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Air pollution exposure and adverse pregnancy outcomes in a large UK birth cohort: use of a novel spatio-temporal modelling technique[1]

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1 Supplementary material
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Table S1: Descriptive statistics of the pollutant concentration estimates by pregnancy period and by estimation technique.

		Pre conception		**1st trimester**		**2nd trimester**		**3rd trimester**	
Pollutant (µg/m³)	**Estimation technique**	Mean	*SD*	*Mean*	*SD*	*Mean*	*SD*	*Mean*	*SD*
NO2	*S-T model*	53.6	18.88	53.52	18.98	53.59	18.9	53.52	18.98
NO2	*NSTAT*	72.98	25.63	72.91	25.58	72.95	25.55	72.95	25.59
NOx	*S-T model*	76.26	34.26	76.17	34.38	76.41	34.23	76.27	34.32
NOx	*NSTAT*	125.69	26.33	125.48	56.16	125.52	56.05	125.59	56.21
PM10	*S-T model*	41.24	8.73	41.2	8.72	41.26	8.72	41.23	8.74
PM10	*NSTAT*	52.89	9.49	52.87	9.51	52.95	9.51	52.91	9.51
PM2.5	*S-T model*	22.27	4.97	22.26	4.95	22.31	4.95	22.27	4.96
PM2.5	*NSTAT*	40.46	7.24	40.48	7.17	40.45	7.22	40.53	7.24
CO (mg/m³)	*NSTAT*	0.62	0.26	0.62	0.26	0.62	0.26	0.62	0.27

Table S2: Associations between preterm birth, small for gestational age and birthweight with air pollution exposure from entire pregnancy period estimates based on the spatio-temporal model.

		PTB			SGA			Mean BW change		
Air pollutant	**Quartile cut off points**	**No. of subjects**	**OR**	**95% CI**	**No. of subjects**	**OR**	**95% CI**	**No. of subjects**	**Change**	**95%CI**
NO		11 133			28 926			11 094		
Q1	8.6 - 42.9		REF			REF			REF	
Q2	42.9 - 53.7		0.89	0.69-1.14		0.91	0.74-1.12		21	-9 - 51
Q3	53.7 - 63.6		1.00	0.77-1.29		0.92	0.75-1.15		10	-22 - 41
Q4	63.6 - 169.7		1.10	0.82-1.48		1.00	0.79-1.27		-10	-46 - 27
NOx		24 439			24 246			24 298		
Q1	13.0 - 55.4		REF			REF			REF	
Q2	55.4 - 73.8		1.04	0.86-1.26		0.98	0.83-1.15		0.5	-22 - 23
Q3	73.8 - 96.0		1.04	0.86-1.25		0.95	0.81-1.12		16	-6 - 38
Q4	96.0 - 225.9		1.07	0.89-1.28		1.06	0.91-1.23		1	-9 - 35
PM		38 608			38 331			38 422		
Q1	10.3 - 19.7		REF			REF			REF	
Q2	19.7 - 22.0		1.06	0.93-1.21		0.95	0.85-1.06		-7	-23 - 10
Q3	22.0 - 24.3		0.96	0.84-1.10		0.98	0.88-1.10		12	-4 - 29
Q4	24.3 - 41.0		0.98	0.85-1.12		1.04	0.93-1.17		5	-11 - 22
PM		38 156			37 877			37 969		
Q1	18.3 - 35.4		REF			REF			REF	
Q2	35.4 - 40.8		0.99	0.89-1.11		1.00	0.91-1.10		-3	-16 - 11
Q3	40.8 - 46.3		0.94	0.83-1.06		1.09	0.98-1.21		8	-7 - 24
Q4	46.3 - 69.8		1.05	0.90-1.22		1.14	1.01-1.29		-12	-32 - 7
CO		18 418			18 317			18 359		
Q1	0.2 - 0.4		REF			REF			REF	
Q2	0.4 - 0.6		1.01	0.87-1.19		0.97	0.84-1.11		8	-12 - 27
Q3	0.6 - 0.8		1.02	0.88-1.19		1.11	0.98-1.26		-9	-28 - 10
Q4	0.8 - 1.3		0.65	0.34-1.23		1.32	0.90-1.92		17	-47 - 81

Table S3: Associations between preterm birth and small for gestational age with air pollution estimates from the entire pregnancy based on the spatio-temporal model, with and without adjustment for body mass index and smoking.

		PTB			SGA		
Air pollution metric	**Adjustments**	**No. of subjects**	**OR**	**95% CI**	**No. of subjects**	**OR**	**95% CI**
S-T model							
NO2	*Unadjusted*	46 882	1.14	1.03-1.27	46 602	1.57	1.44-1.72
	Adjusted[1]	32 325	0.99	0.86-1.13	32 168	1.03	0.91-1.17
	Adjusted[2]	11 133	1.10	0.82-1.48	11 070	1.00	0.79-1.27
NO_x	*Unadjusted*	57 770	1.03	0.93-1.14	55 971	1.45	1.33-1.57
	Adjusted[1]	32 467	1.10	0.95-1.28	32 180	1.04	0.92-1.18
	Adjusted[2]	24 439	1.07	0.89-1.28	24 246	1.06	0.91-1.23
PM2.5	*Unadjusted*	81 058	1.00	0.92-1.09	79 714	1.29	1.04-1.20
	Adjusted[1]	51 090	1.00	0.89-1.13	50 686	0.99	0.90-1.09
	Adjusted[2]	38 608	0.98	0.85-1.12	37 591	1.04	0.93-1.17
PM10	*Unadjusted*	81 141	1.07	0.99-1.16	156 590	1.41	1.34-1.48*
	Adjusted[1]	127 774	1.03	0.96-1.10	127 061	1.17	1.10-1.24*
	Adjusted[2]	19 087	0.90	0.74-1.11	37 862	1.14	1.01-1.29*

[1]Adjusted for: maternal age, ethnicity, parity, birth season and socio-economic status
[2]Adjusted for: maternal age, ethnicity, parity, birth season, socio-economic status, body mass index and smoking

Table S4: Sensitivity analyses of the maternal white NSWPSU population for the associations between preterm birth and small for gestational age with air pollution exposure based on the spatio-temporal model by four pregnancy time periods.

Air pollution metric	Adjustments	Pregnancy time period	PTB			SGA		
			No. of subjects	OR	95% CI	No. of subjects	OR	95% CI
NO_2	*Unadjusted*	*Pre-conception*	76 338	1.07	0.98-1.16	75 845	1.27	1.17-1.37
		1st tri	76 295	1.20	1.10-1.30	75 836	1.28	1.19-1.38
		2nd tri	76 384	1.12	1.03-1.21	75 916	1.23	1.14-1.33
		3rd tri	76 360	1.17	1.07-1.27	75 888	1.26	1.17-1.36
	Adjusted[1]	*Pre-conception*	21 187	0.78	0.95-0.96	21 033	1.09	0.92-1.29
		1st tri	21 230	0.99	0.82-1.19	21 095	1.12	0.94-1.32
		2nd tri	21 141	1.05	0.87-1.26	21 002	1.09	0.92-1.28
		3rd tri	21 099	0.97	0.80-1.18	20 960	1.07	0.90-1.26
PM_{10}	*Unadjusted*	*Pre-conception*	113 077	1.08	1.02-1.16	112 418	1.23	1.16-1.31
		1st tri	113 040	1.13	1.06-1.21	112 388	1.21	1.14-1.28
		2nd tri	113 152	1.14	1.07-1.22	112 496	1.22	1.15-1.30
		3rd tri	113 038	1.14	1.07-1.22	112 381	1.26	1.18-1.33
	Adjusted[1]	*Pre-conception*	27 708	0.89	0.75-1.05	27 520	1.11	0.95-1.28
		1st tri	27 693	1.06	0.90-1.25	27 505	1.12	0.96-1.29
		2nd tri	27 700	0.95	0.80-1.12	27 512	1.07	0.93-1.25
		3rd tri	27 698	0.95	0.81-1.12	27 510	1.17	1.01-1.35

[1]Adjusted for: maternal age, ethnicity, parity, birth season, socio-economic status, body mass index and smoking

Table S5: Sensitivity analyses of the maternal primiparous NWPSU population for the associations between preterm birth and small for gestational age with air pollution exposure based on the spatio-temporal model by four pregnancy time periods.

Air pollution metric	Adjustments	Pregnancy time period	PTB			SGA		
			No. of subjects	OR	95% CI	No. of subjects	OR	95% CI
NO_2	*Unadjusted*	*Pre-conception*	38 600	0.99	0.88-1.11	38 274	1.43	1.30-1.57
		1st tri	38 651	1.11	0.99-1.25	38 344	1.41	1.29-1.55
		2nd tri	38 759	1.05	0.94-1.18	38 450	1.32	1.20-1.44
		3rd tri	38 562	1.05	0.94-1.18	38 226	1.46	1.33-1.60
	Adjusted[1]	*Pre-conception*	8 732	0.72	0.53-0.98	8 677	1.00	0.80-1.26
		1st tri	8 823	0.95	0.71-1.29	8 773	1.13	0.90-1.43
		2nd tri	8 776	0.88	0.66-1.19	8 724	0.90	0.72-1.13
		3rd tri	8 715	0.76	0.56-1.03	8 658	1.17	0.93-1.48
PM_{10}	*Unadjusted*	*Pre-conception*	55 172	1.31	1.21-1.40	55 172	1.31	1.21-1.40
		1st tri	55 104	1.33	1.24-1.43	55 104	1.24	1.24-1.43
		2nd tri	55 172	1.29	1.20-1.39	55 172	1.29	1.20-1.39
		3rd tri	55 158	1.33	1.23-1.43	55 158	1.33	1.23-1.43
	Adjusted[1]	*Pre-conception*	11 369	1.06	0.87-1.28	11 369	1.06	0.87-1.28
		1st tri	11 368	1.11	0.91-1.34	11 368	1.11	0.91-1.34
		2nd tri	11 362	1.12	0.93-1.36	11 362	1.12	0.93-1.36
		3rd tri	11 370	0.93	0.77-1.14	11 370	0.93	0.77-1.14

[1]Adjusted for: maternal age, ethnicity, parity, birth season, socio-economic status, body mass index and smoking

		PTB			SGA		
Air pollution metric	**Adjustments**	**No. of subjects**	**OR**	**95% CI**	**No. of subjects**	**OR**	**95% CI**
S-T model							
NO_2	*Unadjusted*	30 654	1.13	0.98-1.29	30 461	1.66	1.47-1.87
	Adjusted[1]	9152	1.09	0.79-1.50	9102	0.97	0.75-1.26
PM_{10}	*Unadjusted*	79 687	1.29	1.16-1.43	79 282	1.57	1.43-1.71
	Adjusted[1]	18 575	1.10	0.57-1.39	18 460	1.12	0.93-1.36
Monitoring stations							
NO_2	*Unadjusted*	30 654	1.02	0.90-1.16	30 461	1.28	1.16-1.43
	Adjusted[1]	9152	1.01	0.78-1.32	9120	0.83	0.68-1.02
PM_{10}	*Unadjusted*	73 687	1.07	0.99-1.16	79 282	1.01	0.94-1.08
	Adjusted[1]	18 575	0.93	0.76-1.15	18460	1.09	0.92-1.28

[1]Adjusted for: maternal age, ethnicity, parity, birth season, socio-economic status, body mass index and smoking

Figure S1: Map of North West England study location

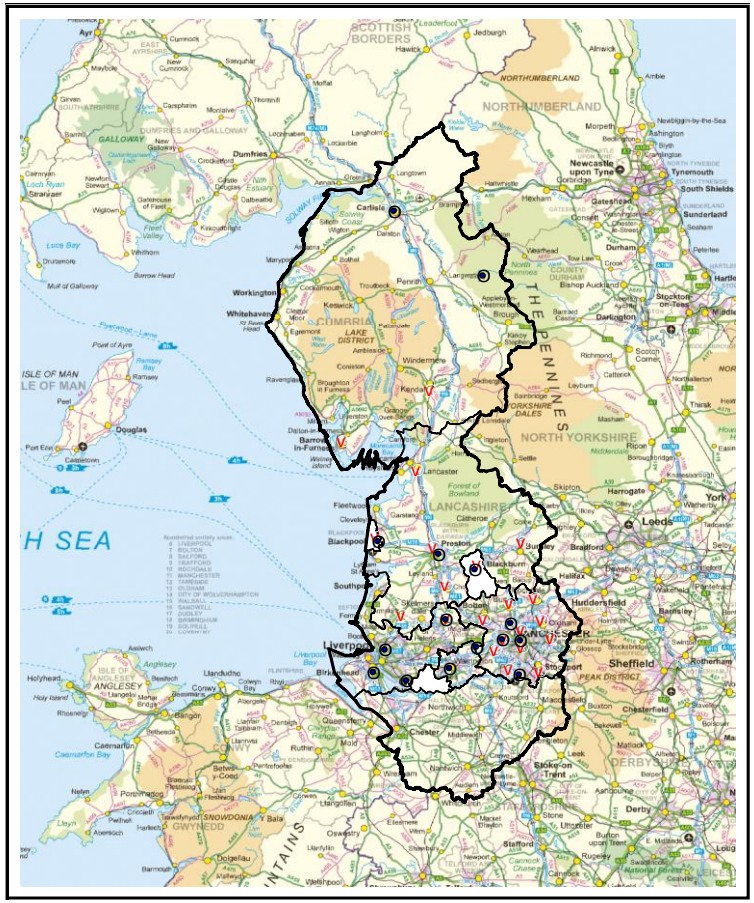


Figure S2: Annual mean modelled NO_2 concentrations from 2008 in NW England.

