

Supplementary Table S1. Distributions of characteristics in participants between term birth and PTB

variable	Term birth <i>n</i> =1752	PTB <i>n</i> =94	Total <i>n</i> =1846	<i>P</i>
Pregnant women				
Maternal age (years)	26.4±3.62	26.0±4.19	26.4 ± 3.66	0.378
Gestational age (weeks)	39.2±1.11	33.1±3.22	38.9 ± 1.88	< 0.001 ^a
Preconception BMI(kg/m²)	22.3±3.50	22.1±3.45	22.3 ± 3.50	0.655
< 18.5	184 (10.5)	12 (12.8)	196 (10.6)	0.725
18.5-24	1122 (64.0)	57 (60.6)	1179 (63.9)	
≥ 24	445 (25.4)	25 (26.6)	470 (25.5)	
Missing	1 (0.05)	0 (0)	1 (0.05)	
Education level, <i>n</i> (%)				0.755
Middle school or below	872 (49.8)	49 (52.1)	921 (49.9)	
High school or above	875 (49.9)	45 (47.9)	920 (49.8)	
Missing	5 (0.3)	0 (0)	5 (0.3)	
Smoking, <i>n</i> (%)				0.325
No	1636 (93.4)	91 (96.8)	1727 (93.6)	
Yes	109 (6.2)	3 (3.2)	112 (6.1)	
Missing	7 (0.4)	0 (0)	7 (0.4)	
Parity, <i>n</i> (%)				0.446
Primiparous	694 (39.6)	33 (35.1)		
Multiparous	1058 (60.4)	61 (64.9)		
Season of conception, <i>n</i> (%)				0.934
Cold	784 (44.7)	43 (45.7)	827 (44.8)	
Warm	968 (55.3)	51 (54.3)	1019 (55.2)	
Infant sex, <i>n</i> (%)				< 0.001
Boys	842 (48.1)	62 (66.0)	904 (49.0)	
Girls	910 (51.9)	30 (31.9)	940 (50.9)	
Missing	0 (0)	2 (2.1)	2 (0.1)	
Districts, <i>n</i> (%)				<0.001
Luoyang City				
Yichuan County	430 (24.5)	8 (8.5)	438 (23.7)	
Xinxiang City				
Hui County	332 (18.9)	4 (4.3)	336 (18.2)	
Jiaozuo City				
Boai County	251 (14.3)	22 (23.4)	273 (14.8)	
Mengzhou County	232 (13.2)	14 (14.9)	246 (13.3)	
Qinyang County	250 (14.3)	23 (24.5)	273 (14.8)	
Wen County	257 (14.7)	23 (24.5)	280 (15.2)	
H19 polymorphism				
rs2067051				
CC	951 (54.3)	59 (62.8)	1010 (54.7)	0.179
CT	683 (39.0%)	32 (34.0)	715 (38.7)	
TT	118 (6.7%)	3 (3.2)	121 (6.6)	
C ^b	2585 (73.8)	150 (79.8)	2735 (74.1)	0.080
T ^b	919 (26.2)	38 (20.2)	957 (25.9)	
rs2107425				
CC	571 (32.6)	15 (16.0)	586 (31.7)	0.002
CT	849 (48.5)	61 (64.9)	910 (49.3)	
TT	332 (18.9)	18 (19.1)	350 (19.0)	
C ^b	1991 (56.8)	91 (48.4)	2082 (56.4)	0.028
T ^b	1513 (43.2)	97 (51.6)	1610 (43.6)	

Note. ^a: Gestational age does not satisfy the homogeneity of variance, used *Wilcoxon* rank-test. PTB, preterm birth. ^b: Frequency of allele: NC=2NCC+NCT, NT=2NTT+NCT.

Supplementary Table S2. General information of SNPs in *H19*

	SNP	Position	Ancestral Allele	Frequency (CHB)
<i>H19</i>	rs2067051	Chr11:1996938	C	C=0.752 T=0.248
	rs2107425	Chr11:1999845	C	C=0.583 T=0.417

Note. From Ensembl (Asia): <http://asia.ensembl.org/index.html>

Supplementary Table S3. The condition of Multiple PCR reaction

	Denaturation	Annealing	Extension	Cycle
1step	95°C 2min			1
2step	94°C 20sec	65°C 40sec(-0.5°C/cycle)	72°C 1.5min	11
3step	94°C 20sec	59°C 30sec	72°C 1.5min	24
4step			72°C 2.0min	4°C 1

Supplementary Table S4. The primer information of multiple PCR reaction and ligation Reaction

Loci	Multiple PCR Reaction	
	F-seq (5'-3')	R-seq (5'-3')
rs2067051	AGGGCATACAGCGTCACCAAGT	TCACCCACCGCAATTCATTTAG
rs2107425	TGGATAATGCCCGACCTGAAGA	GGGGTCATCTGGGAATAGGACA
	Ligation Reaction	
	Seq (5'-3')	
	rs2067051FC	TTCCGCGTTCGGACTGATATCGCTTCGCCCTCCTGGTCAC
rs2067051	rs2067051FT	TACGGTTATTCGGGCTCCTGTCGCTTCGCCCTCCTGGTCAT
	rs2067051FP	GTCCTGCTGCAACTCCCCGATTTTTTTTTT
	rs2107425FC	TTCCGCGTTCGGACTGATAT GAAGATCTGGTGCGGCTACC
rs2107425	rs2107425FT	TACGGTTATTCGGGCTCCTGT GAAGATCTGGTGCGGCTGCT
	rs2107425FP	ATGAGTGCCTATTCCCAGATGACC TTTTTTTTTTTTTTTTTT

Supplementary Table S5. Variable Assignment

Variable name	Assignment
Maternal age	Continuous variable
Gestational age	Continuous variable
Preconception BMI	Continuous variable
PTB	0=Term birth, 1=PTB
Educational level	1=Middle school or below, 2=High school or above
Smoking	1=Yes, 2=No
Parity	1=Primiparous, 2=Multiparous
Season of conception	1=Cold, 2=Warm
Infant sex	1=Boy, 2=Girl

Supplementary Table S6. Correlation coefficient and dual pollutant model between PM_{2.5} constituents and other air pollutants during the entire pregnancy

	PM ₁₀	CO	SO ₂	NO ₂	O ₃					
Person correlation coefficient (all <i>P</i> < 0.05)										
PM _{2.5}	0.472	0.117	0.395	0.579	-0.307					
BC	0.523	0.156	0.401	0.578	-0.353					
OM	0.513	0.120	0.389	0.595	-0.343					
NO ₃ ⁻	0.521	0.148	0.396	0.596	-0.382					
NH ₄ ⁺	0.490	0.138	0.398	0.616	-0.366					
SO ₄ ²⁻	0.387	0.095	0.408	0.560	-0.202					
T	-0.693	-0.340	-0.256	-0.601	0.905					
RH	-0.498	0.078	-0.142	-0.273	0.293					
PM_{2.5} constituents-Air pollutants models										
	<i>OR</i> (95% <i>CI</i>)	<i>P</i>	<i>OR</i> (95% <i>CI</i>)	<i>P</i>	<i>OR</i> (95% <i>CI</i>)	<i>P</i>	<i>OR</i> (95% <i>CI</i>)	<i>P</i>	<i>OR</i> (95% <i>CI</i>)	<i>P</i>
PM _{2.5}	1.31(1.06,1.64)	0.014	1.44(1.17,1.78)	0.001	1.31(1.05,1.64)	0.019	1.68(1.33,2.15)	<0.001	1.40(1.14,1.73)	0.002
BC	1.86(1.08,3.25)	0.027	2.33(1.38,3.99)	0.002	1.88(1.08,3.34)	0.027	3.46(1.95,6.31)	<0.001	2.26(1.35,3.83)	0.002
OM	1.13(1.01,1.25)	0.032	1.18(1.07,1.31)	0.001	1.13(1.01,1.26)	0.031	1.27(1.14,1.44)	<0.001	1.17(1.05,1.30)	0.003
NO ₃ ⁻	1.10(1.01,1.20)	0.035	1.14(1.05,1.24)	0.002	1.10(1.00,1.20)	0.041	1.20(1.10,1.32)	<0.001	1.13(1.04,1.23)	0.004
NH ₄ ⁺	1.18(1.02,1.36)	0.026	1.25(1.09,1.44)	0.002	1.17(1.01,1.35)	0.042	1.38(1.18,1.61)	<0.001	1.22(1.07,1.40)	0.004
SO ₄ ²⁻	1.20(1.06,1.37)	0.005	1.26(1.11,1.44)	<0.001	1.19(1.04,1.37)	0.011	1.41(1.22,1.64)	<0.001	1.24(1.09,1.41)	0.001

Note. PTB, preterm birth; PM₁₀, inhalable particles; CO, carbon monoxide; SO₂, sulfur dioxide; NO₂, nitrogen dioxide; O₃, ozone; PM_{2.5}, fine particulate matter; BC, black carbon; OM, organic matter; NO₃⁻, nitrate; NH₄⁺, ammonium; SO₄²⁻, sulfate. Considering the high correlation (*r*=0.905) between O₃ and T, T was not adjusted in model “PM_{2.5} constituents-O₃”.

Supplementary Table S7. Association of WQS indices of per IQR increment of PM_{2.5} constituents with PTB risk

	OR (95% CI)	P
Entire Pregnancy	1.68(1.19,2.36)	0.003
Trimester 1	1.51(1.07,2.14)	0.018
Trimester 2	1.44(0.95,2.18)	0.087
Trimester 3	1.98(1.25,3.12)	0.003

Note. WQS, weighted quantile sum; PTB, preterm birth.

Supplementary Table S8. Association between SNPs and PTB risk

SNPs	Crude		Adjusted	
	OR (95% CI)	P	OR (95% CI)	P
rs2067051				
CC	Reference		Reference	
CT	0.76(0.48,1.17)	0.212	0.80(0.50,1.23)	0.303
TT	0.41(0.10,1.13)	0.137	0.44(0.11,1.24)	0.178
CT+TT	0.70(0.46,1.08)	0.109	0.74(0.48,1.14)	0.177
C ^a	Reference		Reference	
T ^a	0.71(0.49,1.01)	0.068	0.75(0.51,1.06)	0.116
rs2107425				
CC	Reference		Reference	
CT	2.74(1.58,5.04)	<0.001	2.60(1.50,4.81)	0.001
TT	2.06(1.03,4.21)	0.042	1.93(0.95,3.98)	0.070
CT+TT	2.55(1.50,4.63)	0.001	2.42(1.42,4.42)	0.002
C ^a	Reference		Reference	
T ^a	1.40(1.05,1.88)	0.024	1.36(1.01,1.84)	0.043

Note. ^a: The frequency of allele was calculated following the formula: NC=2NCC+NCT,

NT=2NTT+NCT. PTB, preterm birth

Supplementary Table S9. Sensitivity analysis of PTB risk associated with exposure to PM_{2.5} and its constituents

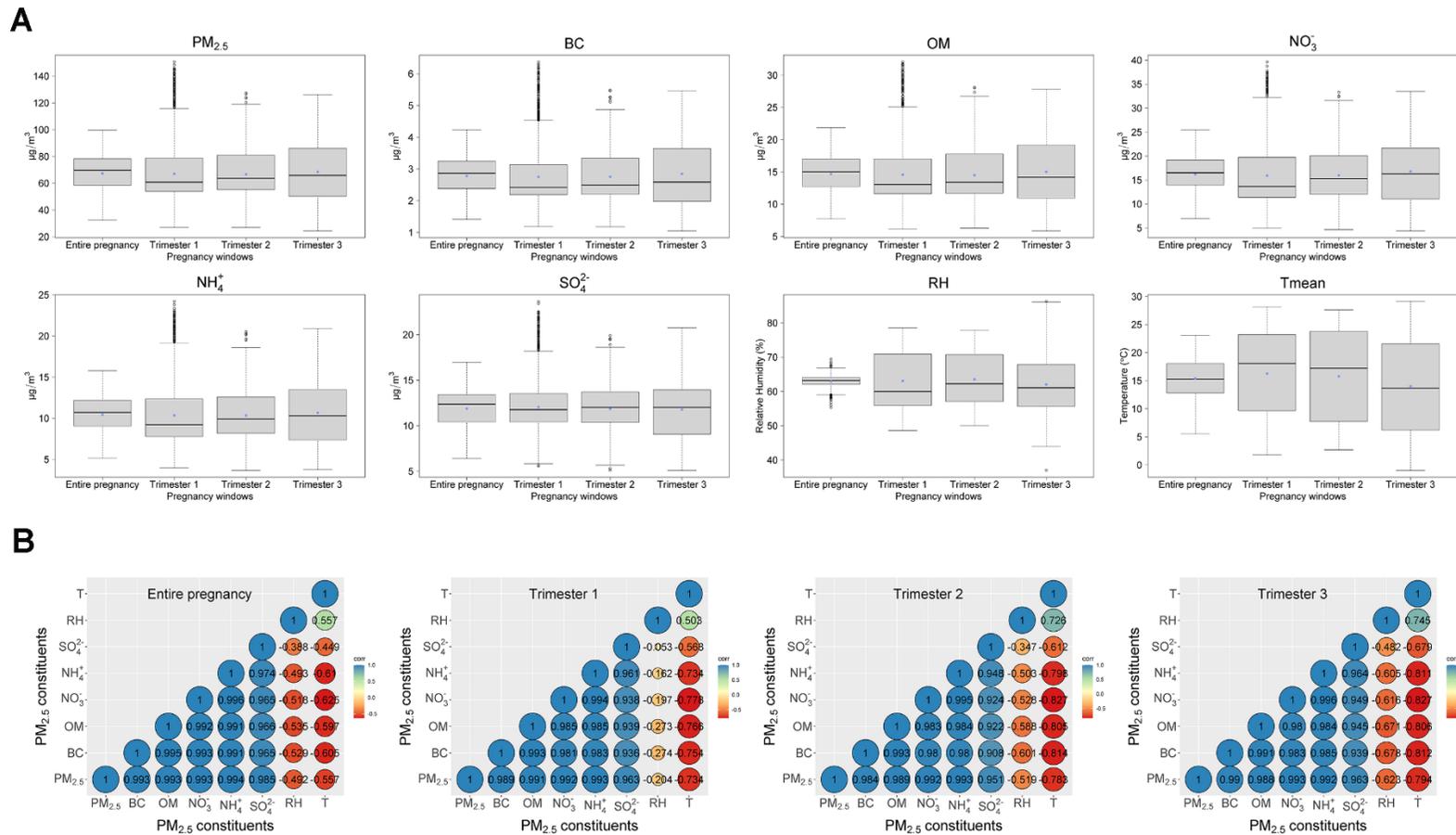
	Models			
	OR (95% CI) ^a	P	OR (95% CI) ^b	P
PM_{2.5}				
Entire pregnancy	1.52(1.23,1.91)	<0.001	1.19(1.47,1.83)	<0.001
Trimester 1	1.26(1.09,1.44)	0.001	1.07(1.23,1.41)	0.003
Trimester 2	1.15(0.97,1.36)	0.118	0.98(1.16,1.37)	0.079
Trimester 3	1.30(1.10,1.54)	0.002	1.10(1.29,1.52)	0.002
BC				
Entire pregnancy	2.81(1.63,4.94)	<0.001	1.52(2.57,4.43)	<0.001
Trimester 1	1.70(1.24,2.33)	<0.001	1.19(1.62,2.20)	0.002
Trimester 2	1.14(0.76,1.70)	0.535	0.80(1.19,1.75)	0.393
Trimester 3	1.67(1.16,2.40)	0.005	1.16(1.66,2.36)	0.006
OM				
Entire pregnancy	1.22(1.09,1.36)	<0.001	1.08(1.20,1.33)	<0.001
Trimester 1	1.11(1.04,1.19)	0.001	1.03(1.10,1.17)	0.003
Trimester 2	1.04(0.96,1.12)	0.386	0.97(1.05,1.13)	0.266
Trimester 3	1.10(1.02,1.19)	0.014	1.02(1.10,1.18)	0.015
NO₃⁻				
Entire pregnancy	1.17(1.07,1.28)	<0.001	1.06(1.15,1.26)	0.001
Trimester 1	1.08(1.02,1.14)	0.004	1.02(1.07,1.13)	0.008
Trimester 2	1.04(0.98,1.11)	0.193	0.99(1.05,1.12)	0.118
Trimester 3	1.09(1.03,1.16)	0.005	1.02(1.09,1.16)	0.007
NH₄⁺				
Entire pregnancy	1.30(1.12,1.50)	<0.001	1.10(1.26,1.46)	0.001
Trimester 1	1.13(1.04,1.23)	0.004	1.03(1.12,1.21)	0.009
Trimester 2	1.06(0.96,1.18)	0.259	0.97(1.08,1.20)	0.164
Trimester 3	1.15(1.04,1.27)	0.008	1.03(1.14,1.26)	0.010
SO₄²⁻				
Entire pregnancy	1.31(1.15,1.50)	<0.001	1.13(1.28,1.46)	<0.001
Trimester 1	1.17(1.07,1.28)	<0.001	1.05(1.15,1.25)	0.002
Trimester 2	1.10(0.99,1.23)	0.063	1.01(1.11,1.23)	0.042
Trimester 3	1.19(1.08,1.33)	<0.001	1.08(1.19,1.32)	0.001

Note. ^a: Models limited the population to mothers aged 18-35, adjusting for maternal age, preconception BMI, the season of conception, education level, smoking status, parity, infant sex, T (°C), and RH (%). ^b: Models adjusted for maternal age, preconception BMI, the season of conception, education level, smoking status, infant sex, T (°C), and RH (%). The OR (95% CI) was assessed per 10.0 ug/m³ in PM_{2.5}, as well as per 1.0 ug/m³ increment in BC, OM, NO₃⁻, NH₄⁺, and SO₄²⁻ in all models.

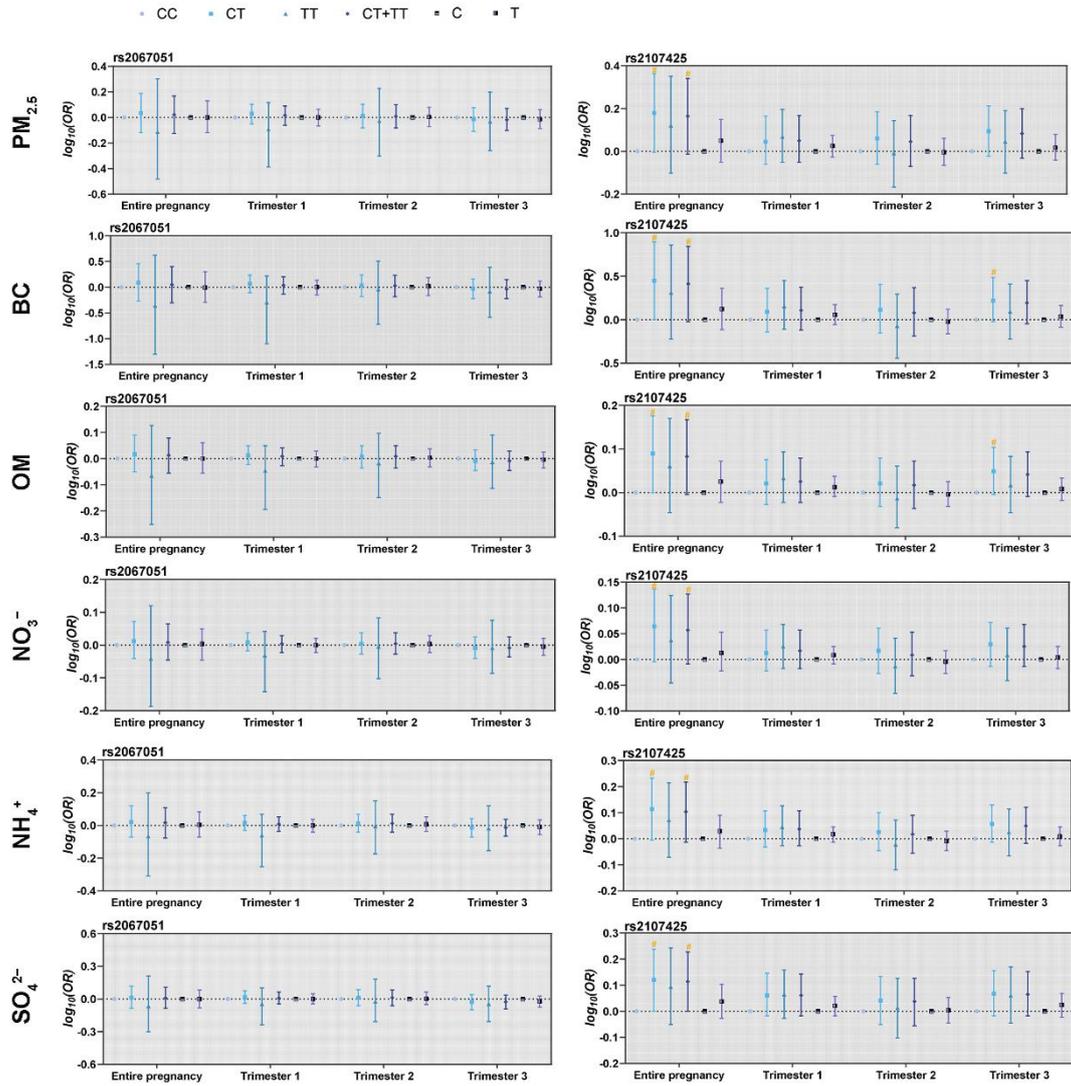
Supplementary Table S10. The summary information for GMDR.

Model^a	TBA	P-value	CVC
rs2107425	0.5404	0.1719	10/10
PM _{2.5} *rs2107425	0.5238	0.3770	9/10
PM _{2.5} *rs2107425*rs2067051	0.5815	0.0547	10/10
rs2107425	0.5404	0.1719	10/10
BC*rs2107425	0.5077	0.3770	8/10
BC*rs2107425*rs2067051	0.5708	0.1719	10/10
rs2107425	0.5404	0.1719	10/10
OM*rs2107425	0.5451	0.1719	6/10
OM*rs2107425*rs2067051	0.5645	0.1719	10/10
rs2107425	0.5404	0.1719	10/10
NO ₃ ⁻ *rs2107425	0.5150	0.6230	8/10
NO ₃ ⁻ *rs2107425*rs2067051	0.5713	0.1719	10/10
rs2107425	0.5404	0.1719	10/10
NH ₄ ⁺ *rs2107425	0.5113	0.6230	8/10
NH ₄ ⁺ *rs2107425*rs2067051	0.5699	0.1719	10/10
rs2107425	0.5404	0.1719	10/10
SO ₄ ²⁻ *rs2107425	0.5343	0.0547	10/10
SO ₄ ²⁻ *rs2107425*rs2067051	0.5617	0.1719	10/10

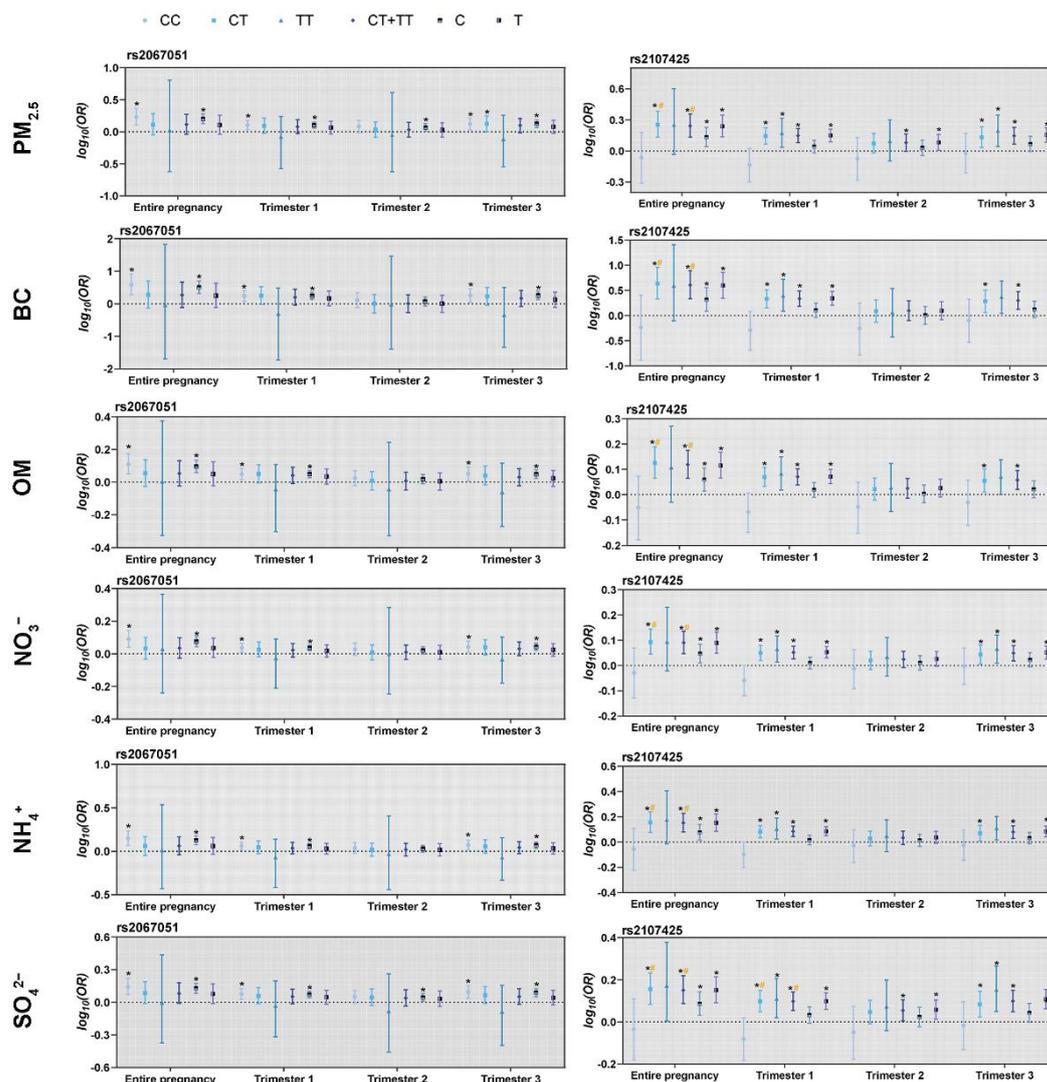
Note. ^a: Models adjusted for maternal age, preconception BMI, season of conception, education level, smoking exposure, parity, infant sex, T (°C), and RH (%). TBA, testing balanced accuracy; CVC, cross-validation consistency.



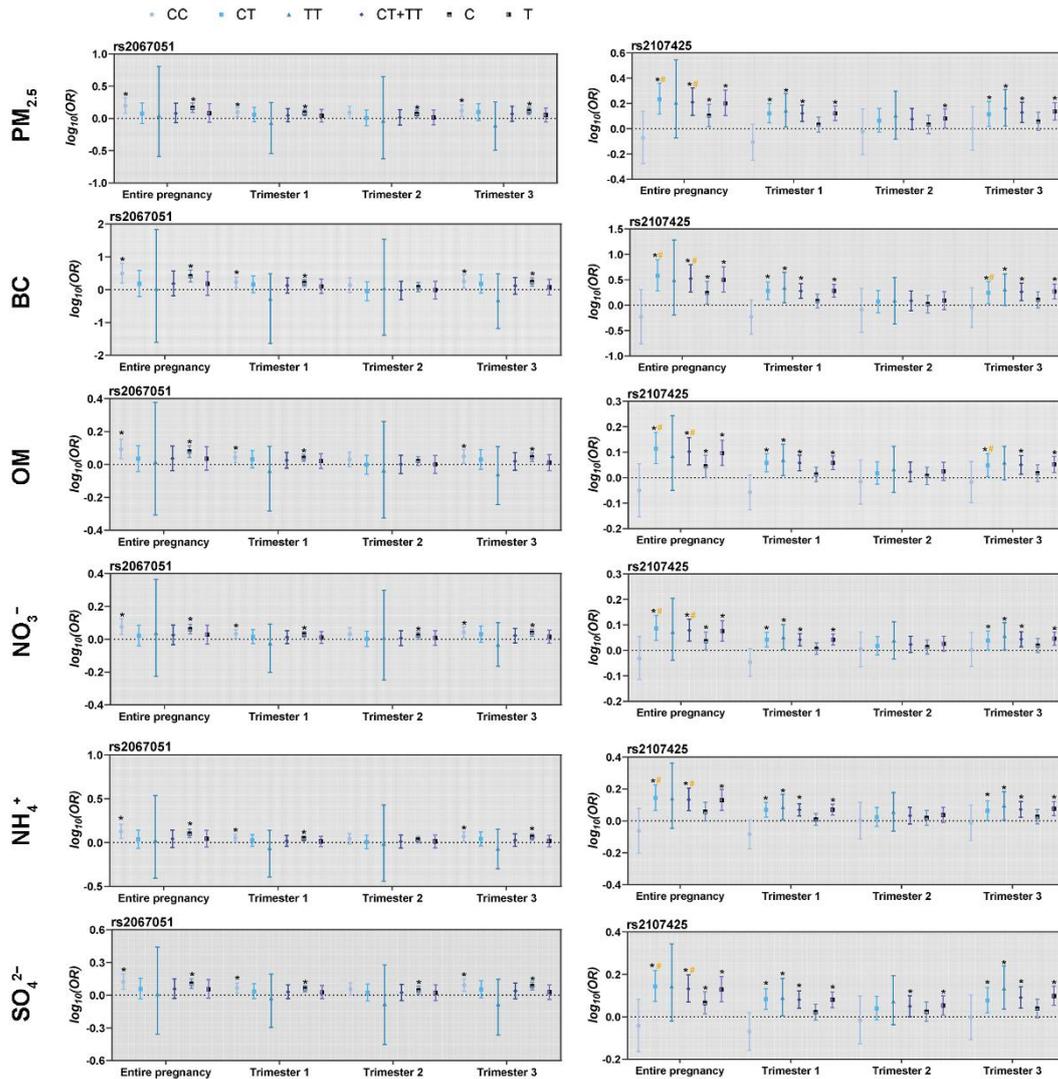
Supplementary Figure S1. PM_{2.5} constituents and meteorological exposure level (A) and their correlations (B). PM_{2.5}, fine particulate matter; BC, black carbon; OM, organic matter; NO₃⁻, nitrate; NH₄⁺, ammonium; SO₄²⁻, sulfate. Tmean, mean of the temperature; RH, relative humidity.



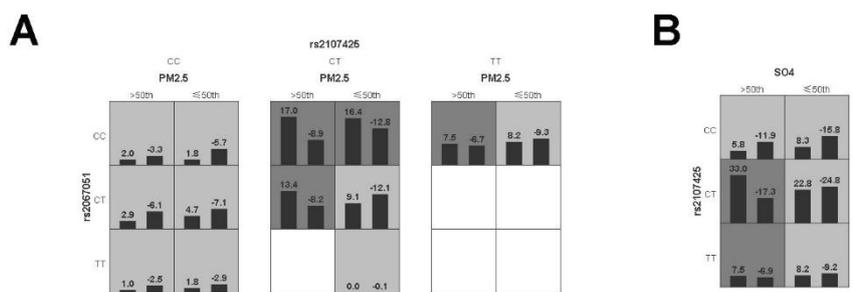
Supplementary Figure S2. Interaction between PM_{2.5} constituents and SNPs on PTB risks. PM_{2.5}, fine particulate matter; BC, black carbon; OM, organic matter; NO₃⁻, nitrate; NH₄⁺, ammonium; SO₄²⁻, sulfate. #: *P*-interaction < 0.10, compared with the CC genotype or C allele in rs2067051 or rs2107025.



Supplementary Figure S3. Association between PTB risk and $PM_{2.5}$ constituents among mothers (aged 18 to 35) stratified by genotypes. *: denoted a $P < 0.05$. #: P -interaction < 0.10 , compared with the CC genotype or C allele in rs2067051 or rs2107025. All models were adjusted for maternal age, preconception BMI, the season of conception, education level, smoke exposure, parity, infant sex, T ($^{\circ}C$), and RH (%). $PM_{2.5}$, fine particulate matter; BC, black carbon; OM, organic matter; NO_3^- , nitrate; NH_4^+ , ammonium; SO_4^{2-} , sulfate.



Supplementary Figure S4. Association between PTB risk and PM_{2.5} constituents stratified by maternal genotypes (without adjusted parity). * denoted a $P < 0.05$. **#**: $P_{\text{-interaction}} < 0.10$, compared with the CC genotype or C allele in rs2067051 or rs2107425. All models were adjusted for maternal age, preconception BMI, the season of conception, education level, smoke exposure, infant sex, T (°C), and RH (%). PM_{2.5}, fine particulate matter; BC, black carbon; OM, organic matter; NO₃⁻, nitrate; NH₄⁺, ammonium; SO₄²⁻, sulfate.



Supplementary Figure S5. The interaction model among rs2067051, rs2107425, PM_{2.5} (A), as well as between rs2107425 and SO₄²⁻ (B). In each cell, the black bar on the left and right represent positive and negative scores, respectively. The high-risk interaction combinations are indicated by dark shading, low-risk interaction combinations by light gray shading, and white cells are unclassified. The highest sum score is the highest risk combination. PM_{2.5}, fine particulate matter; SO₄²⁻, sulfate.