

Supplementary Table S1. Detailed information of each single nucleotide polymorphism selected in our study

SNP	Effect allele	F-statistic	R ²	Exposure	Exposure				Outcome	Outcome			
					beta	se	pval	eaf		beta	se	pval	eaf
rs114708313	T	30.076	7.420E-05	PM _{2.5}	0.025	0.004	4.200E-08	0.066	Crohn's disease	2.531E-04	2.440E-04	2.997E-01	0.067
rs1372504	A	30.674	7.077E-05	PM _{2.5}	0.012	0.002	3.100E-08	0.374	Crohn's disease	-1.056E-04	1.172E-04	3.679E-01	0.373
rs1537371	A	33.149	7.651E-05	PM _{2.5}	0.012	0.002	8.500E-09	0.500	Crohn's disease	-1.802E-05	1.135E-04	8.738E-01	0.496
rs6749467	A	32.228	7.642E-05	PM _{2.5}	-0.012	0.002	1.400E-08	0.466	Crohn's disease	-8.829E-05	1.152E-04	4.434E-01	0.467
rs72642437	T	35.119	9.894E-05	PM _{2.5}	0.113	0.019	3.100E-09	0.004	Crohn's disease	4.525E-04	1.224E-03	7.116E-01	0.003
rs77205736	T	31.399	7.273E-05	PM _{2.5}	0.014	0.002	2.100E-08	0.274	Crohn's disease	-5.372E-05	1.272E-04	6.729E-01	0.274
rs77255816	T	30.041	6.933E-05	PM _{2.5}	0.031	0.006	4.200E-08	0.037	Crohn's disease	3.314E-04	3.031E-04	2.742E-01	0.036
rs12203592	T	69.918	1.573E-04	PM _{2.5}	0.022	0.003	6.200E-17	0.213	ulcerative colitis	2.908E-04	1.617E-04	7.200E-02	0.220
rs1372504	A	30.674	7.077E-05	PM _{2.5}	0.012	0.002	3.100E-08	0.374	ulcerative colitis	-5.507E-05	1.404E-04	6.900E-01	0.374
rs1537371	A	33.149	7.651E-05	PM _{2.5}	0.012	0.002	8.500E-09	0.500	ulcerative colitis	9.277E-05	1.358E-04	4.900E-01	0.501
rs6749467	A	32.228	7.642E-05	PM _{2.5}	-0.012	0.002	1.400E-08	0.466	ulcerative colitis	-2.473E-04	1.380E-04	7.300E-02	0.465
rs77205736	T	31.399	7.273E-05	PM _{2.5}	0.014	0.002	2.100E-08	0.274	ulcerative colitis	1.130E-04	1.524E-04	4.600E-01	0.275
rs4915350	C	33.933	7.819E-05	PM _{2.5} absorbance	0.046	0.008	5.700E-09	0.019	Crohn's disease	-7.632E-05	4.327E-04	8.600E-01	0.018
rs59727727	C	30.823	6.941E-05	PM _{2.5} absorbance	0.018	0.003	2.800E-08	0.122	Crohn's disease	3.910E-06	1.777E-04	9.824E-01	0.115
rs77205736	T	29.911	6.813E-05	PM _{2.5} absorbance	0.013	0.002	4.500E-08	0.274	Crohn's disease	-5.372E-05	1.272E-04	6.729E-01	0.274
rs79475047	C	36.427	8.255E-05	PM _{2.5} absorbance	0.040	0.007	1.600E-09	0.027	Crohn's disease	-6.937E-06	3.516E-04	9.843E-01	0.027
rs12203592	T	41.539	9.189E-05	PM _{2.5} absorbance	0.017	0.003	1.200E-10	0.213	ulcerative colitis	2.908E-04	1.617E-04	7.200E-02	0.220
rs77205736	T	29.911	6.813E-05	PM _{2.5} absorbance	0.013	0.002	4.500E-08	0.274	ulcerative colitis	1.130E-04	1.524E-04	4.600E-01	0.275
rs884436	T	29.070	6.660E-05	PM _{2.5} absorbance	0.012	0.002	7.000E-08	0.485	ulcerative colitis	6.223E-05	1.366E-04	6.500E-01	0.486

Note. PM_{2.5}, particulate matter air pollution; *eaf*, effect allele frequency; *se*, standard error; *pval*, P-value.

Supplementary Table S2. Single mendelian randomization analyses

Exposure	Outcome	SNP	<i>beta</i>	<i>se</i>	<i>p</i>
Particulate matter air pollution (PM _{2.5})	Crohn's disease	rs114708313	0.010	0.010	2.997E-01
Particulate matter air pollution (PM _{2.5})	Crohn's disease	rs1372504	-0.009	0.010	3.679E-01
Particulate matter air pollution (PM _{2.5})	Crohn's disease	rs1537371	-0.001	0.009	8.738E-01
Particulate matter air pollution (PM _{2.5})	Crohn's disease	rs6749467	0.007	0.009	4.434E-01
Particulate matter air pollution (PM _{2.5})	Crohn's disease	rs72642437	0.004	0.011	7.116E-01
Particulate matter air pollution (PM _{2.5})	Crohn's disease	rs77205736	-0.004	0.009	6.729E-01
Particulate matter air pollution (PM _{2.5})	Crohn's disease	rs77255816	0.011	0.010	2.742E-01
Particulate matter air pollution (PM _{2.5})	Crohn's disease	All – Inverse variance weighted	0.002	0.004	5.168E-01
Particulate matter air pollution (PM _{2.5})	Crohn's disease	All – MR Egger	0.012	0.009	2.531E-01
Particulate matter air pollution (PM _{2.5})	ulcerative colitis	rs12203592	0.013	0.007	7.207E-02
Particulate matter air pollution (PM _{2.5})	ulcerative colitis	rs1372504	-0.004	0.011	6.949E-01
Particulate matter air pollution (PM _{2.5})	ulcerative colitis	rs1537371	0.007	0.011	4.945E-01
Particulate matter air pollution (PM _{2.5})	ulcerative colitis	rs6749467	0.020	0.011	7.326E-02
Particulate matter air pollution (PM _{2.5})	ulcerative colitis	rs77205736	0.008	0.011	4.585E-01
Particulate matter air pollution (PM _{2.5})	ulcerative colitis	All – Inverse variance weighted	0.010	0.004	2.648E-02
Particulate matter air pollution (PM _{2.5})	ulcerative colitis	All – MR Egger	0.021	0.019	3.521E-01
Particulate matter air pollution (PM _{2.5}) absorbance	Crohn's disease	rs4915350	-0.002	0.009	8.600E-01
Particulate matter air pollution (PM _{2.5}) absorbance	Crohn's disease	rs59727727	0.000	0.010	9.824E-01
Particulate matter air pollution (PM _{2.5}) absorbance	Crohn's disease	rs77205736	-0.004	0.010	6.729E-01
Particulate matter air pollution (PM _{2.5}) absorbance	Crohn's disease	rs79475047	0.000	0.009	9.843E-01
Particulate matter air pollution (PM _{2.5}) absorbance	Crohn's disease	All – Inverse variance weighted	-0.001	0.005	7.692E-01
Particulate matter air pollution (PM _{2.5}) absorbance	Crohn's disease	All – MR Egger	0.000	0.010	9.683E-01
Particulate matter air pollution (PM _{2.5}) absorbance	ulcerative colitis	rs12203592	0.018	0.010	7.207E-02
Particulate matter air pollution (PM _{2.5}) absorbance	ulcerative colitis	rs77205736	0.009	0.012	4.585E-01
Particulate matter air pollution (PM _{2.5}) absorbance	ulcerative colitis	rs884436	0.005	0.012	6.487E-01
Particulate matter air pollution (PM _{2.5}) absorbance	ulcerative colitis	All – MR Egger	0.046	0.042	4.693E-01
Particulate matter air pollution (PM _{2.5}) absorbance	ulcerative colitis	All – Inverse variance weighted	0.012	0.004	2.425E-03

Note. SNP, single nucleotide polymorphism; *b*, beta; *se*, standard error; *pval*, *P*-value.

Supplementary Table S3. MR-Egger regression analyses on detecting directional pleiotropy

Exposure	Outcome	egger_intercept	<i>se</i>	<i>pval</i>
Particulate matter air pollution (PM _{2.5})	Crohn's disease	-1.600E-04	1.400E-04	0.312
Particulate matter air pollution (PM _{2.5})	ulcerative colitis	-1.700E-04	2.800E-04	0.591
Particulate matter air pollution (PM _{2.5}) absorbance	Crohn's disease	-6.300E-02	4.500E-02	0.396
Particulate matter air pollution (PM _{2.5}) absorbance	ulcerative colitis	-4.784E-04	5.700E-04	0.556

Note. *se*, standard error; *pval*, *P*-value.

Supplementary Table S4. Heterogeneity test of mendelian randomization

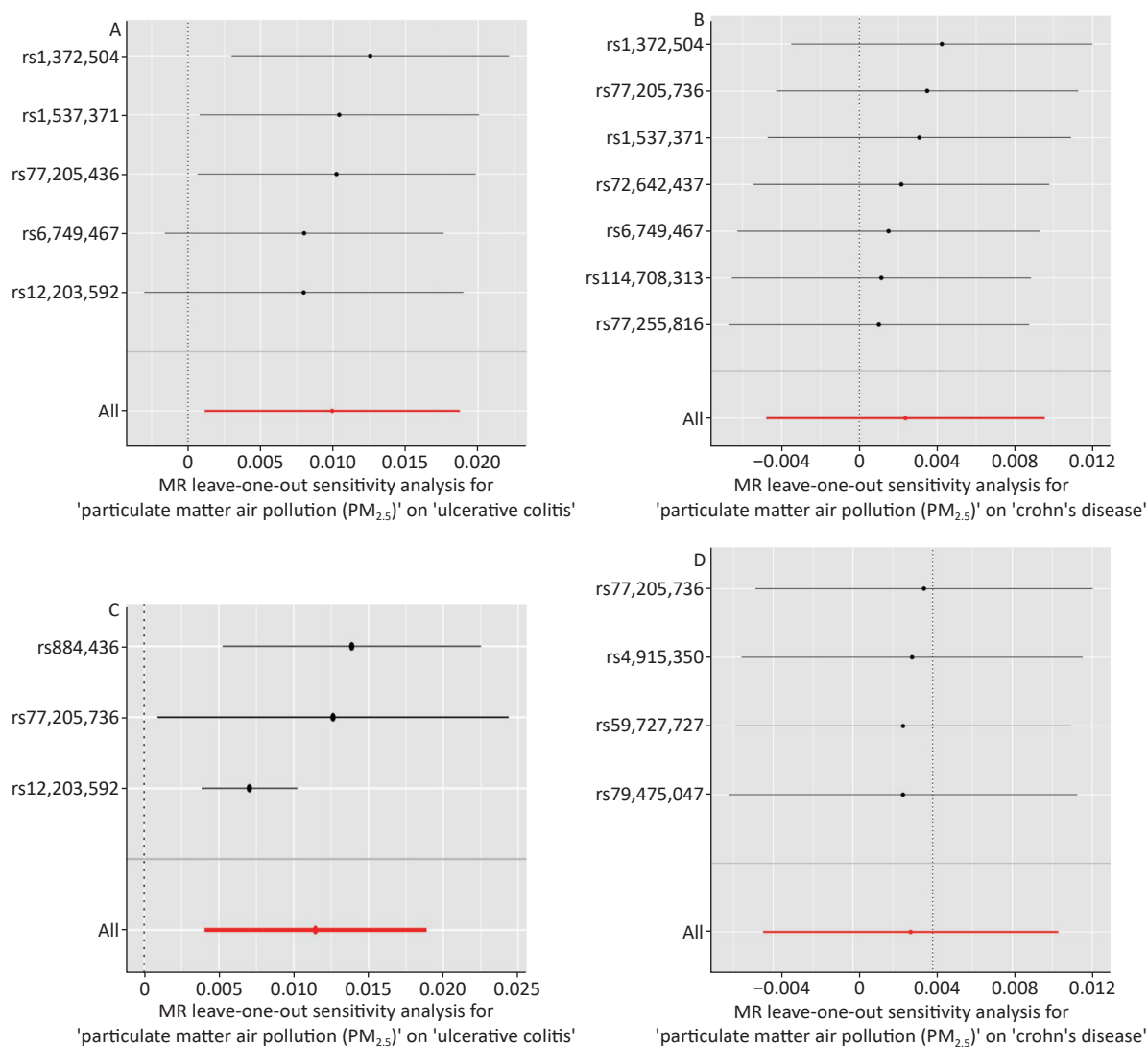
Exposure	Outcome	Method	<i>Q</i>	<i>Q</i> , <i>df</i>	<i>Q</i> , <i>pval</i>
Particulate matter air pollution (PM _{2.5})	Crohn's disease	MR Egger	2.324	5.000	8.028E-01
Particulate matter air pollution (PM _{2.5})	Crohn's disease	Inverse variance weighted	3.589	6.000	7.321E-01
Particulate matter air pollution (PM _{2.5})	ulcerative colitis	MR Egger	2.329	3.000	5.070E-01
Particulate matter air pollution (PM _{2.5})	ulcerative colitis	Inverse variance weighted	2.689	4.000	6.111E-01
Particulate matter air pollution (PM _{2.5}) absorbance	Crohn's disease	MR Egger	0.083	2.000	9.594E-01
Particulate matter air pollution (PM _{2.5}) absorbance	Crohn's disease	Inverse variance weighted	0.124	3.000	9.888E-01
Particulate matter air pollution (PM _{2.5}) absorbance	ulcerative colitis	MR Egger	0.011	1.000	9.170E-01
Particulate matter air pollution (PM _{2.5}) absorbance	ulcerative colitis	Inverse variance weighted	0.713	2.000	7.001E-01

Notes. *df*, degrees of freedom; *pval*, *P*-value.

Supplementary Table S5. Leave-one-out analysis of mendelian randomization

Exposure	Outcome	SNP	<i>b</i>	<i>se</i>	<i>p</i>
Particulate matter air pollution (PM _{2.5})	Crohn's disease	rs114708313	0.001	0.004	0.774
Particulate matter air pollution (PM _{2.5})	Crohn's disease	rs1372504	0.004	0.004	0.283
Particulate matter air pollution (PM _{2.5})	Crohn's disease	rs1537371	0.003	0.004	0.438
Particulate matter air pollution (PM _{2.5})	Crohn's disease	rs6749467	0.001	0.004	0.705
Particulate matter air pollution (PM _{2.5})	Crohn's disease	rs72642437	0.002	0.004	0.578
Particulate matter air pollution (PM _{2.5})	Crohn's disease	rs77205736	0.003	0.004	0.378
Particulate matter air pollution (PM _{2.5})	Crohn's disease	rs77255816	0.001	0.004	0.799
Particulate matter air pollution (PM _{2.5})	ulcerative colitis	All	0.002	0.004	0.517
Particulate matter air pollution (PM _{2.5})	ulcerative colitis	rs12203592	0.008	0.006	0.154
Particulate matter air pollution (PM _{2.5})	ulcerative colitis	rs1372504	0.013	0.005	0.010
Particulate matter air pollution (PM _{2.5})	ulcerative colitis	rs1537371	0.010	0.005	0.034
Particulate matter air pollution (PM _{2.5})	ulcerative colitis	rs6749467	0.008	0.005	0.102
Particulate matter air pollution (PM _{2.5})	ulcerative colitis	rs77205736	0.010	0.005	0.036
Particulate matter air pollution (PM _{2.5})	ulcerative colitis	All	0.010	0.004	0.026
Particulate matter air pollution (PM _{2.5}) absorbance	Crohn's disease	rs4915350	-0.001	0.005	0.813
Particulate matter air pollution (PM _{2.5}) absorbance	Crohn's disease	rs59727727	-0.002	0.005	0.729
Particulate matter air pollution (PM _{2.5}) absorbance	Crohn's disease	rs77205736	-0.001	0.005	0.919
Particulate matter air pollution (PM _{2.5}) absorbance	Crohn's disease	rs79475047	-0.002	0.006	0.738
Particulate matter air pollution (PM _{2.5}) absorbance	Crohn's disease	All	-0.001	0.005	0.769
Particulate matter air pollution (PM _{2.5}) absorbance	ulcerative colitis	rs12203592	0.007	0.008	0.397
Particulate matter air pollution (PM _{2.5}) absorbance	ulcerative colitis	rs77205736	0.013	0.008	0.094
Particulate matter air pollution (PM _{2.5}) absorbance	ulcerative colitis	rs884436	0.014	0.008	0.064
Particulate matter air pollution (PM _{2.5}) absorbance	ulcerative colitis	All	0.012	0.004	0.002

Note. SNP, single nucleotide polymorphism; *b*, beta; *se*, standard error; *pval*, *P*-value.



Supplementary Figure S1. Forest plots of the “leave-one-out” sensitivity analyses to demonstrate the impact of individual SNPs on the results. The x-axis shows MR “leave-one-out” sensitivity analyses for PM_{2.5} on UC (Panel A), PM_{2.5} on CD (Panel B), PM_{2.5} absorbance on UC (Panel C), PM_{2.5} absorbance on CD (Panel D). The y-axis shows the analyses for the effect of “leave-one-out” of SNPs on UC and CD. The red points indicate the IVW estimates using all SNPs. MR, Mendelian randomization; PM_{2.5}, particulate matter 2.5; SNP, single nucleotide polymorphism; UC, ulcerative colitis; CD, Crohn’s disease. These authors contributed equally to this work.