

Supporting Materials

Table S1 AIC value under different degrees of freedom choice

df (temperature)	df (relative humidity)	df (time)	AIC value
3	3	5	8753.39
3	3	6	8756.85
3	3	7	8753.28
3	4	5	8755.51
3	4	6	8754.67
3	4	7	8752.56
3	5	5	8756.39
3	5	6	8755.47
3	5	7	8759.84
4	3	5	8754.10
4	3	6	8754.78
4	3	7	8757.87
4	4	5	8756.20
4	4	6	8755.88
4	4	7	8753.96
4	5	5	8757.00
4	5	6	8756.64
4	5	7	8760.77
5	3	5	8756.90
5	3	6	8765.09
5	3	7	8759.29
5	4	5	8757.98
5	4	6	8757.18
5	4	7	8761.37
5	5	5	8758.77
5	5	6	8757.91
5	5	7	8762.18

Table S2 Likelihood ratio test for linear and nonlinear model

Model	Linear/Nonlinear	Loglik value	P value
AMI_PM _{2.5}	Linear	-4524.5	0.16
	Nonlinear	-4525.5	
AMI_PM ₁₀	Linear	-4525.1	0.78
	Nonlinear	-4525.0	
AMI_NO ₂	Linear	-4524.4	0.57
	Nonlinear	-4524.2	
AMI_SO ₂	Linear	-4525.4	0.62
	Nonlinear	-4525.2	
AMI_CO	Linear	-4524.4	0.40
	Nonlinear	-4524.8	
COPD_NO ₂	Linear	-7524.1	0.44
	Nonlinear	-7523.8	
COPD_SO ₂	Linear	-7523.8	0.44
	Nonlinear	-7524.1	
COPD_CO	Linear	-7528.3	0.02*
	Nonlinear	-7525.7	

Notes: “*” represent $P < 0.05$

Table S3 Adjust *P* value after Bonferroni correction

Subgroup analysis	Adjust P value
AMI_season_age	2.90×10^{-4}
AMI_season_gender	0.58
COPD_season_age	1.32×10^{-16}
COPD_season_gender	0.07

Table S4 Number of days exceeding or satisfying the standard for different pollutants during the study period of October 1, 2014 to September 30, 2018

Standards	No.	Pollutants	Standard limit	Days exceeding the standard	Days satisfying the standard
WHO					
Guidelines	1	PM _{2.5}	25	950	510
	2	PM ₁₀	50	1100	350
	3	SO ₂	20	534	926
	4	NO ₂	40	467	993
	5	O ₃	100	242	1218
	6	CO	10	0	1456
Grade I (GB 3095-2012)					
	1	PM _{2.5}	35	681	779
	2	PM ₁₀	50	1100	350
	3	SO ₂	50	74	1386
	4	NO ₂	80	20	1440
	5	O ₃	100	242	1218
	6	CO	4	0	1456
Grade II (GB 3095-2012)					
	1	PM _{2.5}	75	181	1279
	2	PM ₁₀	150	140	1320
	3	SO ₂	150	0	1460
	4	NO ₂	80	20	1440
	5	O ₃	160	7	1453
	6	CO	4	0	1456

Table S5 Estimated percentage change (95% CI) in AMI and COPD hospitalizations under different lag days for pollutant concentration increase by 10 µg/m³

Disease types	Lag days	PM _{2.5}	PM ₁₀	NO ₂	SO ₂	CO	O ₃
AMI	Lag0	0.24 (−0.39, 0.89)	0.20 (−0.19, 0.61)	0.84 (−0.51, 2.23)	0.88 (−1.11, 2.93)	0.06 (0.00, 12.52)	−0.36 (−1.12, 0.42)
	Lag1	0.73 (0.12, 1.37)*	0.39 (0.01, 0.79)*	1.60 (0.22, 3.01)*	2.50 (0.43, 4.63)*	0.10 (0.03, 16.29)*	−0.45 (−1.21, 0.35)
	Lag2	0.31 (−0.32, 0.96)	0.03 (−0.36, 0.43)	−0.32 (−1.65, 1.05)	0.77 (−1.25, 2.84)	0.02 (−0.05, 8.25)	0.31 (−0.49, 1.13)
	Lag3	0.25 (−0.39, 0.90)	0.01 (−0.37, 0.40)	0.49 (−0.89, 1.90)	1.28 (−0.72, 3.34)	0.05 (−0.02, 11.61)	−0.02 (−0.81, 0.80)
	Lag4	0.51 (−0.12, 1.15)	0.39 (0.01, 0.78)*	0.57 (−0.80, 1.98)	1.58 (−0.45, 3.66)	0.06 (0.00, 12.94)	0.27 (−0.51, 1.08)
	Lag5	0.14 (−0.47, 0.77)	0.15 (−0.23, 0.53)	0.67 (−0.69, 2.07)	0.79 (−1.23, 2.88)	0.04 (−0.03, 9.93)	−0.33 (−1.10, 0.46)
	Lag6	−0.13 (−0.75, 0.51)	−0.08 (−0.48, 0.32)	0.39 (−0.94, 1.77)	0.84 (−1.17, 2.91)	0.01 (−0.06, 6.90)	−0.29 (−1.05, 0.50)
	Lag7	−0.41 (−1.03, 0.22)	−0.16 (−0.55, 0.25)	−0.65 (−1.94, 0.68)	−0.84 (−2.80, 1.17)	−0.05 (−0.11, 1.23)	0.22 (−0.56, 1.02)
COPD	Lag0	0.44 (−0.04, 0.92)	0.22 (−0.08, 0.54)	1.36 (0.31, 2.43)*	1.60 (0.17, 3.05)*	0.05 (0.00, 0.10)*	−0.40 (0.39, −1.17)
	Lag1	0.21 (−0.25, 0.69)	−0.01 (−0.30, 0.29)	0.69 (−0.35, 1.75)	1.77 (0.31, 3.27)*	0.03 (−0.02, 0.08)	−0.48 (−1.38, 0.47)
	Lag2	0.17 (−0.31, 0.66)	−0.12 (−0.41, 0.18)	0.35 (−0.70, 1.42)	0.84 (−0.61, 2.32)	0.01 (−0.04, 0.06)	−0.46 (−1.33, 0.45)
	Lag3	0.16 (−0.33, 0.65)	−0.12 (−0.41, 0.17)	0.26 (−0.88, 1.34)	0.97 (−0.44, 2.42)	0.00 (−0.05, 0.05)	−0.22 (−0.63, 0.21)
	Lag4	0.06 (−0.41, 0.54)	0.01 (−0.28, 0.30)	0.17 (−0.49, 1.24)	0.18 (−1.24, 1.63)	0.00 (−0.05, 0.05)	0.35 (−0.33, 1.05)
	Lag5	0.07 (−0.40, 0.54)	−0.03 (−0.32, 0.25)	0.54 (−0.86, 1.60)	1.56 (0.10, 3.04)*	0.00 (−0.05, 0.05)	−0.01 (−0.03, 0.01)
	Lag6	0.07 (−0.41, 0.55)	−0.13 (−0.43, 0.18)	0.16 (−0.84, 1.20)	1.31 (−0.12, 2.77)	0.00 (−0.05, 0.04)	0.27 (−0.25, 0.80)
	Lag7	0.13 (−0.34, 0.60)	0.01 (−0.30, 0.32)	0.18 (−0.10, 1.21)	1.09 (−0.33, 2.53)	0.01 (−0.04, 0.06)	0.55 (−0.51, 1.65)

Notes: The symbol “*” represent $P < 0.05$

Table S6 Relative Risk (95% CI) at different cumulative lag days of pollutants with a IQR increase on COPD hospital admissions

Disease types	Lag days	PM_{2.5}	PM₁₀	NO₂	SO₂	CO	O₃
All	Lag01	1.014(0.996, 1.033)	1.007(0.988, 1.027)	1.027(1.003, 1.052)*	1.034(1.009, 1.060)*	1.021(0.999, 1.043)	0.978(0.949, 1.007)
	Lag02	1.015(0.994, 1.036)	1.002(0.980, 1.024)	1.019(0.991, 1.047)	1.038(1.009, 1.068)*	1.018(0.994, 1.043)	0.965(0.934, 0.998)
	Lag03	1.011(0.988, 1.034)	0.998(0.974, 1.022)	1.014(0.984, 1.044)	1.044(1.012, 1.078)*	1.016(0.989, 1.043)	0.962(0.927, 0.998)
	Lag04	1.007(0.982, 1.032)	0.997(0.971, 1.023)	1.009(0.977, 1.042)	1.042(1.007, 1.079)*	1.013(0.984, 1.042)	0.969(0.932, 1.008)
	Lag05	1.002(0.976, 1.029)	0.994(0.967, 1.022)	1.009(0.975, 1.045)	1.046(1.009, 1.085)*	1.009(0.978, 1.041)	0.971(0.931, 1.012)
	Lag06	0.998(0.971, 1.027)	0.988(0.959, 1.018)	1.007(0.971, 1.044)	1.049(1.010, 1.091)*	1.005(0.973, 1.039)	0.974(0.932, 1.018)
Male	Lag01	1.010(0.991, 1.028)	1.004(0.984, 1.024)	1.020(0.995, 1.045)	1.027(1.002, 1.053)*	1.014(0.993, 1.037)	0.979(0.950, 1.009)
	Lag02	1.009(0.988, 1.030)	0.997(0.975, 1.019)	1.012(0.985, 1.041)	1.032(1.002, 1.062)*	1.012(0.988, 1.037)	0.966(0.933, 0.999)
	Lag03	1.005(0.982, 1.028)	0.993(0.969, 1.019)	1.008(0.978, 1.039)	1.038(1.005, 1.072)*	1.010(0.984, 1.038)	0.963(0.928, 1.000)
	Lag04	1.001(0.977, 1.027)	0.993(0.967, 1.019)	1.005(0.971, 1.039)	1.037(1.002, 1.075)*	1.008(0.979, 1.038)	0.970(0.932, 1.009)
	Lag05	0.998(0.971, 1.025)	0.991(0.963, 1.019)	1.006(0.971, 1.042)	1.042(1.004, 1.082)*	1.006(0.975, 1.038)	0.968(0.928, 1.010)
	Lag06	0.992(0.964, 1.021)	0.985(0.955, 1.015)	1.003(0.967, 1.041)	1.045(1.004, 1.087)*	1.000(0.967, 1.034)	0.970(0.927, 1.014)
Female	Lag01	1.025(1.004, 1.046)*	1.015(0.993, 1.038)	1.042(1.014, 1.071)*	1.048(1.020, 1.078)**	1.034(1.010, 1.059)*	0.974(0.941, 1.008)
	Lag02	1.027(1.004, 1.051)*	1.012(0.988, 1.038)	1.032(1.000, 1.064)*	1.052(1.018, 1.086)**	1.031(1.004, 1.060)*	0.965(0.928, 1.002)
	Lag03	1.023(0.997, 1.049)	1.008(0.981, 1.036)	1.025(0.991, 1.061)	1.058(1.021, 1.097)**	1.027(0.997, 1.059)	0.958(0.919, 1.000)
	Lag04	1.018(0.990, 1.047)	1.005(0.976, 1.035)	1.017(0.980, 1.056)	1.052(1.011, 1.094)*	1.021(0.988, 1.056)	0.969(0.926, 1.014)
	Lag05	1.013(0.982, 1.044)	1.000(0.969, 1.032)	1.017(0.978, 1.057)	1.055(1.011, 1.108)*	1.016(0.981, 1.053)	0.976(0.931, 1.025)

	Lag06	1.011(0.979, 1.044)	0.996(0.963, 1.030)	1.016(0.974, 1.059)	1.060(1.014, 1.108)*	1.016(0.979, 1.055)	0.983(0.935, 1.035)
< 65	Lag01	1.005(0.985, 1.025)	1.003(0.982, 1.024)	1.024(0.998, 1.051)	1.026(0.998, 1.055)	1.012(0.989, 1.036)	0.966(0.936, 0.997)
	Lag02	1.004(0.981, 1.025)	0.998(0.975, 1.022)	1.016(0.986, 1.046)	1.026(0.993, 1.059)	1.007(0.981, 1.033)	0.957(0.924, 0.991)
	Lag03	1.003(0.979, 1.028)	0.999(0.973, 1.025)	1.011(0.979, 1.044)	1.034(0.998, 1.071)	1.008(0.979, 1.037)	0.954(0.918, 0.991)
	Lag04	1.001(0.974, 1.028)	1.000(0.972, 1.028)	1.010(0.976, 1.046)	1.038(0.999, 1.079)	1.005(0.974, 1.037)	0.955(0.916, 0.996)
	Lag05	0.992(0.964, 1.021)	0.991(0.962, 1.021)	1.004(0.968, 1.041)	1.038(0.997, 1.082)	0.997(0.964, 1.031)	0.958(0.916, 1.001)
	Lag06	0.985(0.955, 1.015)	0.982(0.951, 1.014)	0.997(0.959, 1.036)	1.038(0.993, 1.084)	0.987(0.953, 1.023)	0.961(0.917, 1.007)
≥ 65	Lag01	1.017(0.997, 1.037)	1.009(0.988, 1.031)	1.028(1.001, 1.055)*	1.037(1.010, 1.064)**	1.024(1.001, 1.048)*	0.981(0.949, 1.013)
	Lag02	1.018(0.996, 1.041)	1.003(0.979, 1.027)	1.019(0.989, 1.050)	1.042(1.011, 1.075)**	1.023(0.996, 1.050)	0.967(0.933, 1.004)
	Lag03	1.013(0.988, 1.038)	0.998(0.972, 1.024)	1.014(0.982, 1.048)	1.048(1.013, 1.084)**	1.019(0.990, 1.049)	0.964(0.926, 1.004)
	Lag04	1.009(0.982, 1.036)	0.996(0.968, 1.024)	1.008(0.973, 1.045)	1.044(1.005, 1.083)*	1.015(0.984, 1.048)	0.974(0.933, 1.017)
	Lag05	1.006(0.977, 1.035)	0.995(0.965, 1.025)	1.011(0.974, 1.050)	1.048(1.008, 1.091)*	1.013(0.980, 1.048)	0.975(0.931, 1.021)
	Lag06	1.003(0.972, 1.034)	0.991(0.959, 1.023)	1.010(0.971, 1.051)	1.053(1.010, 1.098)*	1.012(0.976, 1.048)	0.978(0.932, 1.027)

Notes: “ * ” represent $P < 0.05$

Table S7 Relative Risk (95% CI) at lag1 day on AMI hospital admissions in two, pollutant models, PM_{2.5}, PM₁₀, NO₂, SO₂, O₃ as the main pollutant

Model	Whole-period	Cold season	Warm season
PM _{2.5}	1.024(1.004, 1.045)*	1.033(1.013, 1.077) *	0.987(0.953, 1.022)
+ PM ₁₀	1.030(0.984, 1.079)	0.983(0.918, 1.052)	0.995(0.897, 1.102)
+ NO ₂	1.017(0.991, 1.044)	1.021(0.989, 1.054)	0.964(0.905, 1.027)
+ SO ₂	1.017(0.991, 1.043)	1.027(0.995, 1.059)	0.955(0.895, 1.019)
+ CO	1.023(0.999, 1.047)	1.025(0.998, 1.052)	0.978(0.897, 1.067)
+ O ₃	1.027(1.007, 1.048) *	1.029(1.005, 1.054) *	0.976(0.918, 1.039)
PM ₁₀	1.022(1.000, 1.044) *	1.015(1.018, 1.081) *	1.004(0.952, 1.010)
+ PM _{2.5}	0.996(0.948, 1.047)	1.062(0.981, 1.151)	0.981(0.910, 1.058)
+ NO ₂	1.014(0.988, 1.040)	1.033(0.997, 1.071)	0.974(0.933, 1.018)
+ SO ₂	1.014(0.989, 1.040)	1.038(1.003, 1.074) *	0.970(0.927, 1.014)
+ CO	1.020(0.996, 1.044)	1.035(1.004, 1.068) *	0.982(0.936, 1.031)
+ O ₃	1.026(1.004, 1.048) *	1.039(1.011, 1.069) *	0.980(0.939, 1.023)
NO ₂	1.032(1.004, 1.060) *	1.055(1.015, 1.097) *	1.005(0.967, 1.046)
+ PM _{2.5}	1.021(0.986, 1.057)	1.023(0.975, 1.074)	1.018(0.964, 1.076)
+ PM ₁₀	1.026(0.994, 1.059)	1.018(0.972, 1.065)	1.013(0.963, 1.067)
+ SO ₂	1.021(0.987, 1.057)	1.036(0.988, 1.086)	0.992(0.932, 1.056)
+ CO	1.029(0.999, 1.061)	1.034(0.995, 1.075)	1.025(0.964, 1.089)
+ O ₃	1.033(1.005, 1.061) *	1.041(1.001, 1.083) *	1.002(0.955, 1.052)
SO ₂	1.036(1.006, 1.067) *	1.049(1.006, 1.093) *	1.017(0.954, 1.084)
+ PM _{2.5}	1.024(0.986, 1.064)	1.011(0.966, 1.058)	1.066(0.954, 1.191)
+ PM ₁₀	1.030(0.995, 1.066)	1.009(0.966, 1.053)	1.052(0.949, 1.166)
+ NO ₂	1.025(0.987, 1.064)	1.014(0.968, 1.062)	1.032(0.914, 1.166)
+ CO	1.033(1.000, 1.067) *	1.025(0.987, 1.065)	1.081(0.958, 1.220)
+ O ₃	1.038(1.008, 1.069) *	1.032(0.996, 1.070)	1.027(0.934, 1.130)
O ₃	0.984(0.953, 1.018)	0.990(0.939, 1.044)	0.989(0.958, 1.022)
+ PM _{2.5}	0.976(0.944, 1.010)	0.963(0.894, 1.038)	0.996(0.952, 1.042)
+ PM ₁₀	0.976(0.944, 1.009)	0.967(0.897, 1.042)	0.994(0.953, 1.038)

+ NO ₂	0.985(0.952, 1.019)	0.982(0.904, 1.065)	0.988(0.949, 1.028)
+ SO ₂	0.981(0.948, 1.014)	0.962(0.892, 1.038)	0.986(0.947, 1.027)
+ CO	0.978(0.946, 1.012)	0.956(0.888, 1.029)	0.992(0.951, 1.035)

Notes: “*” represent $P < 0.05$

Table S8 The comparison of relevant studies results of cardiovascular diseases

References	Study area	Study period	Data source	Diseases type	Method	E-r curve ¹	Significant lag effects							Subgroup analysis		
							PM _{2.5}	PM ₁₀	NO ₂	SO ₂	CO	O ₃	Others	Season	Gender	Age
This study	Qingdao, China	2014–2018	Affiliated Hospital of Qingdao University	AMI hospital admission	GAM	Linear	Lag1	Lag1	Lag1	Lag1	Lag1	NS ²	–	cold	female	≥ 65
Chang et al., 2005	Taipei, China	1997–2001	Taiwan Health Insurance Program	CVD hospital admissions	case–crossover	–	–	Lag0	Lag0	–	Lag0	Lag0	–	cool	–	–
Chen et al., 2012	16 cities, China	1996–2008	Municipal Center for Disease Control and Prevention	CVD mortality	GLM	–	–	Lag2	–	–	–	–	–	–	female	≥ 65
Chen et al., 2018	30 cities, China	2012–2015	Chinese Center for Disease Control and Prevention	AMI mortality	GLM	–	Lag0	–	–	–	–	–	–	–	Male	≥ 75
Collart et al., 2015	Charleroi, Belgium	1999–2008	7 hospitals	AMI	case–crossover	–	–	Lag0	Lag0	–	–	Lag2	–	Warm	–	–

References	Study area	Study period	Data source	Diseases type	Method	E-r curve ¹	Significant lag effects						Subgroup analysis			
							PM _{2.5}	PM ₁₀	NO ₂	SO ₂	CO	O ₃	Others	Season	Gender	Age
Fischer et al., 2003	Netherlands	1986–1994	Central Bureau of Statistics	CVD mortality	GAM	–	–	NS	Lag06	Lag06	NS	Lag1	Black smoke: lag06	–	–	≥ 65
Goggins et al., 2013	Hong Kong and Taiwan, China	2000–2009	Hong Kong Hospital Authority and Taiwan Health Research Institute	AMI hospital admission	GAM	–	–	NS	Lag0–15	NS	–	–	–	cool	ND	≥ 65
Guo et al., 2009	Beijing, China	2004–2006	Peking University Third Hospital	CVD ERV	case–crossover	–	Lag0	–	Lag0	Lag0	–	–	–	–	–	–
Kan et al., 2007	Shanghai, China	2004–2005	Shanghai Municipal Center of Disease Control and Prevention	CVD mortality	GAM	Nonlinear	Lag01	–	–	–	–	–	PM _{10-2.5} : NS	–	–	–
Kan et al., 2008	Shanghai, China	2001–2004	Shanghai Municipal Center of Disease	CVD mortality	GLM	–	–	NS	NS	NS	–	NS	–	ND ³	female	≥ 65

References	Study area	Study period	Data source	Diseases type	Method	E-r curve ¹	Significant lag effects						Subgroup analysis				
							PM _{2.5}	PM ₁₀	NO ₂	SO ₂	CO	O ₃	Others	Season	Gender	Age	
			Control and Prevention														
Lee et al., 2015	11 East Asian cities	2001–2009	The statistical offices of the cities;	CVD mortality	GAM	–	Lag01	–	–	–	–	–	PM _{10-2.5} : lag01	cold	–	–	
Lin and Kuo, 2013	Taiwan, China	2005	10 hospitals	CVD ERV	Case control study	–	–	Lag0	–	–	–	–	–	–	female	≥ 65	
Lin et al., 2013	Hong Kong, China	1998–2010	Hong Kong Census and Statistics Department	AMI mortality	time–stratified case–crossover	–	–	–	Lag0	Lag0	NS	NS	–	–	–	–	
Phung et al., 2016	Ho Chi Minh City Vietnam	2004–2007	Two largest hospitals in HCMC	CVD hospital admission	GLM	–	–	Lag0	Lag0	Lag0	–	NS	–	–	Male:PM ₁₀ Female: NO ₂	5–65	
Samoli et al., 2006	30 cities across Europe	1990–1997	APHEA project	CVD mortality	Poisson regression models	–	–	–	Lag05	–	–	–	–	–	–	–	

References	Study area	Study period	Data source	Diseases type	Method	E-r curve ¹	Significant lag effects						Subgroup analysis			
							PM _{2.5}	PM ₁₀	NO ₂	SO ₂	CO	O ₃	Others	Season	Gender	Age
Stafoggia et al., 2013	10 European cities	2011–2010	national or regional health information systems	CVD hospital admission	Poisson regression models	linear	Lag01	Lag01	–	–	–	–	PM _{2.5–10} : lag01	–	–	–
Stieb et al., 2009	7 Canadian Cities	1990–2000	14 hospitals	MI ERV	GLM	–	NS	NS	Lag1	Lag1	Lag1	NS	–	ND	–	–
Su et al., 2016	Beijing, China	2007–2008	Peking University Third Hospital	CVD ERV	GAM	–	Lag7	Lag7	NS	Lag7	–	–	–	cold	female	ND
Wang et al., 2015	Alberta, Canada	1999–2010	Alberta Health administrative databases	AMI admission	Case–Crossover	–	NS	–	Lag1	–	NS	NS	–	–	ND	≥ 65
Xu et al., 2017	Beijing, China	2013–2013	10 general hospitals	IHD ERV	GAM	Nonlinear	Lag2	–	–	–	–	–	–	warm	male	< 65
Zhang et al., 2011	Shenyang, China	1998–2009	Local public health bureaus	CVD mortality	retrospective cohort study	–	–	Lag0	Lag0	NS	–	–	–	–	female	ND
Zhang et al., 2014	Guangzhou, China	2008–2011	Guangzhou Health Insurance Bureau (GHIB)	CVD hospital admissions	GAM	–	–	NS	NS	NS	–	–	Haze: lag4	–	female	19–64

Notes: “–“ represent the item not discussed in the corresponding reference; ¹ “E-r curve” represent Exposure-response curve; ² “NS” represent “No significant relationship”; ³ “ND” represent “No Significant difference among the subgroups”

Abbreviations:

CVD: cardiovascular disease

ERV: emergency room visits

MI: Myocardial Infarction

AMI: Acute Myocardial Infarction

IHD: Ischemic heart disease (I20-I25, including AMI (I21))

HF: Heart Failure

Table S9 The comparison of relevant studies results of respiratory diseases

References	Study area	Study period	Data source	Diseases type	Method	E-r curve ¹	Significant lag effect							Subgroup analysis		
							PM _{2.5}	PM ₁₀	NO ₂	SO ₂	CO	O ₃	others	Season	Gender	Age
This study	Qingdao	2014–2018	Affiliated Hospital of Qingdao University	COPD hospital admission	GAM	linear	NS ²	NS	Lag01	Lag03	Lag0	NS	–	ND ³	female	≥65
Cai et al., 2014	Shanghai, China	2005–2011	Shanghai Health Insurance Bureau, Nine urban districts	Asthma hospitalization	Over-dispersed GAM	linear	–	NS	Lag01	Lag01	–	–	Black carbon: Lag01	cold	ND	ND
Cai et al., 2015	Shanghai, China	2006–2008	Shanghai Health Insurance Bureau, nine urban districts	COPD hospitalization	over-dispersed GAM	linear	–	–	–	–	Lag3*	–	–	cool	ND	ND
Chen et al., 2012	16 cities, China	1996–2008	Municipal Center for Disease Control and Prevention	respiratory mortality	GLM	–	–	Lag2	–	–	–	–	–	–	female	≥65
Fischer et al., 2003	Netherlands	1986–1994	Central Bureau of Statistics	COPD and pneumonia mortality	GAM	–	–	Lag06	Lag06	Lag06	Lag06	Lag1	Black smoke: lag06	–	–	≥65
Kan et al., 2007	Shanghai, China	2004–2005	Shanghai Municipal Center of Disease Control and	respiratory mortality	GAM	linear	Lag01	–	–	–	–	–	PM _{10-2.5} : NS	–	–	–

References	Study area	Study period	Data source	Diseases type	Method	E-r curve ¹	Significant lag effect						Subgroup analysis				
							PM _{2.5}	PM ₁₀	NO ₂	SO ₂	CO	O ₃	others	Season	Gender	Age	
			Prevention														
Kan et al., 2008	Shanghai, China	2001–2004	Shanghai Municipal Center of Disease Control and Prevention	respiratory mortality	GLM	–	–	Lag01	Lag01	Lag01	–	NS	–	cool	female	≥65	
Lee et al., 2015	11 East Asian cities	2001–2009	The statistical offices of the cities	respiratory mortality	GAM	–	Lag01	–	–	–	–	–	PM _{10-2.5} : NS	cold	–	–	
Liu et al., 2017	Yichang, China	2014–2015	3 hospitals	respiratory outpatient visit	GAM	Non-linear	Lag0	Lag0	Lag0	NS	Lag0	Lag4	–	ND	–	0–14	
Middleton et al., 2008	Nicosia, Cyprus	1995–2004	2 public hospitals	respiratory mortality	GAM	–	–	Lag0	–	–	–	Lag2	–	warm	female	≥15	
Phung et al., 2016	Ho Chi Minh City, Vietnam	2004–2007	2 largest hospitals	respiratory hospital admissions	GLM	–	–	Lag0	Lag0	Lag0	–	NS	–	–	female	5–65	

References	Study area	Study period	Data source	Diseases type	Method	E-r curve ¹	Significant lag effect							Subgroup analysis		
							PM _{2.5}	PM ₁₀	NO ₂	SO ₂	CO	O ₃	others	Season	Gender	Age
Samoli et al., 2006	30 cities across Europe	1990–1997	APHEA project	respiratory mortality	Poisson regression models	–	–	–	Lag05	–	–	–	–	–	–	–
Stafoggia et al., 2013	10 European cities	2011–2010	National health information systems	respiratory hospital admission	Poisson regression models	linear	Lag05	Lag05	–	–	–	–	PM _{2.5-10} : lag05	–	–	–
Stieb et al., 2009	7 Canadian cities	1990–2000	14 hospitals	Respiratory ERV	GLM	–	Lag0–Asthma	Lag0–Asthma	NS	NS	NS	Lag2–Asthma; COPD	–	warm	–	–
Tao et al., 2014	Lanzhou, China	2001–2005	4 general hospitals	respiratory diseases hospital admission	GAM	–	–	Lag4	Lag1	Lag1	–	–	–	–	female	≥65
Wang et al., 2018a	Shanghai, China	2013–2016	Shanghai Tenth People's Hospital	respiratory diseases daily outpatient visits	GLM	–	Lag0	–	–	–	–	Lag05*	–	cold	female	15–60

References	Study area	Study period	Data source	Diseases type	Method	E-r curve ¹	Significant lag effect							Subgroup analysis		
							PM _{2.5}	PM ₁₀	NO ₂	SO ₂	CO	O ₃	others	Season	Gender	Age
Xu et al., 2016	Beijing, China	2013	10 general hospitals	respiratory disease ERV	GAM	linear	Lag0	–	–	–	–	–	–	–	female	≥60
Zhang et al., 2014	Guangzhou, China	2008–2011	Guangzhou Health Insurance Bureau (GHIB)	respiratory hospital admissions	GAM	–	–	Lag2	Lag0	NS	–	–	–	warm	female	19–64

Notes: “–” represent the item not discussed in the corresponding reference; ¹“E-r curve” represent Exposure-response curve; ²“NS” represent “No significant relationship”; ³“ND” represent “No Significant difference among the subgroups”; *The text in red represents negative correlation, while all the others show positively significant relationship

Table S10 Spearman correlation coefficients between air pollutants

Variables	PM _{2.5}	PM ₁₀	NO ₂	SO ₂	CO	O ₃
PM _{2.5}	1	–	–	–	–	–
PM ₁₀	0.92	1	–	–	–	–
NO ₂	0.67	0.69	1	–	–	–
SO ₂	0.69	0.69	0.63	1	–	–
CO	0.87	0.79	0.71	0.77	1	–
O ₃	–0.14	–0.13	–0.38	–0.37	–0.28	1

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