	10,862	1.01 (0.97 – 1.05)	3.8	1.00 (0.97 – 1.03)	9.8	1.02 (0.98 – 1.06)
2 nd trimester	10,770	1.09 (1.06 – 1.12)	3.8	1.07 (1.04 – 1.10)	9.7	1.11 (1.08 – 1.15)
3 rd trimester	10,853	1.04 (1.00 – 1.08)	3.7	1.03 (0.98 – 1.06)	9.6	1.01 (0.98 – 1.05)
Entire pregnancy	10,820	1.03 (0.99 – 1.07)	3.8	1.02 (0.99 – 1.05)	9.7	1.01 (0.97 – 1.06)
Childhood cumulative exposure	10,551	1.03 (1.00 – 1.06)	3.4	1.02 (0.99 – 1.05)	8.7	1.01 (0.97 – 1.05)

^a Model mutually adjusted for the distributed lag weekly exposures of the selected pollutant during the pregnancy period, distributed lag monthly exposures after birth to the selected pollutant, maternal age at delivery, infant sex, parity, breastfeeding status at the time of discharge, maternal smoking during pregnancy, maternal atopy, gestational age, birth weight, residential greenness exposure during pregnancy, dissemination area median family income, dissemination area proportion of population who are visible minority, dissemination area proportion of the adult female population aged 25-64 years old who completed postsecondary education, a frailty term for neighbourhood in the city of Toronto and random effects for clustering within families.
IQR, interquartile range

Figure E1. Exposure-response curves (blue solid line) and 95% confidence intervals (grey shaded area) for the associations between NO_2 (a) and $\text{PM}_{2.5}$ (b) over the second trimester of pregnancy and childhood asthma risk.

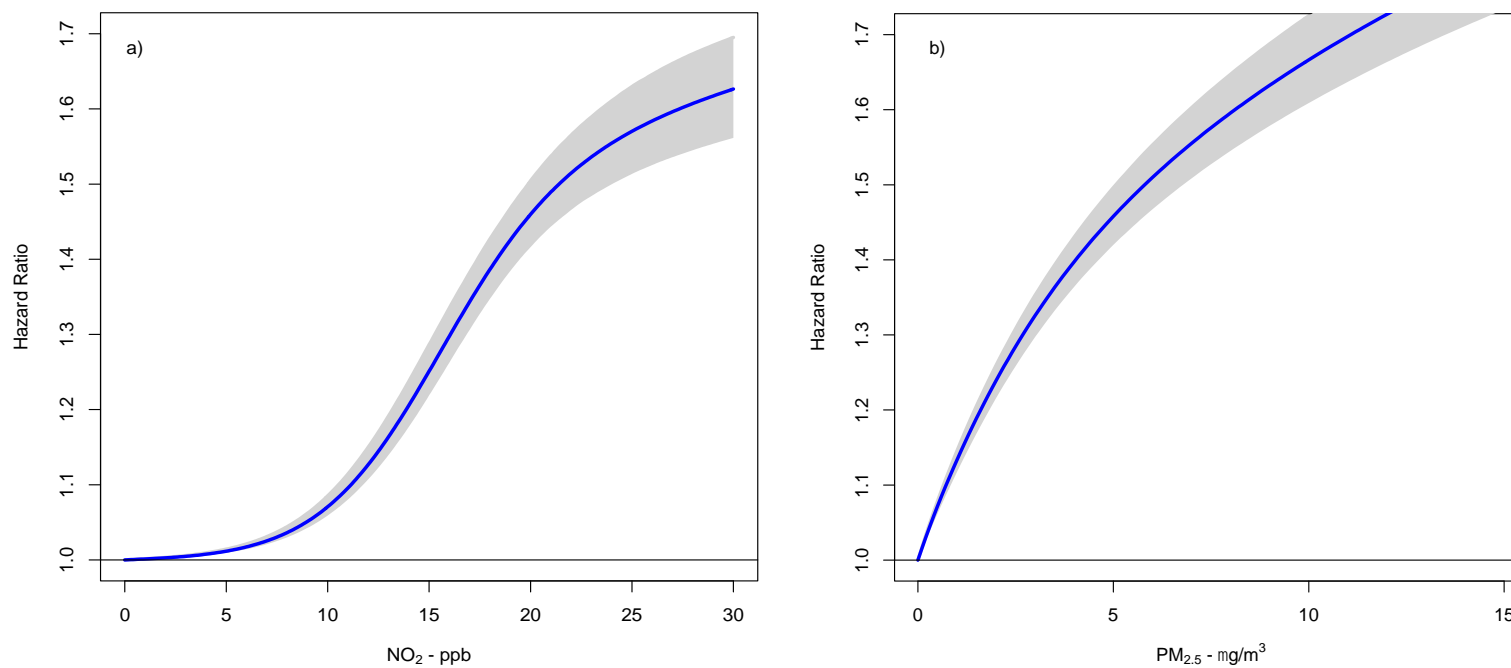


Figure E2. Directed acyclic graph for estimating the direct effect of ambient air pollution exposure on childhood asthma.

