

## SUPPLEMENTARY APPENDIX

# Is Short-term and Long-term Exposure to Black Carbon Associated with Cardiovascular and Respiratory Diseases? A Systematic Review and Meta-Analysis based on Evidence Reliability

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**Table S1** Search Strategy for PubMed.

No.	Search Strategy
#1	particulate matter/or aerosols.sh.
#2	particulate matter*/or "PM10"/or "PM2.5"/or fine particle*/or thoracic particle*/or ultrafine/or aerosol*/or carbon*/or soot*.ti,ab.
#3	"PM".tw.
#4	or/1,2,3
#5	"EC" /or "BC".tw.
#6	and/4,5
#7	black carbon*/or elemental carbon*/or element carbon*.ti,ab.
#8	or/6,7
#9	respiratory tract disease.sh.
#10	respirat*/or pulmonary disease*/or lung/or chest infection*/or airway/or asthma*/or pneumonia*/or "chronic obstructive pulmonary disease"/or COPD.ti,ab.
#11	cardiovascular diseases.sh.
#12	cardio*/or cardiop*/or cardior*/or heart/or coronary/or vascular/or blood/or cardiac.ti,ab.
#13	or/9,10,11,12
#14	morbidity/or hospitalization/or death/or mortality/or outpatient.sh
#15	morbidity*/or hospitalisation*/or hospitalization*/or death*/or mortalit*/or outpatien*/or emergency room*/or emergency department*/or emergency admi*/or hospital admission*.ti,ab.
#16	or/14,15
#17	epidemiologic studies/or cross over study.sh.
#18	time series*/or timeseries*/or case cross*/or casecross*.tw.
#19	generalized additive model/or generalised additive model/or generalized linear model/or generalised linear model/or distributed lag non-linear model/or distributed lag nonlinear model/or distributed lag model/or quasipoisson*/or poisson*/or generalized estimating equation/or generalised estimating equation/or GAM/or GLM/or DLNM/or GEE/or DLM/or ARIMA.tw.
#20	cohort*/or follow up*/or observational/or longitudinal/or case control*/or epidemiologic/or population stud*/or prospective*/or retrospective*.tw.
#21	or/17,18,19,20
#22	and/8,13,16,21

**Table S2** Characteristics of included studies in the systematic review and meta-analysis.

Study	Study Design	Country	Study Period	Outcome	Age	Pollutant	ICD code	Diseases
Atkinson et al. 2016	TS	UK	2011-2012	Mortality	All	BC,EC	ICD-10	CVD(ICD-10:I00-I99),RES(ICD-10:J00-J99)
Bell et al. 2014	TS	USA	2000-2004	Morbidity	≥65	BC	ICD-9	RES[COPD(ICD-9-CM:490-492,RTI(ICD-9-CM:464-466, 480-487));CVD[HF(ICD-9-CM:428),Heart Rhythm Disturbances(ICD-9-CM:426-427), Cerebrovascular Events(ICD-9-CM:430-438),IHD(ICD-9-CM:410-414, 429),PVD(ICD-9-CM:440-448)]
Cai et al. 2014	TS	China	2005-2011	Morbidity	≥18	BC	ICD-10	Asthma(ICD-10:J45)
Geng et al. 2013	TS	China	2007-2008	Mortality	All	BC	ICD-10	CVD(ICD-10:I00-I99),RES(ICD-10:J00-J98)
Hua et al. 2014	TS	China	2007-2012	Morbidity	0-14	BC	ICD-10	Asthma(ICD-10:J45)
Ostro et al. 2015a	CS	Spain, Greece	2008-2009 (Athens), 2009-2010(Barcelona)	Mortality	All	BC	ICD-10	CVD(ICD-10:I00-I99),RES(ICD-10:J00-J99)
Samoli et al. 2016	TS	UK	2011-2012	Morbidity	≥15(CVD), all (RES)	BC,EC	ICD-10	CVD(ICD-10:I00-I99),RES(ICD-10:J00-J99)
Zanobetti and Schwartz 2006	CS	USA	1995-1999	Morbidity	≥65	BC	ICD-9	MI(ICD-9:410),Pneumonia (ICD-9: 480-487)
Liu et al. 2016a	TS	USA	2008-2013	Morbidity	All	EC	ICD-9	CVD(ICD-9:390-429),Stroke(ICD-9:430-438),RES(ICD-9:460-519),COPD(ICD-9:490-492,494,496),Pneumonia(ICD-9:480-486),Asthma(ICD-9:493),SSID(ICD-9:780-799)
Liu et al. 2016b	TS	USA	2008-2013	Morbidity	All	EC	ICD-9	CVD(ICD-9:390-429),Stroke(ICD-9:430-438),RESP(ICD-9:460-519),COPD(ICD-9:490-492,494,496),Pneumonia (ICD-9:480-486),Asthma(ICD-9:493)
Sarnat et al. 2015	TS	USA	2001-2003	Morbidity	All	EC	ICD9	CVD[IHD(ICD9:410-414),Cardiac Dysrhythmias(ICD9:427),CHF(ICD9:428),Other CVD (ICD9:433-437,440,443-445,451-453)],RES[Pneumonia(ICD9:480-486),COPD (ICD:491,492,496),Asthma/Wheeze (ICD9:493,786.07),Other RES(ICD9:460-466,477)]
Kim et al. 2012	TS	USA	2003-2007	Morbidity	All	EC	ICD-9	CVD(ICD-9:390-459),RES(ICD-9:460-519)

**Table S2** Characteristics of included studies in the systematic review and meta-analysis.

Study	Study Design	Country	Study Period	Outcome	Age	Pollutant	ICD code	Diseases
Ostro et al. 2009	TS	USA	2000-2003	Morbidity	<19	EC	ICD9	RES(ICD-9:460-519),Asthma(ICD-9:493),Acute bronchitis(ICD-9:466),Pneumonia(ICD-9:480-486)
Kim et al. 2015	TS	USA	2003-2007	Mortality	All	EC	ICD-10	CVD,RES
Huang et al. 2012	TS	China	2004-2008	Mortality	All	EC	ICD-10	RES(ICD-10:I00-I98),CVD(ICD-10:I00-I99 )
Peng et al. 2009	TS	USA	2000-2006	Morbidity	≥65	EC	ICD-9	CVD[Cardiac Dysrhythmias(ICD-9:428),Heart Rhythm Disturbances(ICD-9:426-427),Cerebrovascular Events (ICD-9:430-438),IHD (ICD-9:410-414, 429),PVD(ICD-9:440-448)],RES[COVD(ICD-9:490-492),RES(ICD-9:464-466,480-487)]
Levy et al. 2012	TS	USA	2000-2008	Morbidity	≥65	EC	ICD-9	CVD(ICD-9:390-459),RES(ICD-9:464-466 and 480-487).
Son et al. 2012	TS	Korea	2008-2009	Mortality	All	EC	ICD-10	CVD(ICD-10:I00-I99),RES(ICD-10:J00-J99)
Heo et al. 2014	TS	Korea	2003-2007	Mortality	All	EC	ICD-10	CVD(ICD-10:I00-I99),RES(ICD-10:J00-J98)
Basagaña et al. 2015	CS	Spain, Italy	2003-2013	Morbidity, Mortality	All	EC	ICD-9, ICD-10	CVD(ICD-9:390-459,ICD-10:I00-I99),RES(ICD-9:460-519,ICD-10:J00-J99)
Dai et al. 2014	TS	USA	2000-2006	Mortality	All	EC	ICD-10	CVD(ICD-10:I01-I59),RES(ICD-10:J00-J99),MI(ICD-10:I21-I22),Stroke(ICD-10:I60-I69)
Lin et al. 2016a	TS	China	2007-2011	Mortality	All	EC	ICD-10	CVD(ICD-10:I00-I99)
Cao et al. 2012	TS	China	2004-2008	Mortality	All	EC	ICD-10	CVD(ICD-10:I00-I99),RES(ICD-10:J00-J98)
Klemm et al. 2011	TS	USA	1998-2007	Mortality	≥65	EC	ICD-10	CVD(ICD-10:I00-I99),RES(ICD-10:J00-J99)
Zhou et al. 2011	TS	USA	2002-2004	Mortality	All	EC	ICD-10	CVD(ICD-10:I01-I99),RES(ICD-10:J00-J99)
Winquist et al. 2015	TS	USA	2001-2003	Morbidity	All	BC,EC	ICD-9	RES(ICD-9:460-465,466.0,466.1,466.11,466.19,477,480-486,491,492,493,496,786.07),CVD(ICD-9:410-414,427, 428,433-437,440,443-445,451-453)
Ostro et al. 2007	TS	USA	2000-2003	Mortality	All	EC	ICD-10	CVD(ICD-10:I00-I99),RES(ICD-10:J00-J98)
Tolbert et al. 2000	TS	USA	1998-2000	Morbidity	All	EC	ICD-9	CVD(ICD-9:402,410-414,427,428,433-437,440,444,451-453),RES(ICD-9:460-466,477,480-486,491,492,493,496, 786.09)

**Table S2** Characteristics of included studies in the systematic review and meta-analysis.

Study	Study Design	Country	Study Period	Outcome	Age	Pollutant	ICD code	Diseases
Wang and Lin 2016	TS	China	2004-2010	Morbidity, Mortality	≥65(mortality), all(morbidity)	EC	ICD-9	CVD(ICD-9-CM:390-459),RES(ICD-9-CM:460-519)
Darrow et al. 2014	TS	USA	1993-2010	Morbidity	0-4	EC	ICD-9	Acute Bronchitis or Bronchiolitis(ICD-9:466),Pneumonia(ICD-9:480-486),URI(ICD-9:460-465)
Metzger et al. 2004	TS	USA	1993-2000	Morbidity	All	EC	ICD-9	CVD[IHD(ICD-9:410-414),AMI(ICD-9:410),cardiac dysrhythmias(ICD-9:427),CA(ICD-9:427.5),CHF(ICD-9:428),PVD and cerebrovascular events(ICD-9:433-437,440,443-444,451-453),CHD(ICD-9:440),Stroke(ICD-9:436)]
Mar et al. 2000	TS	USA	1995-1997	Mortality	All	EC	ICD-9	CVD(ICD-9:390-448.9)
Wang et al. 2019a	TS	China	2013-2015	Mortality	All	EC	ICD-10	CVD(ICD-10:I00-I99),RES(ICD-10:J00-J99)
Lin et al. 2016b	TS	China	2007-2011	Mortality	All	EC	ICD-10	Stroke(ICD-10:I60-I66)
Ostro et al. 2008	TS	USA	2000-2003	Mortality	All	EC	ICD-10	CVD(ICD-10:I00-I99)
Ito et al. 2011	TS	USA	2000-2006	Morbidity, Mortality	≥40	EC	ICD-9, ICD-10	CVD[Hypertensive Diseases(ICD-9:402,ICD-10:I11),MI(ICD-9:410;ICD-10:I21-I22),IHD (ICD-9:414,ICD-10:I25),Dysrhythmias(ICD-9:427,ICD-10:I48),HF(ICD-9:428,ICD-10:I50),Stroke(ICD-9:430-439,ICD-10:I60-I69)]
Chen et al. 2014	TS	China	2004-2008	Morbidity	All	EC	ICD-9	Stroke[Ischemic Stroke(ICD-9:433-434),Hemorrhagic Stroke(ICD-9:430-432)]
Tomic 'Spiric' et al. 2019	CS	Serbia	2012-2014	Morbidity	≥18	BC	ICD-10	Allergic RES[AR(ICD-10:J.30.4),AA(ICD-10:J.45.0)]
Maynard et al. 2007	CS	USA	1995-1997, 1999-2002	Mortality	All	BC	ICD-9, ICD-10	CVD(ICD-9:390-429,ICD-10:I01-I52),Stroke(ICD-9:430-438,ICD-10:I60-I69),RES(ICD-9:460-519,ICD-10:J00-J99)
Sinclair et al. 2010	TS	USA	1998-2002	Morbidity	All	EC	NR	Asthma,URTI,LRTI
Krall et al. 2013	TS	USA	2000-2005	Mortality	All	EC	NR	CVD and RES(NR)
Cakmak et al. 2009	TS	Canada	2001-2006	Morbidity	All	EC	ICD-9	RES(ICD-9:460-519)

**Table S2** Characteristics of included studies in the systematic review and meta-analysis.

Study	Study Design	Country	Study Period	Outcome	Age	Pollutant	ICD code	Diseases
Tolbert et al. 2007	TS	USA	1993-2004	Morbidity	All	EC	ICD-9	CVD[IHD(ICD-9:410-414),Cardiac Dysrhythmias(ICD-9:427),CHF(ICD-9:428),PVD and Cerebrovascular Events(ICD-9:433-437,440,443-445,451-453)], RES[Asthma(ICD-9:493,786.07,786.09),COPD(ICD-9:491,492,496),URTI(ICD-9:460-465,460.0,477),Pneumonia (ICD-9:480-486),Bronchiolitis(ICD-9:466.1,466.11,466.19)]
Lall et al. 2011	TS	USA	2001-2002	Morbidity	≥65	EC	ICD-9	RES[Pneumonia(ICD-9:480-486),COPD(ICD-9:490-492,496),Acute Bronchitis and Bronchiolitis(ICD-9:466),Asthma(ICD-9:493)],CVD[Dysrhythmia(ICD-9:427),IHD(ICD-9:410-414),HF(ICD-9:428),Stroke(ICD-9:431-437)]
Jung and Lin 2017	CS	China	2000-2010	Morbidity	0-20	BC	ICD-9	Asthma(ICD-9-CM:493)
Gong et al. 2019	TS	China	2006-2011	Mortality	All	BC	ICD-10	CVD(ICD-10:I00-I99)
Mostofsky et al. 2012	CS	USA	2003-2008	Morbidity	≥21	BC	NO	Acute Ischemic Stroke
Krall et al. 2017	TS	USA	1999-2009(Atlanta,Georgia), 2004-010(Birmingham,Alabama, 2001-2007(St.Louis, Missouri ), 2006-2009(Dallas,Texas)	Morbidity	All	EC	ICD-9	RES[Pneumonia(ICD-9:480-486),COPD(ICD-9:491,492,496),URTI(ICD-9:460-465,466.0,477),Asthma and/or Wheeze(ICD-9:493,786.07)]
O'Lenick et al. 2017	CS	USA	2001-2008	Morbidity	5-18	EC	ICD-9	Asthma(ICD-9:493.0-493.9),Wheeze(ICD-9:786.07)
Pearce et al. 2015	TS	USA	1999-2008	Morbidity	5-17	EC	ICD-9	Asthma(ICD-9:493.0-493.9),Wheeze(ICD-9:786.07)
Strickland et al. 2010	CS	USA	1993-2004	Morbidity	5-17	EC	ICD-9	Asthma(ICD-9:493.0-493.9),Wheeze(ICD-9:786.09),ARI(ICD-9:460.0-466.0)

**Table S2** Characteristics of included studies in the systematic review and meta-analysis.

Study	Study Design	Country	Study Period	Outcome	Age	Pollutant	ICD code	Diseases
Strickland et al. 2014	TS	USA	2000-2010	Morbidity	2-16	EC	ICD-9	Asthma(codes beginning with 493), Wheeze (ICD-9:786.07)
Ito et al. 2013	TS	USA	2001-2006	Morbidity, Mortality	all (mortality), ≥65(morbidity)	EC	ICD-9, ICD-10	CVD(ICD-10:I01-I79),RES(ICD-10:J00-J99)
Ostro et al. 2015b	Co	USA	2001-2007	Mortality	≥30	EC	ICD-10	CVD(ICD-10:I00-I99),IHD(ICD-10:I20-I25),Pulmonary(ICD-10:C34,J00-J98)
Gan et al. 2013	Co	Canada	1999-2002	Morbidity, Mortality	45-85	BC	ICD-9, ICD-10	COPD(ICD-9:490-492,496,ICD10:J40-J44)
Hvidtfeldt et al. 2019	Co	Denmark	1993-2015	Mortality	50–64	BC	ICD-10	CVD(ICD-10:I00-I99),RES(ICD-10:J00-J99,C34)
Thurston et al. 2016	Co	USA	1988-2004	Mortality	≥30	EC	ICD-9, ICD-10	IHD(ICD-9:410-414,ICD-10:I20-I25)
Yang et al. 2018	Co	China	1998-2011	Mortality	≥65	BC	ICD-10	CVD(ICD-10:I00-I99),RES(ICD-10:J00-J47,J80-J99)
Gan et al. 2011	Co	Canada	1999-2002	Morbidity, Mortality	45–85	BC	ICD-9, ICD-10	CHD(ICD-9:410-414,429.2 ),(ICD-10:I20-I25)
De Kluizenaar et al. 2013	Co	Netherlands	1991-2003	Morbidity	15-74	EC	ICD-9	IHD(ICD-9:410-414),CHD(ICD-9:430-438)
Vedal et al. 2013	Co	USA	1994-2005	Morbidity, Mortality	50-79	EC	ICD-9	CVD (ICD-9:CM 410-452)
Rahmatinia et al. 2021	TS	Iran	2014-2017	Mortality	All	BC	ICD-10	RES(ICD10:J00- J99),CVD(ICD10:I00-I99),IHD(ICD 10:I20-I25)
Liu et al. 2021b	Co	China	2010–2017	Morbidity	All	BC	NR	CVD(including but not limited to hypertension and stroke)
Lavigne et al. 2021	Co	Canada	2006-2014	Morbidity	≤6	BC	ICD-10	Asthma(ICD-10:J45)
Rodins et al. 2020	Co	Germany	2000-2015	Morbidity	All	EC	NR	CHD
Kovačević et al. 2020	CS	Serbia	2012-2014	Morbidity	≥18	BC	ICD-10	AA(ICD-10:J45.0) or asthma with coexisting AR
Hasslöf et al. 2020	Co	Sweden	1991-1994	Morbidity	All	BC	NR	Atherosclerosis in the carotid arteries



**Table S2** Characteristics of included studies in the systematic review and meta-analysis.

Study	Study Design	Country	Study Period	Outcome	Age	Pollutant	ICD code	Diseases
Wang et al. 2019b	CS	USA	2005-2016	Morbidity	All	BC	NR	STEMI
Ljungman et al. 2019	Co	Sweden	1990-2011	Morbidity, Mortality	All	BC	ICD-9, ICD-10	IHD(ICD-9:410–414 and ICD-10:I20-25);stroke(ICD-9:431–436 and ICD-10:I61– I65)
Liu et al. 2021a	Co	Sweden, Denmark	1992-2004	Morbidity	All	BC	ICD-9, ICD-10	COPD(ICD-9:490–492, and 494–496, or ICD-10:J40–44)

Abbreviations: NR: Not Reported; TS: Time-Series; CS: Case-Crossover; Co: Cohort; ICD: International Classification of Diseases; MI: Myocardial infarction; CHD: Coronary heart disease; CVD: Cardiovascular disease; RES: respiratory diseases; IHD: Ischemic Heart Disease; ARI: acute respiratory illness; HF: heart failure; CHF: congestive heart failure; PVD: peripheral vascular disease; AA: allergic asthma; AR: allergic rhinitis; AMI: acute myocardial infarction; CA: cardiac arrest; STEMI: ST segment elevation myocardial infarction; RTI: respiratory tract infection; URTI: Upper Respiratory Infection; LRTI: Lower Respiratory Infection; ARTI: Acute respiratory infections.

**Table S3** Subgroup analysis on short-term effects of BC/EC on cardiovascular and respiratory diseases.

Subgroup Analysis	No. of Studies	No. of Estimates	Relative Risk (95%CI)	I <sup>2</sup>	Egger Regression Test (p value)
<b>Cardiovascular Diseases</b>					
<b>Lag Days</b>					
Lag 0d	15	18	1.013 (1.006, 1.020)*	77.30%	0.024
Lag 1d	12	15	1.005 (1.002, 1.008)	32.70%	0.299
Lag 2d	11	14	1.002 (0.999, 1.005)	73.80%	0.969
<b>Geographical Location (Mortality)</b>					
Asia	8	8	1.004 (1.002, 1.006)*	70.00%	—
Europe	4	5	0.991 (0.983, 0.999)	0	—
America	4	4	1.017 (0.998, 1.037)	20.80%	—
<b>Geographical Location (Morbidity)</b>					
Asia	—	—	—	—	—
Europe	—	—	—	—	—
America	12	12	1.023 (1.016, 1.030)	46.00%	0.078
<b>Disease</b>					
Congestive heart failure (Morbidity)	3	3	1.076 (1.021, 1.134)*	64.70%	—
<b>Season (Mortality)</b>					
Warm season	3	3	1.002 (0.995, 1.010)	0	—
Cold season	3	3	1.014 (1.008, 1.019)*	0	—
<b>Respiratory Diseases</b>					
<b>Asthma (Morbidity)</b>					
Asthma 0-18	5	6	1.021 (1.006, 1.035)*	69.10%	—
Asthma ≥18	4	5	1.011 (1.000, 1.021)	0	—

Annotation: "\*" means the data were statistically significant,  $p < 0.05$ .

**Table S4** Summary statistics for the number of possible analyses using the three search spaces.

Statistic	Space1	Space2	Space3
maximum	704	128	22528
quartile	273	64	15360
median	198	64	12000
quartile	42	32	2688
minimum	8	32	256

**Table S5** The p-value calculation process for each study using RR, CI low and CI high.

	Number	Study ID	RR	CI low	CI high	lnRR	lnCI low	lnCI high	SE	Z	p-values
Cardiovascular Diseases	1	Ostro,2015a	0.994000	0.953000	1.038000	0.006018	0.048140	0.037296	0.021795	0.276122	<b>0.782454</b>
	2	Ostro,2015a	1.005000	0.979000	1.031000	0.004988	0.021224	0.030529	0.013202	0.377780	<b>0.705594</b>
	3	Atkinson,2016	0.987000	0.973000	1.001000	0.013085	0.027371	0.001000	0.007237	1.807997	<b>0.070607</b>
	4	Geng,2013	1.012000	1.002000	1.021000	0.011929	0.001998	0.020783	0.004792	2.489281	<b>0.012800</b>
	5	Liu,2016a	0.960000	0.857000	1.076000	0.040822	0.154317	0.073250	0.058053	0.703185	<b>0.481941</b>
	6	Liu,2016b	1.020000	0.858000	1.214000	0.019803	0.153151	0.193921	0.088539	0.223661	<b>0.823021</b>
	7	Sarnat,2015	1.038000	1.005000	1.073000	0.037296	0.004988	0.070458	0.016702	2.233044	<b>0.025546</b>
	8	Kim,2012	1.056000	1.018000	1.094000	0.054488	0.017840	0.089841	0.018368	2.966547	<b>0.003012</b>
	9	Wang,2019a	1.011000	0.999000	1.023000	0.010940	0.001001	0.022739	0.006056	1.806427	<b>0.070852</b>
	10	Maynard,2007	1.076000	0.980000	1.179000	0.073250	0.020203	0.164667	0.047161	1.553215	<b>0.120372</b>
	11	Winqvist,2015	1.048000	1.012000	1.085000	0.046884	0.011929	0.081580	0.017768	2.638621	<b>0.008324</b>
	12	Tolbert,2007	1.013000	1.004000	1.022000	0.012916	0.003992	0.021761	0.004533	2.849359	<b>0.004381</b>
	13	Gong,2019	1.002000	1.001000	1.003000	0.001998	0.001000	0.002996	0.000509	3.923916	<b>0.000087</b>
	14	Ostro,2007	1.026000	1.004000	1.049000	0.025668	0.003992	0.047837	0.011185	2.294831	<b>0.021743</b>
	15	Metzger,2004	1.017000	1.007000	1.027000	0.016857	0.006976	0.026642	0.005017	3.360055	<b>0.000779</b>
	16	Kim,2015	1.031000	0.935000	1.133000	0.030529	0.067209	0.124869	0.048999	0.623052	<b>0.533250</b>
	17	Huang,2012	1.005000	0.998000	1.010000	0.004988	0.002002	0.009950	0.003049	1.635761	<b>0.101890</b>
	18	Son,2012	1.001000	0.981000	1.021000	0.001000	0.019183	0.020783	0.010195	0.098036	<b>0.921904</b>
	19	Heo,2014	1.006000	0.994000	1.017000	0.005982	0.006018	0.016857	0.005836	1.025116	<b>0.305308</b>
	20	Basagana,2015	0.979000	0.944000	1.016000	0.021224	0.057629	0.015873	0.018751	1.131889	<b>0.257681</b>
	21	Basagana,2015	1.026000	1.006000	1.047000	0.025668	0.005982	0.045929	0.010191	2.518785	<b>0.011776</b>
	22	Lin,2016a	1.002000	0.999000	1.005000	0.001998	0.001001	0.004988	0.001528	1.307969	<b>0.190884</b>

**Table S5** The p-value calculation process for each study using RR, CI low and CI high. (continued)

	Number	Study ID	RR	CI low	CI high	lnRR	lnCI low	lnCI high	SE	Z	p-values
Respiratory Diseases	1	Atkinson,2016	1.013000	0.993000	1.033000	0.012916	0.007025	0.032467	0.010074	1.282079	<b>0.199815</b>
	2	Geng,2013	1.002000	0.983000	1.021000	0.001998	0.017146	0.020783	0.009676	0.206497	<b>0.836403</b>
	3	Ostro,2015a	1.090000	1.004000	1.183000	0.086178	0.003992	0.168054	0.041852	2.059084	<b>0.039486</b>
	4	Ostro,2015a	1.064000	1.020000	1.110000	0.062035	0.019803	0.104360	0.021571	2.875902	<b>0.004029</b>
	5	Sarnat,2015	0.995000	0.969000	1.022000	0.005013	0.031491	0.021761	0.013585	0.368983	<b>0.712140</b>
	6	Huang,2012	1.005000	0.993000	1.017000	0.004988	0.007025	0.016857	0.006092	0.818666	<b>0.412977</b>
	7	Son,2012	0.989000	0.956000	1.024000	0.011061	0.044997	0.023717	0.017529	0.631007	<b>0.528036</b>
	8	Kim,2015	1.081000	0.920000	1.266000	0.077887	0.083382	0.235862	0.081440	0.956370	<b>0.338885</b>
	9	Heo,2014	0.988000	0.962000	1.015000	0.012073	0.038741	0.014889	0.013681	0.882435	<b>0.377541</b>
	10	Basagana,2015	0.986000	0.949000	1.026000	0.014099	0.052346	0.025668	0.019902	0.708432	<b>0.478677</b>
	11	Basagana,2015	0.940000	0.879000	1.006000	0.061875	0.128970	0.005982	0.034427	1.797311	<b>0.072286</b>
	12	Maynard,2007	1.196000	1.005000	1.421000	0.178983	0.004988	0.351361	0.088361	2.025595	<b>0.042806</b>
	13	Liu,2016a	0.964000	0.895000	1.039000	0.036664	0.110932	0.038259	0.038059	0.963352	<b>0.335371</b>
	14	Liu,2016b	0.963000	0.806000	1.150000	0.037702	0.215672	0.139762	0.090672	0.415806	<b>0.677552</b>
	15	Kim,2012	1.100000	0.949000	1.270000	0.095310	0.052346	0.239017	0.074327	1.282302	<b>0.199737</b>
	16	Cakmak,2009	1.036000	1.031000	1.041000	0.035367	0.030529	0.040182	0.002462	14.36291	<b>3.2036*10<sup>-45</sup></b>
	17	Wang,2019a	1.038000	1.017000	1.059000	0.037296	0.016857	0.057325	0.010323	3.612723	<b>0.000303</b>
	18	Tolbert,2007	0.997000	0.990000	1.003000	0.003005	0.010050	0.002996	0.003328	0.902791	<b>0.366637</b>

**Table S6** Results of risk of bias assessment.

No.	Study	Key criteria				Other criteria			
		Exposure assessment	Outcome assessment	Confounding bias	Selection bias	Incomplete outcome data	Selective reporting	Conflict of interest	Other
1	Atkinson et al. 2016	Low	Low	Low	Low	Low	Low	Low	Low
2	Bell et al. 2014	High	Low	Low	Low	Low	Low	Low	Low
3	Cai et al. 2014	Low	Low	Low	Low	Low	Low	Low	Low
4	Geng et al. 2013	High	Low	Low	Low	Low	Low	Low	Low
5	Hua et al. 2014	High	Low	Low	Low	Low	Low	Low	Low
6	Ostro et al. 2015a	Low	Low	Low	Low	Low	Low	Low	Low
7	Samoli et al. 2016	Low	Low	Low	Low	Low	Low	Low	Low
8	Zanobetti and Schwartz 2006	High	Low	Low	Low	Low	Low	Low	Low
9	Liu et al. 2016a	High	Low	Low	Low	Low	Low	Low	Low
10	Liu et al. 2016b	High	Low	Low	Low	Low	Low	Low	Low
11	Sarnat et al. 2015	Low	Low	Low	Low	Low	Low	Low	Low
12	Kim et al. 2012	Low	Low	Low	Low	Low	Low	Low	Low
13	Ostro et al. 2009	High	Low	Low	Low	Low	Low	Low	Low
14	Kim et al. 2015	Low	Low	Low	Low	Low	Low	Low	Low
15	Huang et al. 2012	Low	Low	Low	Low	Low	Low	Low	Low
16	Peng et al. 2009	High	Low	Low	Low	Low	Low	Low	Low
17	Levy et al. 2012	High	Low	Low	Low	Low	Low	Low	Low
18	Son et al. 2012	Low	Low	Low	Low	Low	Low	Low	Low
19	Heo et al. 2014	High	Low	Low	Low	Low	Low	Low	Low
20	Basagaña et al. 2015	High	Low	Low	Low	Low	Low	Low	Low
21	Dai et al. 2014	High	Low	Low	Low	Low	Low	Low	Low
22	Lin et al. 2016a	Low	Low	Low	Low	Low	Low	Low	Low
23	Cao et al. 2012	Low	Low	Low	Low	Low	Low	Low	Low
24	Klemm et al. 2011	Low	Low	Low	Low	Low	Low	Low	Low
25	Zhou et al. 2011	Low	Low	Low	Low	Low	Low	Low	Low
26	Winqvist et al. 2015	Low	Low	Low	Low	Low	Low	Low	Low
27	Ostro et al. 2007	High	Low	Low	Low	Low	Low	Low	Low
28	Tolbert et al. 2000	Low	Low	Low	Low	Low	Low	Low	Low
29	Wang and Lin 2016	Low	Low	Low	Low	Low	Low	Low	Low
30	Darrow et al. 2014	Low	Low	Low	Low	Low	Low	Low	Low
31	Metzger et al. 2004	High	Low	Low	Low	Low	Low	Low	Low
32	Mar et al. 2000	Low	Low	Low	Low	Low	Low	Low	Low
33	Wang et al. 2019a	Low	Low	Low	Low	Low	Low	Low	Low
34	Lin et al. 2016b	High	Low	Low	Low	Low	Low	Low	Low
35	Ostro et al. 2008	High	Low	Low	Low	Low	Low	Low	Low

**Table S6** Results of risk of bias assessment. (continued)

No.	Study	Key criteria			Other criteria			
		Exposure assessment	Outcome assessment	Confounding bias	Selection bias	Incomplete outcome data	Selective reporting	Conflict of interest
36	Ito et al. 2011	Low	Probably Low	Probably Low	Probably High	Probably High	High	High
37	Chen et al. 2014	Low	Probably Low	Probably Low	Probably High	Probably High	High	High
38	Tomic'-Spiric' et al. 2019	Probably High	Probably Low	Probably Low	Probably High	Probably High	High	High
39	Maynard et al. 2007	Low	Probably Low	Probably Low	Probably High	Probably High	High	High
40	Sinclair et al. 2010	Low	Probably Low	Probably Low	Probably High	Probably High	High	High
41	Krall et al. 2013	High	Probably Low	Probably Low	Probably High	Probably High	High	High
42	Cakmak et al. 2009	Probably High	Probably Low	Probably Low	Probably High	Probably High	High	High
43	Tolbert et al. 2007	Probably Low	Probably Low	Probably Low	Probably High	Probably High	High	High
44	Lall et al. 2011	Low	Probably Low	Probably Low	Probably High	Probably High	High	High
45	Jung and Lin 2017	Probably High	Probably Low	Probably Low	Probably High	Probably High	High	High
46	Gong et al. 2019	Low	Probably Low	Probably Low	Probably High	Probably High	High	High
47	Mostofsky et al. 2012	Low	Probably Low	Probably Low	Probably High	Probably High	High	High
48	Krall et al. 2017	Probably High	Probably Low	Probably Low	Probably High	Probably High	High	High
49	O'Lenick et al. 2017	Low	Probably Low	Probably Low	Probably High	Probably High	High	High
50	Pearce et al. 2015	Low	Probably Low	Probably Low	Probably High	Probably High	High	High
51	Strickland et al. 2010	Probably Low	Probably Low	Probably Low	Probably High	Probably High	High	High
52	Strickland et al. 2014	Probably Low	Probably Low	Probably Low	Probably High	Probably High	High	High
53	Ito et al. 2013	Probably High	Probably Low	Probably Low	Probably High	Probably High	High	High
54	Ostro et al. 2015b	Low	Probably Low	Probably Low	Probably High	Probably High	High	High
55	Gan et al. 2013	Low	Probably Low	Probably Low	Probably High	Probably High	High	High
56	Hvidtfeldt et al. 2019	Low	Probably Low	Probably Low	Probably High	Probably High	High	High
57	Thurston et al. 2016	Low	Probably Low	Probably Low	Probably High	Probably High	High	High
58	Yang et al. 2018	Low	Probably Low	Probably Low	Probably High	Probably High	High	High
59	Gan et al. 2011	Low	Probably Low	Probably Low	Probably High	Probably High	High	High
60	De Kluizenaar et al. 2013	Probably High	Probably Low	Probably Low	Probably High	Probably High	High	High
61	Vedal et al. 2013	Low	Probably Low	Probably Low	Probably High	Probably High	High	High
62	Rahmatinia et al. 2021	High	Probably Low	Probably Low	Probably High	Probably High	High	High
63	Liu et al. 2021b	Low	Probably Low	Probably Low	Probably High	Probably High	High	High
64	Lavigne et al. 2021	Low	Probably Low	Probably Low	Probably High	Probably High	High	High
65	Rodins et al. 2020	Low	Probably Low	Probably Low	Probably High	Probably High	High	High
66	Kovačević et al. 2020	Low	Probably Low	Probably Low	Probably High	Probably High	High	High
67	Hasslöf et al. 2020	Low	Probably Low	Probably Low	Probably High	Probably High	High	High
68	Wang et al. 2019b	Probably High	Probably Low	Probably Low	Probably High	Probably High	High	High
69	Ljungman et al. 2019	Low	Probably Low	Probably Low	Probably High	Probably High	High	High
70	Liu et al. 2021a	Low	Probably Low	Probably Low	Probably High	Probably High	High	High
Risk of bias rating:		Low	Probably Low	Probably Low	Probably High	Probably High	High	High

**Table S7** Details of risk of bias assessment.

No.	Study	Exposure assessment	Outcome assessment	Confounding bias	Selection bias	Incomplete outcome data	Selective reporting	Conflict of interest	Other
1	Atkinson et al. 2016	Probably Low	Low	Probably Low	Low	Low	Probably Low	Low	Low
		All of the pollutants were measured at the central London background monitoring site at North Kensington. All measurements were 24-h averages except for CO. The number of all observations was 621-693 (<25% missing data).	Death data for the period 1 January 2011 to 31 December 2012 were obtained from the Office for National Statistics. Daily counts of deaths in London, United Kingdom were classified as all disease-related causes, cardiovascular (International Classification of Diseases, 10th revision-ICD10: I00-I99) and respiratory (ICD10: J00-J99) diseases.	Adjusted for time (seasonality, long-term trend), temperature, humidity, day of week and public holidays.	Study included daily counts of deaths in London, United Kingdom for the period 1 January 2011 to 31 December 2012.	Daily counts for death were obtained, so likely have all outcome data. However, any potential errors or missing data did not depend on air pollution levels.	There was insufficient information about selective outcome to judge for low risk, but indirect evidence that suggests study was free of selective report.	The authors declare no conflict of interest.	No other potential sources of bias identified.

No.	Study	Exposure assessment	Outcome assessment	Confounding bias	Selection bias	Incomplete outcome data	Selective reporting	Conflict of interest	Other
2	Bell et al. 2014	Probably High BC measured from filters collected daily using optical reflectance. Monitors from 5 sites across 4 counties were used. Sampling occurred daily, with some missing periods, for Hartford, New Haven, and Springfield, and every third day for Bridgeport and Danbury. Days with missing data were omitted from analysis (the number of missing data was not reported).	Low The study used the Medicare beneficiary denominator file from the Centers for Medicare and Medicaid Services. Cause of admission was determined by principal discharge diagnosis code according to International Classification of Diseases, Ninth Revision, Clinical Modification (ICD-9-CM; National Center for Health Statistics 2006).	Probably Low Models adjusted for time (seasonality, long-term trend), day of week, temperature, and dew point.	Low Data obtained from records of individuals $\geq 65$ years of age enrolled in the Medicare fee-for-service plan during August 2000 to February 2004.	Low Daily counts for hospital admissions were obtained, so likely have all outcome data. However, any potential errors or missing data did not depend on air pollution levels.	Probably Low There was insufficient information about selective outcome to judge for low risk, but indirect evidence that suggests study was free of selective report.	Low The authors declare no conflict of interest.	Low No other potential sources of bias identified.



No.	Study	Exposure assessment	Outcome assessment	Confounding bias	Selection bias	Incomplete outcome data	Selective reporting	Conflict of interest	Other
3	Cai et al. 2014	Probably Low Daily concentrations of BC were measured at a fixed-site station. Daily data was available and no missing data was reported.	Low Asthmatic hospitalization data was obtained from the Shanghai Health Insurance Bureau (SHIB). The causes of hospital admission were coded according to International Classification of Diseases, Revision 10 (ICD-10): Asthma (J45).	Probably Low Adjusted for time (seasonality, long-term trend), temperature, relative humidity and day of the week.	Low Study included all asthmatic hospitalization for adult residents living in the nine urban districts between January 1, 2005 and December 31, 2011(2922 days) from the Shanghai Health Insurance Bureau.	Low Daily counts for asthmatic hospitalization were obtained, so likely have all outcome data. However, any potential errors or missing data did not depend on air pollution levels.	Probably Low There was insufficient information about selective outcome to judge for low risk, but indirect evidence that suggests study was free of selective report.	Low Authors declared no competing financial interests.	Low No other potential sources of bias identified.

No.	Study	Exposure assessment	Outcome assessment	Confounding bias	Selection bias	Incomplete outcome data	Selective reporting	Conflict of interest	Other
4	Geng et al. 2013	Probably High Single, central-site monitor. Daily BC and PM <sub>2.5</sub> were measured continuously and 24hr averaged was estimated if >75% of the 1hr values was available for that day. Missing data was not replaced by other values.	Low Health data were obtained from Shanghai Municipal Center of Disease Control and Prevention database. The causes of death were coded according to the International Classification of Diseases, Revision 10 (ICD 10).	Probably Low Models included time (seasonality, long-term trend), temperature, humidity and day of week.	Low Data consisted of all causes (excluding accidents or injuries) deaths during over the course of the study.	Low Daily counts for death were obtained, so likely have all outcome data. However, any potential errors or missing data did not depend on air pollution levels.	Probably Low There was insufficient information about selective outcome to judge for low risk, but indirect evidence that suggests study was free of selective report.	Low The authors declare no conflict of interest.	Low No other potential sources of bias identified.

No.	Study	Exposure assessment	Outcome assessment	Confounding bias	Selection bias	Incomplete outcome data	Selective reporting	Conflict of interest	Other
5	Hua et al. 2014	Probably High Daily 24h average PM <sub>2.5</sub> and BC data was obtained from a fixed-site station. The study only used the actual collected data and did not fill in the missing data for PM <sub>2.5</sub> and black carbon.	Low Daily asthma hospital admission data was obtained from Shanghai Children's Medical Center. Dates of admission and discharge, and diagnoses using the International Classification of Diseases, Revision 10.	Probably Low Adjusted for long-term and seasonal trend, day of week, temperature and relative humidity.	Low Study included all asthma hospital admissions of children ≤ 14 years of age from Shanghai Children's Medical Center between 1 January 2007 and 31 July 2012 in nine urban districts of Shanghai.	Low Daily counts for asthma hospital admissions of children were obtained, so likely have all outcome data. However, any potential errors or missing data did not depend on air pollution levels.	Probably Low There was insufficient information about selective outcome to judge for low risk, but indirect evidence that suggests study was free of selective report.	Low Authors declared no competing financial interests.	Low No other potential sources of bias identified.

No.	Study	Exposure assessment	Outcome assessment	Confounding bias	Selection bias	Incomplete outcome data	Selective reporting	Conflict of interest	Other
6	Ostro et al. 2015a	Probably Low Daily 24hr average BC concentrations were obtained from one station in Barcelona and Athens. Daily data was available and no missing data was reported.	Low For both cities daily counts of all-cause mortality for all ages were collected (excluding deaths from external causes, International Classification of Disease-ICD9: 001799, ICD10 A00R99), as well as daily counts of cardiovascular (ICD9: 390459, ICD10: I00I99), respiratory (ICD9:460519, ICD10:J00J99) and all-cause mortality for those greater than age 65.	Low Adjusted for long term and seasonal (year, month, day of week) trends, temperature, holidays, summer vacations and influenza.	Low Study population consisted of daily counts of all-cause mortality for all ages and daily counts of cardiovascular, respiratory and all-cause mortality for those greater than age 65.	Low Daily counts for death were obtained, so likely have all outcome data. However, any potential errors or missing data did not depend on air pollution levels.	Probably Low There was insufficient information about selective outcome to judge for low risk, but indirect evidence that suggests study was free of selective report.	Low Authors declared no competing interests.	Low No other potential sources of bias identified.

No.	Study	Exposure assessment	Outcome assessment	Confounding bias	Selection bias	Incomplete outcome data	Selective reporting	Conflict of interest	Other
7	Samoli et al. 2016	Low Daily concentrations of BC and EC were collected from the ClearfLo project, supplemented by local measurements made at the North Kensington urban background site. Number of days of observation for BC: 629 (BC urban in PM <sub>2.5</sub> ) and 702 (BC in PM <sub>2.5</sub> ) between 2011 and 2012 (<25% missing data).	Low Based on the primary discharge diagnosis, daily numbers of admissions for cardiovascular disease (International Classification of Diseases, 10th revision-ICD-10: I00-I99) for those aged 15-64 (adult) and 65+ years (elderly), and respiratory diseases (ICD-10: J00-J99) for those aged 0-14 years (paediatric), adult and the elderly were calculated.	Probably Low Adjusted for long term and seasonal trends, temperature, relative humidity, regulated pollutants (PM <sub>10</sub> , PM <sub>2.5</sub> , NO <sub>2</sub> , SO <sub>2</sub> and O <sub>3</sub> ), day of the week and public holidays.	Low Study included all cardiovascular and respiratory hospital admissions in London, UK between 2011 and 2012.	Low Daily counts for all emergency hospital admissions were obtained, so likely have all outcome data. However, any potential errors or missing data did not depend on air pollution levels.	Probably Low There was insufficient information about selective outcome to judge for low risk, but indirect evidence that suggests study was free of selective report.	Low Authors declared no competing interests.	Low No other potential sources of bias identified.

No.	Study	Exposure assessment	Outcome assessment	Confounding bias	Selection bias	Incomplete outcome data	Selective reporting	Conflict of interest	Other
8	Zanobetti and Schwartz 2006	Probably High Ambient BC from one monitor. The hourly measurements for BC and PM <sub>2.5</sub> were not complete. Missing values were replaced with the predicted values. Additionally BC data was missing from March 1997 to March 1999 and was not included in the study.	Low The study extracted data on all hospital admissions for residents of the Boston Metropolitan area who were admitted to the hospital (in the Boston area) with a primary diagnosis of MI (International Classification of Diseases, 9th revision-ICD-9:410), and pneumonia (ICD-9: 480–487), from Medicare billing records for the years 1995–1999.	Probably Low Adjusted for temperature, day of the week, seasonality, long-term trends, humidity, barometric pressure, and the extinction coefficient.	Low Data consisted of all U.S. Medicare hospital admissions in the Boston Metropolitan area for myocardial infarction during the study duration.	Low Daily counts for hospital admissions were obtained, so likely have all outcome data. However, any potential errors or missing data did not depend on air pollution levels.	Probably Low There was insufficient information about selective outcome to judge for low risk, but indirect evidence that suggests study was free of selective report.	Low Authors declared no competing interests.	Low No other potential sources of bias identified.

No.	Study	Exposure assessment	Outcome assessment	Confounding bias	Selection bias	Incomplete outcome data	Selective reporting	Conflict of interest	Other
9	Liu et al. 2016a	Probably High EC were collected from a single monitor on a one-in-three or one-in-six day schedule. EC were measured for 566 days from April 02, 2009, to December 30, 2013, <25% missing for the frequency of sampling.	Low Emergency department visit data was obtained from the Blue Cross Blue Shield Texa. International Classification of Diseases 9th Revision (ICD-9) diagnosis codes were used to classify outcome groups.	Probably Low Adjusted for time (long-term and seasonal trend), day of week, temperature, dew point and population growth.	Low Study included daily counts of emergency department visits for Greater Houston from claims data insured from January 1, 2008 through December 31, 2013.	Low Daily counts for emergency department visits were obtained, so likely have all outcome data. However, any potential errors or missing data did not depend on air pollution levels.	Probably Low There was insufficient information about selective outcome to judge for low risk, but indirect evidence that suggests study was free of selective report.	Low Authors declared no potential competing financial interests.	Low No other potential sources of bias identified.

No.	Study	Exposure assessment	Outcome assessment	Confounding bias	Selection bias	Incomplete outcome data	Selective reporting	Conflict of interest	Other
10	Liu et al. 2016b	Probably High EC were collected from a single monitor on a one-in-three or one-in-six day schedule. EC were measured for 566 days from April 02, 2009, to December 30, 2013, <25% missing for the frequency of sampling.	Low Hospital admission data was obtained from the Blue Cross Blue Shield Texa. International Classification of Diseases 9th Revision (ICD-9) diagnosis codes were used to classify outcome groups.	Probably Low Adjusted for time, day of week, temperature, seasonality, humidity and population growth.	Low Study included all hospital admissions obtained from billing claims of Blue Cross Blue Shield Texa enrollees for Greater Houston from January 1, 2008 to December 31, 2013.	Low Daily counts for HA were obtained, so likely have all outcome data. However, any potential errors or missing data did not depend on air pollution levels.	Probably Low There was insufficient information about selective outcome to judge for low risk, but indirect evidence that suggests study was free of selective report.	Low Authors declared no competing financial interests.	Low No other potential sources of bias identified.



No.	Study	Exposure assessment	Outcome assessment	Confounding bias	Selection bias	Incomplete outcome data	Selective reporting	Conflict of interest	Other
11	Sarnat et al. 2015	Probably Low 24hr average concentration of PM <sub>2.5</sub> were obtained from a Supersite (single, central site monitoring location). The observations of EC was 666 days during 1 June 2001-30 April 2003 (missing data <25%).	Low Computerized billing records were obtained from the Missouri Hospital Association (MHA) for emergency department visits. The outcome groups were identified using primary International Classification of Diseases 9th Revision (ICD9) codes.	Probably Low Models adjusted for season, day of week, holidays, time trends (using cubic splines for day of visit with monthly knots), and temperature.	Low Data consisted of all emergency department visits during the study period for cardiovascular disease outcomes.	Probably Low Daily counts for emergency department visits were obtained, hence one hospital not providing data after 26 April 2002. However, any potential errors or missing data did not depend on air pollution levels.	Probably Low There was insufficient information about selective outcome to judge for low risk, but indirect evidence that suggests study was free of selective report.	Low The authors declare they have no actual or potential competing financial interests.	Low No other potential sources of bias identified.

No.	Study	Exposure assessment	Outcome assessment	Confounding bias	Selection bias	Incomplete outcome data	Selective reporting	Conflict of interest	Other
12	Kim et al. 2012	Probably Low PM <sub>2.5</sub> mass and chemical constituents were measured daily at one residential monitoring station located on the roof of an elementary school building in Denver. The observations of EC was 1809 days during 2003-2007 (missing data <25%).	Low All individual hospital admission records during the study period were extracted from nonelective hospital admission discharge data obtained from the Colorado Hospital Association. The International Classification of Diseases, Ninth Revision(ICD-9) codes were used to define cardiovascular hospital admissions (codes 390–459) and respiratory hospital admissions (codes 460–519).	Probably Low Model adjusted for days from the start of the study, day of week, seasonality, long-term trends, daily average temperature and relative humidity.	Low Data consisted of all cardiovascular hospital admissions over the course of the study.	Low Daily counts for hospital admission were obtained, so likely have all outcome data. However, any potential errors or missing data did not depend on air pollution levels.	Probably Low There was insufficient information about selective outcome to judge for low risk, but indirect evidence that suggests study was free of selective report.	Low The authors declare they have no actual or potential competing financial interests.	Low No other potential sources of bias identified.

No.	Study	Exposure assessment	Outcome assessment	Confounding bias	Selection bias	Incomplete outcome data	Selective reporting	Conflict of interest	Other
13	Ostro et al. 2009	High EC were generally recorded every 3 days from two co-located monitors or one monitor in 6 counties. The number of available days of data over the 4-year period ranged from 227 to 381 (some counties had >25% missing for the frequency of sampling).	Low Data for hospitalizations were obtained from the Office of Statewide Health Planning and Development, Healthcare Quality and Analysis Division. Hospital admissions for children <19 years of age were classified into one or more categories: all respiratory disease (International Classification of Diseases, Ninth Revision-ICD-9 codes 460–519), asthma (ICD-9 code 493), acute bronchitis (ICD-9 code 466), and pneumonia (ICD-9 codes 480–486).	Probably Low Adjusted for time, day of the week, temperature, seasonality, relative humidity and pollutant.	Low Study included all hospitalizations for children < 19 and < 5 years of age for total respiratory diseases and several subcategories including pneumonia, acute bronchitis, and asthma for six California counties from 2000 through 2003.	Low Daily counts for hospitalizations of children were obtained, so likely have all outcome data. However, any potential errors or missing data did not depend on air pollution levels.	Probably Low There was insufficient information about selective outcome to judge for low risk, but indirect evidence that suggests study was free of selective report.	Low Authors declared no competing financial interests.	Low No other potential sources of bias identified.

No.	Study	Exposure assessment	Outcome assessment	Confounding bias	Selection bias	Incomplete outcome data	Selective reporting	Conflict of interest	Other
14	Kim et al. 2015	Probably Low Daily 24-hour composite PM <sub>2.5</sub> samples were collected from single, central-site monitor. The observations of EC was 1809 days from 2003 through 2007 (missing data <25%).	Low Daily mortality counts for metropolitan Denver were computed from the Colorado Health Information Dataset compiled by the Colorado Department of Public Health and Environment. Data included cause of death by the International Classification of Diseases 10th Revision (ICD-10) code.	Probably Low Models adjusted for longer-term temporal trend, as time since the study began, day of week, and daily temperature and humidity.	Low Data consisted of all deaths over the course of the study in a defined geographical area.	Low Daily counts for death were obtained, so likely have all outcome data. However, any potential errors or missing data did not depend on air pollution levels.	Probably Low There was insufficient information about selective outcome to judge for low risk, but indirect evidence that suggests study was free of selective report.	Low None of the authors has any actual or potential competing interests.	Low No other potential sources of bias identified.

No.	Study	Exposure assessment	Outcome assessment	Confounding bias	Selection bias	Incomplete outcome data	Selective reporting	Conflict of interest	Other
15	Huang et al. 2012	Probably Low	Low	Probably Low	Probably Low	Low	Probably Low	Low	Low
		Daily average concentrations of PM <sub>2.5</sub> were obtained from a single, central-site monitor. Daily average concentrations of EC in PM <sub>2.5</sub> samples were further analyzed. Daily data was available and no missing data was reported.	Daily mortality data were obtained from the Xi'an Center for Disease Control and Prevention. The International Classification of Diseases, Tenth Revision (ICD-10), codes of mortality were as follows: all natural causes (ICD-10 codes A00–R99), respiratory diseases (ICD-10 codes I00–I98), and cardiovascular diseases (ICD-10 codes I00–I99).	Models adjusted for calendar time (seasonality, long-term trends), weather (temperature, relative humidity), year, day of week.	The author removed the death counts on December 31 and January 1 of each year.	Daily counts for death were obtained, so likely have all outcome data. However, any potential errors or missing data did not depend on air pollution levels.	There was insufficient information about selective outcome to judge for low risk, but indirect evidence that suggests study was free of selective report.	No competing financial interests.	No other potential sources of bias identified.

No.	Study	Exposure assessment	Outcome assessment	Confounding bias	Selection bias	Incomplete outcome data	Selective reporting	Conflict of interest	Other
16	Peng et al. 2009	Probably High Ambient EC obtained from Speciation Trends Network monitors and either from central site or averaged over a county. Air pollution concentrations were measured on a 1-in-3-day schedule in the national air monitoring stations and on a 1-in-6-day schedule in the state and local air monitoring stations. Study removed suspect data and extreme values from the original monitor records; monitors with very little data were omitted altogether. Missing data was not replaced by other values.	Low Daily counts of hospital admissions were obtained from billing claims of enrollees in the U.S. Medicare system. Each billing claim contains the date of service, disease classification using International Classification of Diseases, 9th Revision (ICD-9) codes (Centers for Disease Control and Prevention 2008).	Probably Low Model adjusted for weather (i.e., temperature, dew point temperature), day of week, unobserved seasonal factors, and long-term trends.	Low Data consisted of all cardiovascular hospital admissions during over the course of the study.	Low Daily counts for hospital admission were obtained, so likely have all outcome data. However, any potential errors or missing data did not depend on air pollution levels.	Probably Low There was insufficient information about selective outcome to judge for low risk, but indirect evidence that suggests study was free of selective report.	Low The authors declare they have no competing financial interests.	Low No other potential sources of bias identified.

No.	Study	Exposure assessment	Outcome assessment	Confounding bias	Selection bias	Incomplete outcome data	Selective reporting	Conflict of interest	Other
17	Levy et al. 2012	Probably High The U.S. Environmental Protection Agency established the PM Speciation Trends Network (STN) to measure more than 50 PM <sub>2.5</sub> chemical components, in addition to total mass. The STN includes > 50 national air monitoring stations (NAMS) and > 200 state and local air monitoring stations (SLAMS). Air pollution concentrations were typically measured on a 1-in-3-day schedule in the NAMS and on a 1-in-6-day schedule in the SLAMS. There was no information about missing data.	Low Hospital admissions data were obtained from billing claims information for US Medicare enrollees in 119 counties for the years 2000–2008. The Medicare billing claims data were classified into disease categories according to their International Classification of Diseases, Ninth Revision (ICD-9), codes.	Probably Low Adjusted for time (seasonality, long-term trends), seasonality, day of the week and dew-point temperature.	Low Study included people who died any day between 2000 and 2008 in 119 US counties.	Low Daily counts of hospital admissions were obtained from billing claims information, so likely have all outcome data. However, any potential errors or missing data did not depend on air pollution levels.	Probably Low There was insufficient information about selective outcome to judge for low risk, but indirect evidence that suggests study was free of selective report.	Low No competing financial interests.	Low No other potential sources of bias identified.

No.	Study	Exposure assessment	Outcome assessment	Confounding bias	Selection bias	Incomplete outcome data	Selective reporting	Conflict of interest	Other
18	Son et al. 2012	Probably Low Hourly air samples were obtained from a single, central-site monitor. The monitoring system produces hourly estimates of PM <sub>2.5</sub> total mass, and PM <sub>2.5</sub> levels of EC. Daily data was available and no missing data was reported.	Low Daily death counts were obtained from the National Statistical Office. The study classified mortality data into all causes of death [International Classification of Diseases, 10th Revision (ICD-10; codes A00–R99), cardiovascular causes (codes I00–I99), and respiratory causes (codes J00–J99)] (World Health Organization 2007).	Probably Low Models adjusted for time (long-term trends and seasonality), day of week, temperature and relative humidity.	Low Data consisted of all cardiovascular deaths over the course of the study.	Low Daily counts for death were obtained, so likely have all outcome data. However, any potential errors or missing data did not depend on air pollution levels.	Probably Low There was insufficient information about selective outcome to judge for low risk, but indirect evidence that suggests study was free of selective report.	Low The authors declare they have no actual or potential competing financial interests.	Low No other potential sources of bias identified.



No.	Study	Exposure assessment	Outcome assessment	Confounding bias	Selection bias	Incomplete outcome data	Selective reporting	Conflict of interest	Other
19	Heo et al. 2014	Probably High Ambient air samples were collected over a 24-hour period at 3-day intervals from a single monitor. Missing data <25% for the frequency of EC samples.	Low Seoul daily mortality data were obtained from the Korea National Statistical Office. Using the International Classification of Disease, 10th Revision (ICD-10; World Health Organization 1993), the mortality data were classified as all nonaccidental causes (codes A00-R99), cardiovascular disease (codes I00-I99), respiratory disease (codes J00-J98), and injury (S00-T98).	Low Adjusted for long-term trends, seasonality, temperature and humidity, day of the week, holiday and influenza epidemics.	Low Study included all death for all-cause, cardiovascular, and respiratory in Seoul during 2003–2007.	Low Daily counts for death were obtained, so likely have all outcome data. However, any potential errors or missing data did not depend on air pollution levels.	Probably Low There was insufficient information about selective outcome to judge for low risk, but indirect evidence that suggests study was free of selective report.	Low Authors declared no competing financial interests.	Low No other potential sources of bias identified.

No.	Study	Exposure assessment	Outcome assessment	Confounding bias	Selection bias	Incomplete outcome data	Selective reporting	Conflict of interest	Other
20	Basagaña et al. 2015	Probably High	Low	Probably Low	Low	Low	Probably Low	Low	Low
		Single central-site monitor in each city. For each city, PM constituents with >20% of the values below the detection limit or missing were excluded. Otherwise, non-detectable were replaced by half the limit of detection. Air pollution data was collected daily in Bologna (n=472), twice a week in Barcelona (n=736) and Madrid (n=104), and once a week in Huelva (n=406). There was no information about missing data.	Daily mortality counts for all non-external causes [International Classification of Diseases, 9th Revision (ICD9) codes 001–799; 10th revision (ICD10) codes A00–R99], cardiovascular (ICD9 codes 390–459, ICD-10 codes I00–I99) and respiratory (ICD9 codes 460–519, ICD10 codes J00–J99) were collected. Cardiovascular and respiratory hospitalizations were defined on the basis of the primary discharge diagnosis using the same ICD codes defined above.	Models adjusted for holidays, summer population decrease, influenza epidemics, seasonality, long-term trends and temperature.	Data consisted of all deaths over the course of the study in a defined geographical area.	Daily counts for death and emergency hospital admissions were obtained, so likely have all outcome data. However, any potential errors or missing data did not depend on air pollution levels.	There was insufficient information about selective outcome to judge for low risk, but indirect evidence that suggests study was free of selective report.	The authors have no conflicts of interest to disclose.	No other potential sources of bias identified.

No.	Study	Exposure assessment	Outcome assessment	Confounding bias	Selection bias	Incomplete outcome data	Selective reporting	Conflict of interest	Other
21	Dai et al. 2014	Probably High EC were measured on a 1-in-3 or 1-in-6 day schedule. Most of the cities had a single monitor. For every species, the study calculated the monthly average species-to-PM <sub>2.5</sub> proportions for each month as a solution to the missing speciation data problem due to the 1-in-6 or 1-in-3 day sampling frequency. There was no information of missing data for that sampling frequency.	Low Daily mortality data were obtained from National Center for Health Statistics. The study examined nonaccidental deaths due to all causes and specific diseases, derived from the International Statistical Classification of Disease, 10th Revision (World Health Organization 2007).	Probably Low Adjusted for time, temperature, day of the week, and season.	Low Study included all death for all causes, cardiovascular disease, myocardial infarction, stroke, and respiratory diseases from National Center for Health Statistics in 75 U.S. cities between 2000 and 2006.	Low Daily counts for death were obtained, so likely have all outcome data. However, any potential errors or missing data did not depend on air pollution levels.	Probably Low There was insufficient information about selective outcome to judge for low risk, but indirect evidence that suggests study was free of selective report.	Low The authors declare they have no actual or potential competing financial interests.	Low No other potential sources of bias identified.

No.	Study	Exposure assessment	Outcome assessment	Confounding bias	Selection bias	Incomplete outcome data	Selective reporting	Conflict of interest	Other
22	Lin et al. 2016a	Probably Low	Low	Low	Low	Low	Probably Low	Low	Low
		The concentrations of different particle size fractions and PM <sub>2.5</sub> chemical constituents were measured at two air monitoring stations. EC were measured for four months of each year from 2007 through 2010. During the period 2009-2011, the proportion of missing data was very low (ranging from 1% to 2%). There were about 20 days without chemical constituents records and were treated as missing observations.	Daily mortality data from 1 January 2007 to 31 December 2011 were obtained from Guangdong Provincial Center for Disease Control and Prevention. The cause of death was coded using the International Classification of Diseases, Tenth Revision (ICD-10). Mortality from cardiovascular diseases (ICD-10:I00-I99) were extracted to construct the time series.	Adjusted for public holidays, day of the week, influenza outbreaks, seasonal patterns and long-term trends, temperature and relative humidity.	Study included daily cardiovascular mortality data from 1 January 2007 to 31 December 2011 in Guangzhou.	Daily counts for death were obtained, so likely have all outcome data. However, any potential errors or missing data did not depend on air pollution levels.	There was insufficient information about selective outcome to judge for low risk, but indirect evidence that suggests study was free of selective report.	The authors declare they have no actual or potential competing financial interests.	No other potential sources of bias identified.

No.	Study	Exposure assessment	Outcome assessment	Confounding bias	Selection bias	Incomplete outcome data	Selective reporting	Conflict of interest	Other
23	Cao et al. 2012	Probably Low Daily concentrations of EC was obtained from a single monitoring site. The observations of EC was 1749 in 1827 days (missing data <25%).	Low The study obtained numbers of deaths in Xi'an for each day from the Shanxi Provincial Center for Disease Control and Prevention (SPCDCP). SPCDCP staff then classify the cause of death according to the International Classification of Diseases, 10th Revision [ICD-10; World Health Organization (WHO) 1992] as due to total nonaccidental causes (ICD-10 codes A00–R99), cardiovascular diseases (I00–I99), respiratory diseases (J00–J98), or injury (S00–T98).	Probably Low Model adjusted for long-term and seasonal trends, day of week, temperature, humidity, and SO <sub>2</sub> and NO <sub>2</sub> concentrations.	Low Data consisted of all nonaccidental causes deaths during over the course of the study.	Low Daily counts for death were obtained, so likely have all outcome data. However, any potential errors or missing data did not depend on air pollution levels.	Probably Low There was insufficient information about selective outcome to judge for low risk, but indirect evidence that suggests study was free of selective report.	Low The authors declare they have no actual or potential competing financial interests.	Low No other potential sources of bias identified.

No.	Study	Exposure assessment	Outcome assessment	Confounding bias	Selection bias	Incomplete outcome data	Selective reporting	Conflict of interest	Other
24	Klemm et al. 2011	Probably Low Daily 24-hr average EC measurements are available for Atlanta during the study period. The observations of EC was 3317 days from August 1998 to December 31, 2007. Missing data <25%. There was no information for monitor stations.	Low Records of individual deaths were provided by the Georgia Department of Human Resources. Cause of death is categorized using the International Classification of Diseases, 10th edition (ICD-10), including circulatory conditions (I00–I99), respiratory conditions (J00–J99), malignant neoplasm (cancer; C00–D48), or other nonaccidental causes (A00–R99, excluding cardiovascular, respiratory, or cancer causes).	Probably Low Adjusted for time (seasonality, long-term trends), temperature, and day of the week.	Low Study included all nonaccidental deaths during over the course of the study.	Low Daily counts for death were obtained, so likely have all outcome data. However, any potential errors or missing data did not depend on air pollution levels.	Probably Low There was insufficient information about selective outcome to judge for low risk, but indirect evidence that suggests study was free of selective report.	Low Authors declared no competing financial interests.	Low No other potential sources of bias identified.

No.	Study	Exposure assessment	Outcome assessment	Confounding bias	Selection bias	Incomplete outcome data	Selective reporting	Conflict of interest	Other
25	Zhou et al. 2011	Probably Low 24hr PM <sub>2.5</sub> samples were obtained from a single, central-site monitor. Daily data was available and no missing data was reported.	Low Using codes from the International Classification of Diseases, version 10 (ICD10; World Health Organization 2007), daily death counts were aggregated to nonaccidental allcause deaths (ICD10, codes A00 through R99), cardiovascular deaths (ICD10, codes I01 through I99), and respiratory deaths (ICD10, codes J00 through J99).	Probably Low Models adjusted for time, seasonality and long-term trends, day of week, temperature, and humidity.	Low Data consisted of all cardiovascular deaths over the course of the study.	Low Daily counts for death were obtained, so likely have all outcome data. However, any potential errors or missing data did not depend on air pollution levels.	Probably Low There was insufficient information about selective outcome to judge for low risk, but indirect evidence that suggests study was free of selective report.	Low The authors declare they have no actual or potential competing financial interests.	Low No other potential sources of bias identified.

No.	Study	Exposure assessment	Outcome assessment	Confounding bias	Selection bias	Incomplete outcome data	Selective reporting	Conflict of interest	Other
26	Winqvist et al. 2015	Probably Low Daily EC and BC were from a single monitor site. All species of pollutant statistics are missing less than 5%.	Low Individual-level data were obtained from the Missouri Hospital Association for all emergency department visits to 36 of 43 acute-care non-federal hospitals with emergency department visits in the 16-county St Louis metropolitan statistical area during 1 June 2001 through 30 April 2003. Cardiorespiratory outcomes of interest were defined based on the primary ICD-9 (International Classification of Diseases, version 9) diagnosis code for the visit.	Probably Low Adjusted for time trends, day of week, holidays, season, temperature and dew point.	Low Study included emergency department visits in St Louis metropolitan statistical area during 1 June 2001 through 30 April 2003.	Low Daily counts for emergency department visit were obtained, so likely have all outcome data. However, any potential errors or missing data did not depend on air pollution levels.	Probably Low There was insufficient information about selective outcome to judge for low risk, but indirect evidence that suggests study was free of selective report.	Low Authors declared no competing financial interests.	Low No other potential sources of bias identified.



No.	Study	Exposure assessment	Outcome assessment	Confounding bias	Selection bias	Incomplete outcome data	Selective reporting	Conflict of interest	Other
27	Ostro et al. 2007	Probably High Each of the six counties had two monitors measuring PM <sub>2.5</sub> components and mass. Fresno, Kern, Riverside, and Sacramento Counties reported data every third day, whereas San Diego and Santa Clara Counties reported data every sixth day. For the speciation analyses, the number of observation days available ranged from 243 (San Diego County) to 395 (Sacramento County) from 2000 to 2003. There was no specific information about missing data.	Low Daily mortality data were obtained from the California Department of Health Services, Center for Health Statistics. The study determined daily total mortality counts for those > 65 years of age and for deaths from respiratory disease [International Classification of Diseases, 10th Revision (ICD10; World Health Organization 1993) codes J00–J98] and cardiovascular disease (codes I00–I99).	Probably Low Adjusted for time trend, day of week, seasonality, long-term trends, temperature and humidity.	Low Data consisted of all cardiovascular deaths over the course of the study.	Low Daily counts for death were obtained, so likely have all outcome data. However, any potential errors or missing data did not depend on air pollution levels.	Probably Low There was insufficient information about selective outcome to judge for low risk, but indirect evidence that suggests study was free of selective report.	Low The authors declare they have no competing financial interests.	Low No other potential sources of bias identified.

No.	Study	Exposure assessment	Outcome assessment	Confounding bias	Selection bias	Incomplete outcome data	Selective reporting	Conflict of interest	Other
28	Tolbert et al. 2000	Probably Low Daily 24h EC from a single monitor site. The observation of EC was 356 in 365 days, missing data <25%.	Low Computerized billing record data are being obtained from the emergency department visits participating in the study. Several case groups are being defined using the primary ICD-9 (International Classification of Diseases, 9th Revision) diagnostic code.	Probably Low Adjusted for time (seasonality, long-term trends), temperature, dew point, and day of week.	Low Study included emergency department visits of the participating hospitals in the Atlanta Metropolitan Statistical Area, including 33 hospitals between January 1 1993-August 31 2000, 4 hospitals between January 1 1993-February 30 2000.	Low Daily count for emergency department visits were obtained, so likely have all outcome data. However, any potential errors or missing data did not depend on air pollution levels.	Probably Low There was insufficient information about selective outcome to judge for low risk, but indirect evidence that suggests study was free of selective report.	Low Authors declared no competing financial interests.	Low No other potential sources of bias identified.

No.	Study	Exposure assessment	Outcome assessment	Confounding bias	Selection bias	Incomplete outcome data	Selective reporting	Conflict of interest	Other
29	Wang and Lin 2016	Low The hourly data were simply averaged to calculate the daily average data for PM <sub>10</sub> , PM <sub>2.5</sub> monitored at 13 general air quality monitoring stations located in a densely populated area in Taipei. Hourly concentrations of EC were detected by series 5400 Monitor. Very few missing values in the database were omitted as the daily average was calculated.	Low This study obtained universal health insurance claims from the National Health Research Institute (NHRI) and vital statistics from the Ministry of Health and Welfare from 2004 to 2008. Death causes were coded according to the diagnoses of the 9th revision of International Classification of Diseases (ICD-9). Disease diagnoses were based on the International Classification of Diseases with Clinical Modification, Ninth Revision (ICD-9 CM).	Probably Low Adjusted for temperature, relative humidity, wind speed, barometric pressure, holidays, day of the week, pneumonia and influenza.	Low Study included elderly ( $\geq 65$ years) mortality from 2004 to 2008 and all population EVR from 2004 to 2010 in Taipei, Taiwan.	Low Daily counts for elderly mortality and all population emergency room visits were obtained, so likely have all outcome data. However, any potential errors or missing data did not depend on air pollution levels.	Probably Low There was insufficient information about selective outcome to judge for low risk, but indirect evidence that suggests study was free of selective report.	Low Authors declared no competing financial interests.	Low No other potential sources of bias identified.

No.	Study	Exposure assessment	Outcome assessment	Confounding bias	Selection bias	Incomplete outcome data	Selective reporting	Conflict of interest	Other
30	Darrow et al. 2014	Low Daily 24-hour average EC was from ambient monitoring networks. Missing data <1%.	Low Health data were obtained from 41 metropolitan Atlanta hospitals and the Georgia Hospital Association. The diagnoses of respiratory infection were based on International Classification of Diseases, 9th Revision (ICD-9), diagnosis codes: acute bronchitis or bronchiolitis (code 466); pneumonia (codes 480–486); and upper respiratory infection (codes 460–465).	Low Adjusted for dew point, temperature, seasonality, long-term trends, day of week, holiday and influenza epidemics.	Low Study included daily emergency department visit data from 41 metropolitan Atlanta hospitals for the period January 1, 1993, to December 31, 2004 (not all hospitals contributed the full period), and from the Georgia Hospital Association for the period January 1, 2005, to June 30, 2010.	Probably Low Daily counts for emergency department visit were obtained. In the earliest years of the study, not all hospitals were participating. However, any potential errors or missing data did not depend on air pollution levels.	Probably Low There was insufficient information about selective outcome to judge for low risk, but indirect evidence that suggests study was free of selective report.	Low Authors declared no competing financial interests.	Low No other potential sources of bias identified.

No.	Study	Exposure assessment	Outcome assessment	Confounding bias	Selection bias	Incomplete outcome data	Selective reporting	Conflict of interest	Other
31	Metzger et al. 2004	Probably High Ambient 24hr average EC were obtained from one monitor. On days when measurements were missing at the central site, data for the pollutant were imputed using an algorithm that modeled measurements. The observations of EC was 714 days during the period August 1, 1998–August 31, 2000 (missing data >25%).	Low The study asked 41 hospitals with emergency departments that serve the 20-county Atlanta metropolitan statistical area (MSA) to provide computerized billing data for all emergency department visits between January 1, 1993, and August 31, 2000. Using the primary International Classification of Diseases, 9th Revision (ICD-9) diagnosis code, the study defined several cardiovascular disease (cardiovascular disease) groups based largely on ICD-9 diagnosis codes.	Probably Low Model adjusted for temporal trends, meteorological conditions (i.e., temperature, dew point temperature), day of week, hospital entry and exit, and federally observed holidays.	Low Data consisted of all cardiovascular hospital admissions over the course of the study.	Low Daily counts for emergency department visits were obtained, so likely have all outcome data. However, any potential errors or missing data did not depend on air pollution levels.	Probably Low There was insufficient information about selective outcome to judge for low risk, but indirect evidence that suggests study was free of selective report.	Low No competing financial interests.	Low No other potential sources of bias identified.

No.	Study	Exposure assessment	Outcome assessment	Confounding bias	Selection bias	Incomplete outcome data	Selective reporting	Conflict of interest	Other
32	Mar et al. 2000	Probably Low Hourly PM <sub>2.5</sub> chemical composition data from a single, central-site monitor. Daily data was available and no missing data was reported.	Low Mortality data for all of Maricopa County from 1995 to 1997 were obtained from the Arizona Center for Health Statistics in Phoenix. Death certificate data included residence zip code and the primary cause of death as identified by the International Classification of Diseases, Ninth Revision (ICD-9, World Health Organization, Geneva).	Probably Low Adjusted for time trend, seasonality, day of week, temperature and relative humidity.	Low Data consisted of all cardiovascular deaths during over the course of the study.	Low Daily counts for death were obtained, so likely have all outcome data. However, any potential errors or missing data did not depend on air pollution levels.	Probably Low There was insufficient information about selective outcome to judge for low risk, but indirect evidence that suggests study was free of selective report.	Low No competing financial interests.	Low No other potential sources of bias identified.

No.	Study	Exposure assessment	Outcome assessment	Confounding bias	Selection bias	Incomplete outcome data	Selective reporting	Conflict of interest	Other
33	Wang et al. 2019a	Low Hourly data of PM <sub>2.5</sub> were collected at 10 Chinese air quality monitoring sites in Shanghai. Hourly mass concentrations of PM <sub>2.5</sub> and EC were predicted in Shanghai by using a Community Multiscale Air Quality model. The study included continuous daily data from 2013 to 2015 (1095 days). Daily data was available and no missing data was reported.	Low The daily mortality data were obtained from the system of Disease Monitoring Point belonged to the Chinese Center for Disease Control and Prevention (China CDC). Deaths were classified according to the 10th revised International Statistical Classification of Disease (ICD-10), all-cause mortality (A00-R99), circulatory disease mortality (I00-I99, the circulatory disease is also known as cardiovascular disease) and respiratory disease mortality (J00-J99).	Probably Low Adjusted for long term trends, seasonal influence, day of the week, holidays, temperature and relative humidity.	Low Study included daily mortality data in Huangpu district from January 1, 2013 to December 31, 2015.	Low Daily counts for death were obtained, so likely have all outcome data. However, any potential errors or missing data did not depend on air pollution levels.	Probably Low There was insufficient information about selective outcome to judge for low risk, but indirect evidence that suggests study was free of selective report.	Low No competing financial interests.	Low No other potential sources of bias identified.

No.	Study	Exposure assessment	Outcome assessment	Confounding bias	Selection bias	Incomplete outcome data	Selective reporting	Conflict of interest	Other
34	Lin et al. 2016b	Probably High EC was from a single monitor site for four months of each year from 2007 to 2010. Missing data for the particle concentration was very low (ranging from 1% to 2%).	Low Daily mortality data were obtained from the death registry system. The cause of death was coded using the International Classification of Diseases, Tenth Revision (ICD-10). Mortality from stroke (ICD-10:I60–I66), and sub-categories, including ischemic stroke (ICD-10:I63–I66), and hemorrhagic stroke (ICD-10: I60–I62) were extracted to construct the time series.	Probably Low Adjusted for long-term trends, seasonality, temperature, humidity, day of week and public holidays.	Low Study included the residents who died of ischemic or hemorrhagic strokes in urban districts of Guangzhou between 2007 and 2011.	Low Daily counts for death were obtained, so likely have all outcome data. However, any potential errors or missing data did not depend on air pollution levels.	Probably Low There was insufficient information about selective outcome to judge for low risk, but indirect evidence that suggests study was free of selective report.	Low Authors declared no conflict of interest.	Low No other potential sources of bias identified.



No.	Study	Exposure assessment	Outcome assessment	Confounding bias	Selection bias	Incomplete outcome data	Selective reporting	Conflict of interest	Other
35	Lin et al. 2016b	Probably High Each of the six counties had two monitors measuring components of PM <sub>2.5</sub> . Fresno, Kern, Riverside and Sacramento counties reported 24-hour average EC in PM <sub>2.5</sub> every third day; San Diego and Santa Clara counties reported data every sixth day. The study included only species for which at least 50% of the observations were above the level of detection.	Low Daily mortality for all California residents were obtained from the California Department of Health Services, Center for Health Statistics. Daily counts of deaths from cardiovascular disease (International Classification of Diseases, Tenth Revision (ICD10) =I00–I99) were calculated.	Probably Low Adjusted for time, temperature, humidity and day of the week.	Low Study included daily cardiovascular mortality for all California residents from 1 January 2000 to 31 December 2003.	Low Daily counts for death were obtained, so likely have all outcome data. However, any potential errors or missing data did not depend on air pollution levels.	Probably Low There was insufficient information about selective outcome to judge for low risk, but indirect evidence that suggests study was free of selective report.	Low Authors declared no competing interests.	Low No other potential sources of bias identified.

No.	Study	Exposure assessment	Outcome assessment	Confounding bias	Selection bias	Incomplete outcome data	Selective reporting	Conflict of interest	Other
36	Ito et al. 2011	Probably Low	Low	Probably Low	Low	Low	Probably Low	Low	Low
		Ambient EC obtained from multiple monitors and the average of data from multiple monitors was computed using the 24hr average values. The sampling frequency of the chemical speciation data was every third day. Daily data was available and no missing data was reported.	Hospitalizations and mortality data were available at the New York City Department of Health and Mental Hygiene. The relevant variables available in the electronic discharge abstract for each patient included date of admission and International Classification of Diseases, Ninth Revision (ICD9) discharge diagnosis code. The International Classification of Diseases, Tenth Revision (ICD10) codes for determining cause of death.	Model adjusted for temporal trends and seasonal cycles, immediate and delayed temperature effects, and day of the week.	Data consisted of all cardiovascular hospital admissions over the course of the study.	Daily counts for death and hospitalization were obtained, so likely have all outcome data. However, any potential errors or missing data did not depend on air pollution levels.	There was insufficient information about selective outcome to judge for low risk, but indirect evidence that suggests study was free of selective report.	The authors declare they have no actual or potential competing financial interests.	No other potential sources of bias identified.

No.	Study	Exposure assessment	Outcome assessment	Confounding bias	Selection bias	Incomplete outcome data	Selective reporting	Conflict of interest	Other
37	Chen et al. 2014	Probably Low Hourly mass concentrations of PM <sub>2.5</sub> and the four PM <sub>2.5</sub> constituents obtained from a Supersite (single, central site monitoring location). The observations of EC was 1599 in 1705 days (missing data <25%).	Low The counts of daily emergency room visits were obtained from the National Taiwan University Hospital. The emergency room visit data were coded regarding the discharge diagnosis using the International Classification of Disease, 9th revision (ICD-9).	Probably Low Models adjusted for time, day of week, temperature, seasonality and relative humidity.	Low Data consisted of all emergency department visits during the study period for ischemic and hemorrhagic stroke.	Low Daily counts for emergency room visit were obtained, so likely have all outcome data. However, any potential errors or missing data did not depend on air pollution levels.	Probably Low There was insufficient information about selective outcome to judge for low risk, but indirect evidence that suggests study was free of selective report.	Low No competing financial interests.	Low No other potential sources of bias identified.

No.	Study	Exposure assessment	Outcome assessment	Confounding bias	Selection bias	Incomplete outcome data	Selective reporting	Conflict of interest	Other
38	Tomic' -Spiric' et al. 2019	Low Average daily concentrations of BC in micrograms per cubic meter were measured by three automatic ambient air quality monitoring stations. There was no information about missing data.	Low Emergency department visits data were obtained from the Health Center Užice, either from the emergency department visits in Užice, Sevojno, and Kosjerić, or from a general hospital in Užice. The inclusion criteria were adults aged 18 years and older with the diagnosis of allergic rhinitis (International Classification of Diseases, 10th revision, code J.30.4), allergic asthma (International Classification of Diseases, 10th revision, code J.45.0), or asthma with coexisting allergic rhinitis.	Probably High Adjusted for temperature, humidity, and air pressure.	Low Study included emergency department visit for allergic rhinitis and allergic asthma from 1 July 2012 to 30 June 2014 in the Zlatibor District, Western Serbia.	Low All counts for emergency department visits were obtained, so likely have all outcome data. However, any potential errors or missing data did not depend on air pollution levels.	Probably Low There was insufficient information about selective outcome to judge for low risk, but indirect evidence that suggests study was free of selective report.	Low Authors declared no competing financial interests.	Low No other potential sources of bias identified.

No.	Study	Exposure assessment	Outcome assessment	Confounding bias	Selection bias	Incomplete outcome data	Selective reporting	Conflict of interest	Other
39	Maynard et al. 2007	Probably Low	Low	Probably Low	Low	Low	Probably Low	Low	Low
		Daily measurements of BC were obtained from a single monitor site. In order to predict local BC level, the study used a validated spatial-temporal land use regression model to predict 24-hr measures of traffic exposure data (BC) at > 80 locations in the Boston area.	Individual mortality records were obtained from the Massachusetts Department of Public Health, for the years 1995–2002. Specific cause mortality was derived from the International Classification of Diseases (ICD) codes [9th Revision before 1999 (World Health Organization 1975) and 10th Revision 1999 to 2002 World Health Organization 1993)].	Adjusted for season and long term trend, temperature, dew point and day of week.	Study included all death for all causes, cardiovascular, respirator, stroke, and diabetes diseases in Boston metropolitan area from the Massachusetts Department of Public Health between 1995–1997 and 1999–2002.	Daily counts for individual mortality records were obtained, so likely have all outcome data. However, any potential errors or missing data did not depend on air pollution levels.	There was insufficient information about selective outcome to judge for low risk, but indirect evidence that suggests study was free of selective report.	Authors declared no competing financial interests.	No other potential sources of bias identified.

No.	Study	Exposure assessment	Outcome assessment	Confounding bias	Selection bias	Incomplete outcome data	Selective reporting	Conflict of interest	Other
40	Sinclair et al. 2010	Probably Low Daily 24-hr averages EC was from a single monitor site. The total observed rate of EC was 95.2%.	Probably Low Daily outpatient visits were obtained from the electronic patient data warehouse of a not-for-profit, group-model managed care organization (MCO) in the metropolitan Atlanta area between August 1, 1998 and December 31, 2002. Visits that met acute visit definition and that had a visit diagnosis code of asthma, upper respiratory infection (URI), or lower respiratory infection (LRI) were included in the study.	Probably Low Adjusted for season, day of week, federal holidays, study month, time, temperature and dew point.	Low Study included daily outpatient visits for acute respiratory diseases from the electronic patient data warehouse of a not-for-profit, group-model managed care organization (MCO) in the metropolitan Atlanta area between August 1, 1998 and December 31, 2002.	Low Daily counts for outpatient visits were obtained, so likely have all outcome data. However, any potential errors or missing data did not depend on air pollution levels.	Probably Low There was insufficient information about selective outcome to judge for low risk, but indirect evidence that suggests study was free of selective report.	Low No competing financial interests.	Low No other potential sources of bias identified.

No.	Study	Exposure assessment	Outcome assessment	Confounding bias	Selection bias	Incomplete outcome data	Selective reporting	Conflict of interest	Other
41	Krall et al. 2013	High Monitors typically measure PM <sub>2.5</sub> constituent concentrations every third or sixth day. Some communities with a single monitor. The observation of EC was 58-921 days, some communities had >25% missing data.	Probably Low All-cause mortality data (excluding accidental deaths) were aggregated from death certificate data obtained from the National Center for Health Statistics for 2000 to 2005.	Probably Low Adjusted for temperature, day of week, long-term and seasonal trends.	Low Study included all death (excluding accidental deaths) for 108 urban communities from 2000 to 2005.	Low Daily counts for death were obtained, so likely have all outcome data. However, any potential errors or missing data did not depend on air pollution levels.	Probably Low There was insufficient information about selective outcome to judge for low risk, but indirect evidence that suggests study was free of selective report.	Low The authors declare they have no actual or potential competing financial interests.	Low No other potential sources of bias identified.

No.	Study	Exposure assessment	Outcome assessment	Confounding bias	Selection bias	Incomplete outcome data	Selective reporting	Conflict of interest	Other
42	Cakmak et al. 2009	Probably High Daily PM <sub>2.5</sub> aerosol samples approximately 1 of every 4 days from a single monitor site. Sampling occurred daily during the cold season (April through September) and alternate days during the warm season (October through March). Missing data <25% for that frequency.	Low Diseases were coded using the WHO International Classification of Disease, 9th Revision (ICD-9). The daily number of emergency department visits for all nonaccidental (ICD-9 < 800) and respiratory (ICD-9 460–519) causes in Santiago Centro, Cerrillos, and Pudahuel were obtained from the Departamento de Estadísticas e Informaciones Salud (DEIS) of the Ministry of Health from April 2001 through August 2006.	Probably Low Adjusted for temperature and humidity, day of week, long-term and seasonal trends.	Low Study included all emergency department visits obtained from the Departamento de Estadísticas e Informaciones Salud (DEIS) of the Ministry of Health from April 2001 through August 2006.	Low Daily counts for emergency department visit were obtained, so likely have all outcome data. However, any potential errors or missing data did not depend on air pollution levels.	Probably Low There was insufficient information about selective outcome to judge for low risk, but indirect evidence that suggests study was free of selective report.	Low No competing financial interests.	Low No other potential sources of bias identified.



No.	Study	Exposure assessment	Outcome assessment	Confounding bias	Selection bias	Incomplete outcome data	Selective reporting	Conflict of interest	Other
43	Tolbert et al. 2007	Low Daily ambient EC obtained from multiple monitors and a single concentration obtained by averaging across monitors. The observations of EC was 2258 during the period August 1, 1998 to December 31, 2004 (missing data <25%).	Low Computerized billing records for all emergency department visits between January 1, 1993 and December 31, 2004 were collected, including the following data for each visit: primary International Classification of Diseases 9th Revision (ICD-9) diagnostic code, secondary ICD-9 diagnosis codes.	Probably Low Model adjusted for long-term and seasonal trends, daily average temperature, dew point, day of week, federal holiday, and hospital entry and exit.	Low Data consisted of all cardiovascular disease and respiratory disease hospital admissions during the period 1993 to 2004 over the course of the study.	Low Daily counts for emergency department visit were obtained, so likely have all outcome data. However, any potential errors or missing data did not depend on air pollution levels.	Probably Low There was insufficient information about selective outcome to judge for low risk, but indirect evidence that suggests study was free of selective report.	Low No competing financial interests.	Low No other potential sources of bias identified.

No.	Study	Exposure assessment	Outcome assessment	Confounding bias	Selection bias	Incomplete outcome data	Selective reporting	Conflict of interest	Other
44	Lall et al. 2011	Low Daily EC data were obtained from two monitors. Daily data was available and no missing data was reported.	Low The categorization of the admissions data was based on codes from the International Classification of Diseases, revision 9 (ICD-9).	Probably Low Model adjusted for season, wintertime influenza episode, weather, day of week, and other possible confounders (e.g., federal holidays).	Low Data consisted of all cardiovascular hospital admissions over the course of the study.	Low Daily counts for hospital admission were obtained, so likely have all outcome data. However, any potential errors or missing data did not depend on air pollution levels.	Probably Low There was insufficient information about selective outcome to judge for low risk, but indirect evidence that suggests study was free of selective report.	Low The authors declare they have no actual or potential competing financial interests.	Low No other potential sources of bias identified.

No.	Study	Exposure assessment	Outcome assessment	Confounding bias	Selection bias	Incomplete outcome data	Selective reporting	Conflict of interest	Other
45	Jung and Lin 2017	Probably High A total of 153 daily samples (approximately 4 weeks per season) from a single monitor site were collected. Multiple linear regression models were used to back extrapolate the historic concentration of individual components of PM <sub>2.5</sub> from 2000 through to 2010, including BC.	Low The health data used in the study were sourced from Longitudinal Health Insurance Database 2000. Daily outpatient visits for asthma (International Classification of Diseases, Ninth Revision, Clinical Modification, ICD-9-CM code 493) data was obtained from Longitudinal Health Insurance Database 2000.	Probably Low Adjusted for seasonal trend, day of week, temperature, precipitation and wind vectors.	Low Study included all asthma outpatient visits (0-20 years old) in Shalu district from Longitudinal Health Insurance Database 2000 during January 1, 2000 to December 31, 2010.	Low Daily counts for asthma outpatient visits (0-20 years old) data were obtained, so likely have all outcome data. However, any potential errors or missing data did not depend on air pollution levels.	Probably Low There was insufficient information about selective outcome to judge for low risk, but indirect evidence that suggests study was free of selective report.	Low No competing financial interests.	Low No other potential sources of bias identified.

No.	Study	Exposure assessment	Outcome assessment	Confounding bias	Selection bias	Incomplete outcome data	Selective reporting	Conflict of interest	Other
46	Gong et al. 2019	Probably Low The 24-h mean BC concentrations data were obtained from a single monitor site. During the study period (2091 days), missing rate of BC was 0.68%.	Low The disease data used in this study were collected from the Chinese Center for Disease Control and Prevention, and included all deaths in Beijing from January 1, 2006 to December 31, 2011. Causes of death were classified according to the International Classification of Diseases, 10th Edition (ICD-10) and data on cardiovascular diseases (ICD-10 code: I00–I99) were obtained.	Probably Low Adjusted for calendar effects, long-term trends, temperature, humidity, day of week, NO <sub>2</sub> and SO <sub>2</sub> .	Low Study included all cardiovascular mortality in Beijing obtained from the Chinese Center for Disease Control and Prevention during January 1, 2006 to December 31, 2011.	Low Daily counts for all deaths were obtained, so likely have all outcome data. However, any potential errors or missing data did not depend on air pollution levels.	Probably Low There was insufficient information about selective outcome to judge for low risk, but indirect evidence that suggests study was free of selective report.	Low Authors declared no conflict of interest.	Low No other potential sources of bias identified.

No.	Study	Exposure assessment	Outcome assessment	Confounding bias	Selection bias	Incomplete outcome data	Selective reporting	Conflict of interest	Other
47	Mostofsky et al. 2012	Probably Low Ambient EC obtained from one monitor. BC concentrations were measured continuously. Daily data was available and no missing data was reported.	Probably Low Patients potentially eligible for this study were identified by reviewing daily emergency department admission logs, stroke service admission logs, stroke service consult logs, and hospital electronic discharge records.	Probably High Model adjusted for seasonality, time-trends, temperature, dew point temperature, barometric pressure and chronic and slowly-varying potential confounders.	Low Population consisted of patients $\geq 21$ years of age admitted to the hospital with neurologist-confirmed ischemic stroke and residing in the Boston metropolitan region. Also patients had to reside within 40 km of the air pollution monitor.	Low Daily counts for emergency department admission were obtained, so likely have all outcome data. However, any potential errors or missing data did not depend on air pollution levels.	Probably Low There was insufficient information about selective outcome to judge for low risk, but indirect evidence that suggests study was free of selective report.	Low No competing financial interests.	Low No other potential sources of bias identified.

No.	Study	Exposure assessment	Outcome assessment	Confounding bias	Selection bias	Incomplete outcome data	Selective reporting	Conflict of interest	Other
48	Krall et al. 2017	Probably High PM <sub>2.5</sub> constituents from one urban, ambient monitor located in each city. Daily pollution data were available in Atlanta; however, data were only available approximately every third day in the remaining three cities. There was no information about missing data.	Low The study obtained electronic billing data for respiratory disease emergency department visits for all ages at acute care hospitals. Using International Classification of Diseases, 9th Revision (ICD-9), the study considered subcategories of respiratory diseases including pneumonia (ICD-9 codes 480–486), chronic obstructive pulmonary disease (491,492,496), upper respiratory infection (URI) (460–465, 466.0, 477), and asthma and/or wheeze (493, 786.07).	Probably Low Adjusted for holidays, long-term trends, day of the week, season, hospitals reporting data, temperature and dew point.	Low Study included all emergency department visits for respiratory disease at acute care hospitals in the 20-county Atlanta metropolitan area, the 7-county Birmingham metropolitan area, the 8 Missouri and 8 Illinois counties in the St. Louis metropolitan area, and the 12-county Dallas metropolitan area.	Low Daily counts for emergency department visits of respiratory disease were obtained, so likely have all outcome data. However, any potential errors or missing data did not depend on air pollution levels.	Probably Low There was insufficient information about selective outcome to judge for low risk, but indirect evidence that suggests study was free of selective report.	Low The authors declare they have no actual or potential competing financial interests.	Low No other potential sources of bias identified.

No.	Study	Exposure assessment	Outcome assessment	Confounding bias	Selection bias	Incomplete outcome data	Selective reporting	Conflict of interest	Other
49	O'Lenick et al. 2017	Probably Low The 24-hour average concentration of EC was evaluated. Pollutant concentration estimates were obtained by fusing observational data from available network monitors with pollutant concentration simulations from the Community Multi-Scale Air Quality emissions-based chemical transport model at 12×12km grids over Atlanta. 24-hour average EC were evaluated. Daily data was available and no missing data was reported.	Low Patient-level emergency department visit data from 1 January 2002 to 31 December 2008 were acquired from hospitals located within the 20-county metropolitan area of Atlanta; Relevant data elements included admission date, International Classification of Diseases Ninth Revision (ICD-9) diagnosis codes, age and ZIP code of patient residence.	Probably Low Adjusted for season, periods of hospital participation and holidays, temperature and mean dew point, interaction terms between season and maximum temperature and day of year.	Low Study included all emergency department visit data acquired directly from hospitals (2002–2004 period) and the Georgia Hospital Association (2005–2008 period) located within the 20-county metropolitan area of Atlanta.	Low Daily counts for emergency department visit were obtained, so likely have all outcome data. However, any potential errors or missing data did not depend on air pollution levels.	Probably Low There was insufficient information about selective outcome to judge for low risk, but indirect evidence that suggests study was free of selective report.	Low Competing interests: None declared.	Low No other potential sources of bias identified.

No.	Study	Exposure assessment	Outcome assessment	Confounding bias	Selection bias	Incomplete outcome data	Selective reporting	Conflict of interest	Other
50	Pearce et al. 2015	Probably Low Daily EC data were obtained from a central monitoring location in Atlanta. Daily data was available and no missing data was reported.	Low The study obtained aggregate daily counts for pediatric asthma related emergency department visits for children ages 5 to 18 years from 41 hospitals within metropolitan Atlanta; and defined emergency department visits for pediatric asthma as all visits with a code for asthma (493.0–493.9) or wheeze (786.07) using the International Classification of Diseases, 9th Revision.	Probably Low Adjusted for year, season, month, day of the week, hospital, holidays, temperature and dew point.	Low Study included all emergency department visits for pediatric asthma of children ages 5 to 18 years from 41 hospitals within metropolitan Atlanta for study period.	Low Daily counts for pediatric asthma related emergency department visits were obtained, so likely have all outcome data. However, any potential errors or missing data did not depend on air pollution levels.	Probably Low There was insufficient information about selective outcome to judge for low risk, but indirect evidence that suggests study was free of selective report.	Low The authors declare that they have no competing interests.	Low No other potential sources of bias identified.



No.	Study	Exposure assessment	Outcome assessment	Confounding bias	Selection bias	Incomplete outcome data	Selective reporting	Conflict of interest	Other
51	Strickland et al. 2010	Low 24-hour average EC were obtained from 6 monitors. Missing data <1%.	Low Daily counts of emergency department visits for asthma or wheeze among children were collected from 41 Metropolitan Atlanta hospitals during 1993-2004. Using the International Classification of Diseases, 9th Revision, the study defined emergency department visits for pediatric asthma as all visits with a code for asthma (493.0–493.9) or wheeze (786.09 before October 1, 1998; 786.07 after October 1, 1998).	Probably Low Adjusted for season, dew point, temperature, year, month, day of week, hospital, upper respiratory infections (the logarithm of the daily count of upper respiratory infections) and pollen concentrations (various lags of ambient ragweed, pine, oak, juniper, grass and birch concentrations).	Low Study included all emergency department visits for asthma or wheeze among children aged 5 to 17 years from metropolitan Atlanta hospitals during 1993–2004.	Low Daily counts for emergency room visits of asthma or wheeze disease were obtained, so likely have all outcome data. However, any potential errors or missing data did not depend on air pollution levels.	Probably Low There was insufficient information about selective outcome to judge for low risk, but indirect evidence that suggests study was free of selective report.	Low No conflict of interests.	Low No other potential sources of bias identified.

No.	Study	Exposure assessment	Outcome assessment	Confounding bias	Selection bias	Incomplete outcome data	Selective reporting	Conflict of interest	Other
52	Strickland et al. 2014	Low 24-hour average EC were obtained from 6 monitors. Missing data was 1%.	Low Daily counts of emergency department visits for asthma or wheeze among children aged 2 to 16 years were collected from the Georgia Hospital Association from 1 January 2002 through 30 June 2010. The study identified all emergency department visits with an International Classification of Diseases, 9th revision (ICD-9) code for asthma (codes beginning with 493) or wheeze (code 786.07) present in any diagnosis field.	Probably Low Adjusted for season, dew point, temperature, day of week, and holiday.	Low Study included all emergency department visits for asthma or wheeze among children 2 to 16 years of age from the Georgia Hospital Association.	Low Daily counts for emergency room visits of asthma or wheeze disease were obtained, so likely have all outcome data. However, any potential errors or missing data did not depend on air pollution levels.	Probably Low There was insufficient information about selective outcome to judge for low risk, but indirect evidence that suggests study was free of selective report.	Low No conflict of interests.	Low No other potential sources of bias identified.

No.	Study	Exposure assessment	Outcome assessment	Confounding bias	Selection bias	Incomplete outcome data	Selective reporting	Conflict of interest	Other
53	Ito et al. 2013	Probably High The study chose 150 U.S. metropolitan statistical areas where the data from at least one Chemical Species Network monitor were available. The Chemical Species Network data for PM <sub>2.5</sub> components were available either every third day or every sixth day. There was no information about missing data.	Low Using International Classification of Diseases, 10th Revision (ICD-10) codes, the study aggregated daily death counts for the nonaccidental all-cause, cardiovascular disease and respiratory deaths. Using International Classification of Diseases, 9th Revision (ICD-9) codes, emergency hospitalizations for the elderly (those 65 and older) data were divided into cardiovascular disease and respiratory categories.	Probably Low Adjusted for modeling of confounding temporal trends (annual cycles and influenza epidemics), day-of-week patterns and temperature.	Low Study included all nonaccidental all-cause, cardiovascular disease and respiratory deaths and emergency hospitalizations for the elderly (those 65 and older) of cardiovascular disease and respiratory diseases.	Low Daily counts for death and emergency hospitalization were obtained, so likely have all outcome data. However, any potential errors or missing data did not depend on air pollution levels.	Probably Low There was insufficient information about selective outcome to judge for low risk, but indirect evidence that suggests study was free of selective report.	Low No conflict of interests.	Low No other potential sources of bias identified.

No.	Study	Exposure assessment	Outcome assessment	Confounding bias	Selection bias	Incomplete outcome data	Selective reporting	Conflict of interest	Other
54	Ostro et al. 2015b	Probably Low The model calculations track the mass and concentrations of the PM constituents in particle diameters ranging from 0.01 to 10µm through calculations that describe emissions, transport, diffusion, deposition, coagulation, gas- and particle-phase chemistry, and gas-to-particle conversion. The University of California Davis/California Institute of Technology model was used to estimate ground-level concentrations of 50 PM constituents over the major population regions in California.	Low Deaths were assigned codes based on the International Classification of Diseases, 10th Revision (ICD-10) for the following outcomes: all-cause deaths excluding those with an external cause (A00–R99), cardiovascular deaths (I00–I99), Ischemic heart disease deaths (I20–I25), and pulmonary deaths (C34, J00–J98).	Probably Low Age, race, marital status, smoking status, pack-years of smoking, secondhand smoke exposure, body mass index, lifetime physical activity, alcohol consumption, average daily dietary intake of fat, calories, menopausal status, family history of myocardial infarction, stroke, use of blood pressure medication, aspirin; living conditions	Low Data obtained for a cohort of female teachers ≥30 years old.	Probably Low There was no information on the rate of lost follow up.	Probably Low There was insufficient information about selective outcome to judge for low risk, but indirect evidence that suggests study was free of selective report.	Low The authors declare they have no actual or potential competing financial interests.	Low No other potential sources of bias identified.

No.	Study	Exposure assessment	Outcome assessment	Confounding bias	Selection bias	Incomplete outcome data	Selective reporting	Conflict of interest	Other
				(income, income inequality, education, population size, racial composition, unemployment).					
55	Gan et al. 2013	Probably Low Using high spatial resolution land use regression models to estimate residential exposure to traffic-related air pollutants including black carbon. During the 5-year exposure period, individual exposures to ambient air pollutants were estimated at each person's residential postal code centroid using land use regression models.	Low The study used International Statistical Classification of Diseases, 9th Revision (ICD-9) codes 490–492 and 496 or 10th Revision (ICD-10) codes J40–J44 to identify COPD cases during the 4-year follow-up period.	Probably High Individual-level covariates: age, sex, preexisting comorbid conditions; and neighborhood socioeconomic status (SES).	Low Data obtained for a cohort of people (45–85 years old) registered with the provincial health insurance plan. Study provided total number of subjects along with those lost during the follow-up period.	Probably Low During the 4-year follow-up period, 38,377 (8%) subjects were lost to follow-up because of moving out of the province or dying from other diseases.	Probably Low There was insufficient information about selective outcome to judge for low risk, but indirect evidence that suggests study was free of selective report.	Low The authors declare they have no actual or potential competing financial interests.	Low No other potential sources of bias identified.

No.	Study	Exposure assessment	Outcome assessment	Confounding bias	Selection bias	Incomplete outcome data	Selective reporting	Conflict of interest	Other
56	Hvidtfeldt et al. 2019	Probably Low The PM, NO <sub>2</sub> , BC, and O <sub>3</sub> concentrations at residential addresses of the cohort members were derived by a high-resolution dispersion modelling system which incorporates contributions from local, urban, and regional sources of precursors to PM, NO <sub>2</sub> , BC, and O <sub>3</sub> .	Low Participants who died from external causes such as injuries, accidents and suicides (International Classification of Diseases, 10th Revision-ICD-10 codes S–Z) were censored at date of death. In addition, the study investigated cardiovascular (ICD10 codes I00–I99) and respiratory (ICD10 codes J00–J99 and C34) subgroups of mortality.	Probably Low Age, sex, educational attainment, occupational status, marital status, smoking (status, intensity, and duration), environmental tobacco smoke (ETS), alcohol consumption, body mass index, waist circumference, fruit consumption, vegetable consumption, physical activity; neighborhood level socioeconomic status (SES).	Low Data obtained for a cohort of men and women aged 50–64 years residing in the areas of Copenhagen and Aarhus.	Probably Low There was no information on the rate of lost follow up.	Probably Low There was insufficient information about selective outcome to judge for low risk, but indirect evidence that suggests study was free of selective report.	Low The authors declare they have no competing financial interests.	Low No other potential sources of bias identified.

No.	Study	Exposure assessment	Outcome assessment	Confounding bias	Selection bias	Incomplete outcome data	Selective reporting	Conflict of interest	Other
57	Thurston et al. 2016	Probably Low The mean concentrations of PM <sub>2.5</sub> mass and trace constituents were obtained from U.S. Environmental Protection Agency Air Quality System. These PM <sub>2.5</sub> constituent data were analyzed to derive estimates of source apportioned PM <sub>2.5</sub> mass exposure concentrations using the absolute principal component analysis (APCA) PM <sub>2.5</sub> source apportionment method.	Probably Low More than 99% of known deaths were assigned a cause using the International Classification of Diseases, 9th and 10th Revision (ICD-9 codes 410–414; ICD-10 codes I20–I25).	Probably High Active smoking and former smoking, passive smoke exposure, possible workplace exposure to PM, occupational dirtiness index, marital status, education, BMI and BMI <sup>2</sup> , consumption of beer, wine, and other alcohol, quintile of dietary fat consumption, quintile of combined dietary vegetable, fruit, fiber consumption; Six ecologic covariates.	Low Data obtained for a cohort of persons at least 30 years of age, in households including someone at least 45 years of age and resided in all 50 states, the District of Columbia, and Puerto Rico.	Probably High The analytic cohort included 445,860 participants, with 34,408 Ischemic heart disease deaths (of a total of 157,572 deaths from all causes) occurring during follow-up.	Probably Low There was insufficient information about selective outcome to judge for low risk, but indirect evidence that suggests study was free of selective report.	Low No competing financial interests.	Low No other potential sources of bias identified.

No.	Study	Exposure assessment	Outcome assessment	Confounding bias	Selection bias	Incomplete outcome data	Selective reporting	Conflict of interest	Other
58	Yang et al. 2018	Probably Low Land use regression models were derived from street level measurements collected during two sampling campaigns conducted in 2014 and 2015.	Low Deaths were coded according to the International classification of Diseases, 10th Revision (ICD-10; WHO 2010) including natural cause mortality (A00–R99), overall cardiovascular disease (I00–I99) and overall respiratory disease (J00–J47 and J80–J99). Subcategories included Ischemic heart disease (IHD) (I20–I25), cerebrovascular disease (I60–I69), Pneumonia (J12–J18) and chronic obstructive pulmonary disease (COPD) (J40–I44 and I47).	Probably Low Age at entry, gender, individual smoking status, body mass index (BMI), physical activity, education level and monthly expenses; percentage of participants who were equal to or older than 65 years old, percentage of participants whose educational level was higher than secondary school, average income per month and percentage of smokers.	Low Data obtained for a cohort of people who were older than or equal to 65 years old.	Probably Low There was no information on the rate of lost follow up.	Probably Low There was insufficient information about selective outcome to judge for low risk, but indirect evidence that suggests study was free of selective report.	Low The authors declare they have no actual or potential competing financial interests.	Low No other potential sources of bias identified.



No.	Study	Exposure assessment	Outcome assessment	Confounding bias	Selection bias	Incomplete outcome data	Selective reporting	Conflict of interest	Other
59	Gan et al. 2011	Probably Low Land use regression to estimate air pollution concentrations and exposure assigned to residential centroid.	Low A coronary heart disease hospitalization case is a record of hospitalization with the following International Statistical Classification of Diseases, 9th Revision codes, ICD-9, 410–414 and 429.2 or 10th Revision (ICD-10), I20–I25, as the principal diagnosis (the most responsible diagnosis) for a hospital admission in the hospitalization database. A coronary heart disease death is a death record with coronary heart disease as the cause of death in the provincial death registration database.	Probably High Model adjusted for age, sex, preexisting comorbidity, and neighborhood socioeconomic status. No individual data on behavioral risk factors.	Low Study provided total number of subjects along with those lost during the follow-up period.	Probably Low During the 4-year follow-up period, 17,542 (3.9%) moved out of the province and 16,367 (3.6%) died from other diseases, leaving 418,826 (92.5%) subjects at the end of follow-up.	Probably Low There was insufficient information about selective outcome to judge for low risk, but indirect evidence that suggests study was free of selective report.	Low The authors declare they have no actual or potential competing financial interests.	Low No other potential sources of bias identified.

No.	Study	Exposure assessment	Outcome assessment	Confounding bias	Selection bias	Incomplete outcome data	Selective reporting	Conflict of interest	Other
60	De Kluizenaar et al. 2013	Probably High Used black smoke (BS) as an indicator of EC concentrations. Derived background EC concentrations from BS measured at two regional monitoring sites. Local traffic-related EC emission contributions were estimated based on fuel-specific EC content of exhaust PM <sub>10</sub> emission. Used the traffic-related EC emissions as input to calculate local EC concentrations, assuming absence of other local EC sources. Also assumed that dispersion dynamics of EC are identical to those of PM <sub>10</sub> .	Low The study obtained information on the incidence of hospital-based Ischemic heart disease (International Classification of Diseases [ICD9] 410-414) and cerebrovascular disease (ICD9 430-438) in the study population.	Probably Low Individual-level covariates: age, gender, marital status, education, smoking, alcohol use, physical activity, body mass index, living conditions (employment status, financial problems).	Low Data obtained for a cohort of 27,070 non-institutionalized subjects.	Probably Low There was no information on the rate of lost follow up.	Probably Low There was insufficient information about selective outcome to judge for low risk, but indirect evidence that suggests study was free of selective report.	Low No competing financial interests.	Low No other potential sources of bias identified.

No.	Study	Exposure assessment	Outcome assessment	Confounding bias	Selection bias	Incomplete outcome data	Selective reporting	Conflict of interest	Other
61	Vedal et al. 2013	Probably Low The exposure estimation were used the national spatial model predictions and secondary exposure measures of citywide average exposures and distance to major roadways.	Probably Low All outcomes were reported via questionnaire and assessed via physician-adjudicator review of medical records following established protocols.	Probably Low Individual-level covariates: age, body mass index, smoking status, cigarettes smoked per day and years of smoking, systolic blood pressure, history of hypertension, hypercholesterolemia, history of diabetes, education, household income level, and race.	Low Data obtained for a cohort of postmenopausal women.	Probably Low There was no information on the rate of lost follow up.	Probably Low There was insufficient information about selective outcome to judge for low risk, but indirect evidence that suggests study was free of selective report.	Low No financial interests.	Low No other potential sources of bias identified.

No.	Study	Exposure assessment	Outcome assessment	Confounding bias	Selection bias	Incomplete outcome data	Selective reporting	Conflict of interest	Other
62	Rahmatini a et al. 2021	High BC were collected from two monitors (Sharif and Setad) with data recorded at 5 min intervals. BC measurements began from March 2017 to August 2017. But the gaseous pollutant at the Setad site were unreliable and models utilizing the 2-site data were unsatisfactory. So, only the Sharif data were used.	Low Daily non-accidental deaths were obtained from Ministry of Health and Medical Education database. The causes of death were coded according to the International Classification of Disease (10th revision—ICD-10).	Probably Low Models adjusted for time, temperature, relative humidity, atmospheric pressure, PM2.5 data, Day of week (DOW) and public holidays.	Low Study included all daily non-accidental deaths from Ministry of Health and Medical Education database from March 2017 to August 2017.	Low Daily counts for death were obtained, so likely have all outcome data. However, any potential errors or missing data did not depend on air pollution levels.	Probably Low There was insufficient information about selective outcome to judge for low risk, but indirect evidence that suggests study was free of selective report.	Low The authors of this article declare that they have no conflict of interests.	Low No other potential sources of bias identified.

No.	Study	Exposure assessment	Outcome assessment	Confounding bias	Selection bias	Incomplete outcome data	Selective reporting	Conflict of interest	Other
63	Liu et al. 2021b	Probably Low	Probably Low	Probably Low	Low	Low	Probably Low	Low	Low
		Annual county-level exposures of PM2.5 and its constituents for each participant were assessed by aggregating satellite-derived estimates at a monthly time-scale and 1 km-resolution.	The three cardiovascular events as health outcomes: 1) total cardiovascular disease, including but not limited to hypertension and stroke; 2) hypertension; 3) stroke were defined according to the Disease Classification Codebook for Chinese Family Panel Studies.	Model adjusted for age, gender, education level (illiteracy, primary to middle school, and high school or above), household income (RMB, strata of $\leq$ 15,000, 15,000 – 40,000, and 40,000 +, grouped according to the upper and lower quartiles), urbanicity (urban/rural, defined by CFPS participants' home addresses).	All of participants were drawn from the China Family Panel Studies (CFPS) launched by Peking University Institute of Social Science Survey (ISSS) in 2010, an ongoing national longitudinal survey of social-demography in China.	The cohort included 14,331 adults who completed three waves of follow-up.	There was insufficient information about selective outcome to judge for low risk, but indirect evidence that suggests study was free of selective report.	The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.	No other potential sources of bias identified.

No.	Study	Exposure assessment	Outcome assessment	Confounding bias	Selection bias	Incomplete outcome data	Selective reporting	Conflict of interest	Other
64	Lavigne et al. 2021	Probably Low A spatial PM2.5 surface gridded at a resolution of approximately 1-km <sup>2</sup> was derived using multiple satellite-based retrievals of aerosol optical depth in combination with a chemical transport model, and enhanced through statistical incorporation of ground-based observations (including BC).	Low Incident childhood asthma cases were identified according to International Classification of Diseases [ICD]-10: J45.	Probably Low Model adjusted for parity, child sex, breastfeeding status at the time of discharge, maternal smoking during pregnancy, maternal atopy, gestational age and birth weight.	Low The study used data on singleton live births that occurred between April 1st 2006 and March 31st 2014 in the Province of Ontario, Canada. Mother-infant pair data were obtained from the Better Outcomes Registry & Network (BORN) Ontario, a province wide birth registry that captures perinatal health information.	Probably Low There was no information on the rate of lost follow up.	Probably Low There was insufficient information about selective outcome to judge for low risk, but indirect evidence that suggests study was free of selective report.	Low The authors declared that there is no conflict of interest.	Low No other potential sources of bias identified.

No.	Study	Exposure assessment	Outcome assessment	Confounding bias	Selection bias	Incomplete outcome data	Selective reporting	Conflict of interest	Other
65	Rodins et al. 2020	Probably Low The study used the validated, time-dependent, three-dimensional European Air Pollution Dispersion chemistry transport model (EURAD) to estimate the exposure to EC.	Probably Low Cardiovascular outcomes in the HNR Study were determined by an independent endpoint committee based on self-reports, physician and next-of-kin interviews, and medical records.	Probably Low Model adjusted for age, sex, individual and neighborhood SES, BMI, nighttime traffic noise exposure and lifestyle factors: smoking, alcohol consumption, physical activity and nutritional pattern.	Low The study used baseline (2000–2003) and 14 years follow-up data from the German HNR Study, an ongoing population-based prospective cohort study.	Probably Low There was no information on the rate of lost follow up.	Probably Low There was insufficient information about selective outcome to judge for low risk, but indirect evidence that suggests study was free of selective report.	Low The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.	Low No other potential sources of bias identified.

No.	Study	Exposure assessment	Outcome assessment	Confounding bias	Selection bias	Incomplete outcome data	Selective reporting	Conflict of interest	Other
66	Kovačević et al. 2020	Probably Low The daily average concentration of BC were collected from three automatic ambient air quality monitoring stations located in Užice, Sevojno, and Kosjerić. BC were measured between 1st July 2012 and 30th June 2014. There was no information about missing data.	Low The data of emergency department (ED) visits for allergic asthma were collected from the Užice Health Centre, either from the EDs (ambulances or home care) in Užice, Sevojno, and Kosjerić or from a general hospital in Užice. International Classification of Diseases, 10th revision, codes were used in the diagnosis of allergic asthma or asthma with coexisting allergic rhinitis (AR).	Probably High Model adjusted for seasonality, long-term trends, temperature, humidity, air pressure, air pollutants and pollens.	Low Study included all the data of emergency department (ED) visits for allergic asthma were collected from the Užice Health Centre, either from the EDs (ambulances or home care) in Užice, Sevojno, and Kosjerić or from a general hospital in Užice during 1st July 2012 to 30th June 2014.	Low Daily counts for emergency department (ED) visits were obtained, so likely have all outcome data. However, any potential errors or missing data did not depend on air pollution levels.	Probably Low There was insufficient information about selective outcome to judge for low risk, but indirect evidence that suggests study was free of selective report.	Low The authors declare no conflict of interest.	Low No other potential sources of bias identified.



No.	Study	Exposure assessment	Outcome assessment	Confounding bias	Selection bias	Incomplete outcome data	Selective reporting	Conflict of interest	Other
67	Hasslöf et al. 2020	Probably Low BC levels were modelled using EnviMan (Opsis AB, Sweden) by the Environmental Department of Malmö. The program uses a Gaussian dispersion model (AERMOD) combined with an emission database for the county of Scania in Sweden.	Probably Low The outcomes were plaque presence and CIMT of the right carotid artery, which were assessed by ultrasound examination B-mode ultrasonography, conducted by trained and certified sonographers.	Probably Low Model adjusted for age, sex, air pollutant, education level, smoke score, apoB/apoA1 ratio, use of lipid lowering drugs, living alone, cardiovascular heredity, diabetes mellitus, waist hip ratio, physical activity, alcohol consumption, median income level in residential area, systolic blood pressure and being born outside of Sweden.	Low In the cardiovascular subcohort of the MDCS cohort, 6031 participants who had a residential address within the air pollution modelling area. Of these, 224 were missing data on plaque and 20 on CIMT, respectively. The number of participants included in the plaque analyses were 5807 and in the CIMT analyses 6011.	Probably Low Of these, 224 were missing data on plaque and 20 on CIMT, respectively. Hence, the number of participants included in the plaque analyses were 5807 and in the CIMT analyses 6011.	Probably Low There was insufficient information about selective outcome to judge for low risk, but indirect evidence that suggests study was free of selective report.	Low The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.	Low No other potential sources of bias identified.

No.	Study	Exposure assessment	Outcome assessment	Confounding bias	Selection bias	Incomplete outcome data	Selective reporting	Conflict of interest	Other
68	Wang et al. 2019b	Probably High BC were collected from a routine air quality monitoring site operated by the New York State Department of Environmental Conservation continuously throughout the study period (2005–2016). There was no information about missing data.	Probably Low All patients treated at the Cardiac Catheterization Laboratory (Cath Lab) at URMC in Rochester, NY for STEMI, who resided within 15 miles of the pollution monitoring station in Rochester were included. American College of Cardiology (ACC)/American Heart Association (AHA) guidelines were used at the time of Cath Lab admission to diagnose STEMI.	Probably High Model adjusted for seasonality, long-term trends, temperature and relative humidity.	Low Study included all patients treated at the Cardiac Catheterization Laboratory (Cath Lab) at URMC in Rochester, NY for STEMI throughout the study period (2005–2016).	Low Daily counts for all patients were obtained, so likely have all outcome data. However, any potential errors or missing data did not depend on air pollution levels.	Probably Low There was insufficient information about selective outcome to judge for low risk, but indirect evidence that suggests study was free of selective report.	Low The authors declare that they have no competing interests.	Low No other potential sources of bias identified.

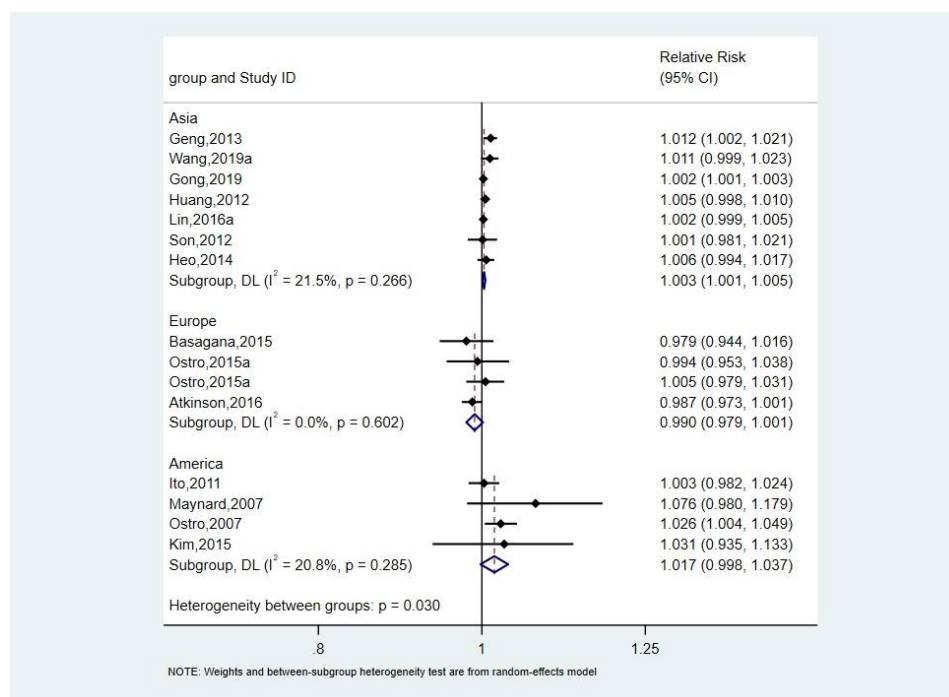
No.	Study	Exposure assessment	Outcome assessment	Confounding bias	Selection bias	Incomplete outcome data	Selective reporting	Conflict of interest	Other
69	Ljungman et al. 2019	Probably Low	Low	Probably Low	Low	Probably Low	Probably Low	Low	Low
		Based on detailed emission databases, monitoring data, and high-resolution dispersion models, the study calculated source contributions to black carbon (BC) from road wear, traffic exhaust, residential heating, and other sources in Gothenburg, Stockholm, and Umeå.	The International Classification of Diseases, Ninth Revision (ICD-9) codes 410–414 and ICD-10 I20-25 codes were used to define IHD and ICD-9 codes 431–436 and ICD-10 codes I61– I65 were used to define stroke.	Model adjusted for sex, calendar year, subcohort, smoking status, alcohol consumption in Stockholm and Umeå, physical activity, marital status, socioeconomic index by occupation, education level, occupation status, and mean neighborhood individual income in persons of working age by Small Areas for Market Statistics.	The study included individuals in two cohorts from Gothenburg, four pooled cohorts from Stockholm, and one cohort from Umeå. In total, 114,758 individuals were included from all study areas.	The study used high-quality and comprehensive national patient and death registries, minimizing loss to follow-up for our outcomes of interest. Missing information for variables $\leq$ 5% not specified.	There was insufficient information about selective outcome to judge for low risk, but indirect evidence that suggests study was free of selective report.	The authors declare they have no actual or potential competing financial interests.	No other potential sources of bias identified.

No.	Study	Exposure assessment	Outcome assessment	Confounding bias	Selection bias	Incomplete outcome data	Selective reporting	Conflict of interest	Other
70	Liu et al. 2021a	Probably Low	Low	Probably Low	Low	Probably Low	Probably Low	Low	Low
		Annual mean concentrations of BC for 2010 were estimated at the study participants' baseline residential addresses, using standardized Europe-wide hybrid land use regression (LUR) models. The LUR model utilized routine monitoring data from the European Environment Agency (EEA) AirBase for PM <sub>2.5</sub> , NO <sub>2</sub> , and O <sub>3</sub> , and ESCAPE monitoring data for BC as the dependent variable. BC was measured by the reflectance of PM <sub>2.5</sub> filters and expressed in absorbance units.	COPD was defined by following the principal diagnosis of International Classification of Diseases, 9th Revision (ICD-9) codes 490–492, and 494–496, or ICD-10 codes J40–44.	Model adjusted for age, sex, smoking status, smoking duration, smoking intensity, body-mass index, marital status, employment status, educational level and area-level annual year income.	The study used data from three cohorts within the ELAPSE project with available information on COPD hospital discharge diagnoses. Mean follow-up time is 16.6 years.	From a total of 106,727 participants with complete air pollution exposure data, the study excluded 633 participants with COPD at baseline and 7,586 participants with missing information on confounders.	There was insufficient information about selective outcome to judge for low risk, but indirect evidence that suggests study was free of selective reporting.	The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.	No other potential sources of bias identified.

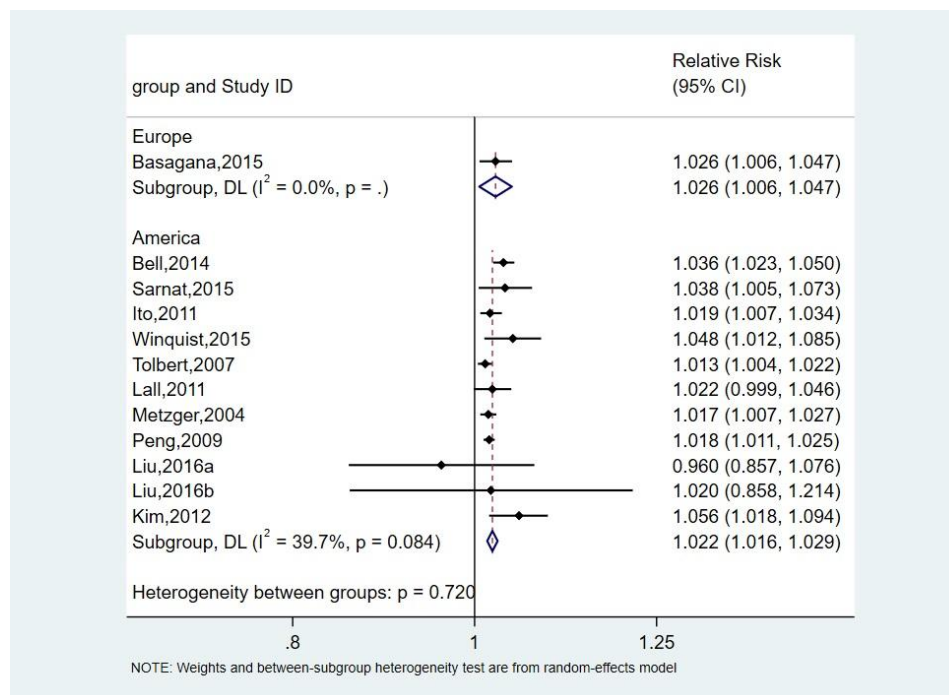
**Table S8** Assessment of certainty of evidence for the outcomes.

Evidence	Reasons for downgrading										Reasons for upgrading						Overall	Final certainty assessment
	A1	Rationale	A2	Rationale	A3	Rationale	A4	Rationale	A5	Rationale	B1	Rationale	B2	Rationale	B3	Rationale		
Acute effects of BC/EC on CVD in PM <sub>2.5</sub> -unadjusted model	0	Little influence on the overall effect	0	All included studies were consistent with our prespecified PECOS	0	80% PI 1.005 (95%CI: 1.001, 1.009) does not include unity	0	Risk estimates reported by the studies are sufficiently precise	-1	publication bias existed, RR adjusted for publication bias with trim and fill.	0	Insufficient basis for upgrading	0	Confounders would shift the RR in both directions	0	Evidence of increase in risk with increasing exposure	-1	<b>Low</b>
Acute effects of BC/EC on CVD in PM <sub>2.5</sub> -adjusted model	0	Little influence on the overall effect	0	All included studies were consistent with our prespecified PECOS	0	80% PI 1.011(95%CI: 1.002, 1.020) does not include unity	0	Risk estimates reported by the studies are sufficiently precise	0	No evidence of publication bias	0	Insufficient basis for upgrading	0	Confounders would shift the RR in both directions	0	Evidence of increase in risk with increasing exposure	0	<b>Moderate</b>
Chronic effects of BC/EC on CVD in PM <sub>2.5</sub> -unadjusted model	0	Little influence on the overall effect	0	All included studies were consistent with our prespecified PECOS	0	80% PI 1.068 (95%CI: 0.965, 1.181) include unity but no larger than twice the 95%CI	0	Risk estimates reported by the studies are sufficiently precise	0	No evidence of publication bias	0	Insufficient basis for upgrading	0	Confounders would shift the RR in both directions	0	No evidence of a clear increasing risk with exposure	0	<b>Moderate</b>

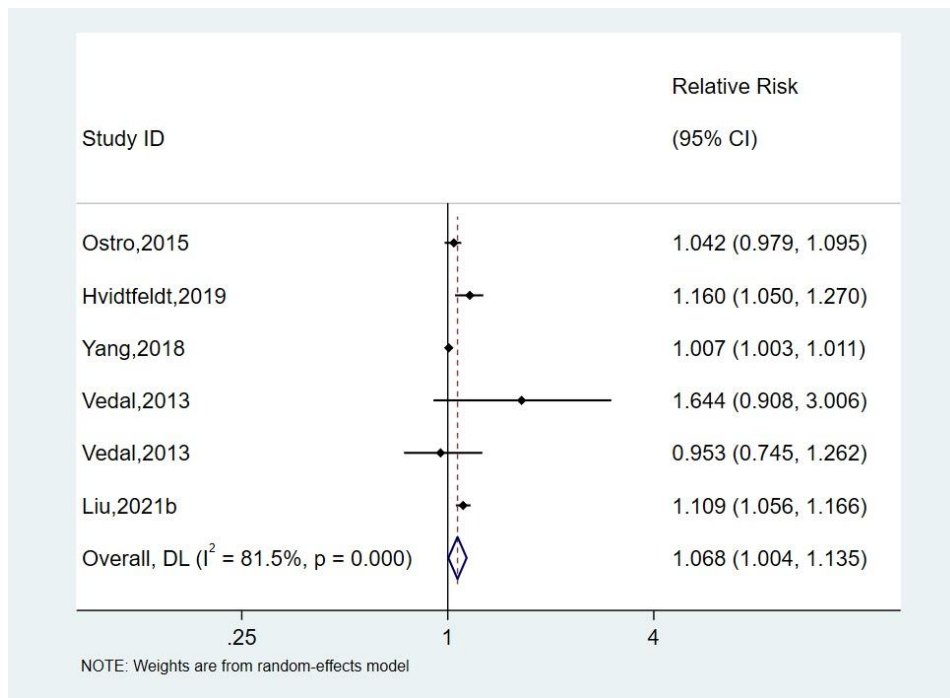
Abbreviations: BC: Black carbon; EC: Elemental carbon; CVD: cardiovascular diseases; RES: respiratory diseases; IHD: ischemic heart diseases; PI: prediction interval; CI: confidence interval. A1 = limitations in studies (risk of bias); A2 = indirectness; A3 = inconsistency; A4 = imprecision; A5 = publication bias; B1 = large RR; B2 = all confounding decreases observed RR; B3= concentration-response gradient.



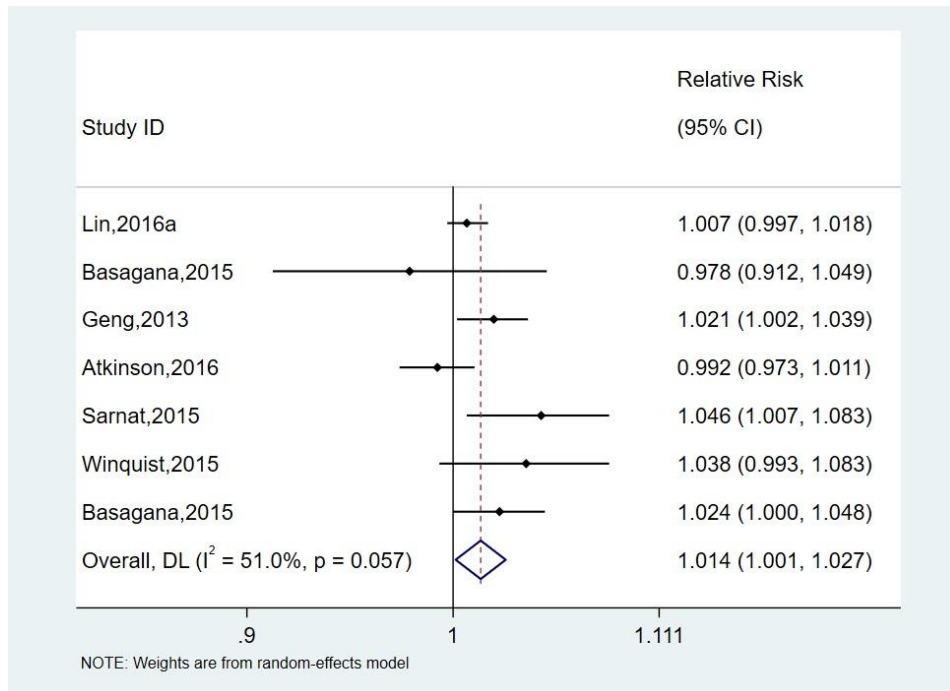
**Figure S1** Impact of short-term exposure to BC/EC on cardiovascular mortality stratified by geographical locations.



**Figure S2** Impact of short-term exposure to BC/EC on cardiovascular morbidity stratified by geographical locations.



**Figure S3** Impact of long-term exposure to BC/EC on cardiovascular diseases.



**Figure S4** Impact of short-term exposure to BC/EC on cardiovascular diseases in the  $PM_{2.5}$ -adjusted model.