

## **Web Appendix – Levy et al.**

The following tables provide information on the 42 epidemiological studies addressing fine particulate matter differential toxicity, selected based on criteria delineated in the main text.

“Measure” refers to whether the numbers in the subsequent columns represent odds ratios (OR), relative risks (RR), hazard ratios (HR), effect estimates characterized by coefficients from regression models (EE), raw coefficients (Coeff), or attributable risks (AR). We report the statistical significance for each measure, noting whether the values reflect confidence intervals, p-values, t-values, or other measures. Where possible, we report values identically to how they were reported in the original publications (i.e., not converting between regression coefficients and relative risks), to facilitate direct comparison with the original publications. When estimates are presented with numerous lags, values are reported that are most consistent with the presentation of results by the original authors. For publications in which relevant estimates were only provided in figures, estimates are approximated using visual inspection.

“Single/multi” refers to whether the effect estimates reported were from models with individual particle constituents or multiple particle constituents included concurrently – whether gaseous pollutants or other confounders were addressed is not considered in this metric. Studies that provide quantitative estimates using both single-constituent and multi-constituent models have both sets of values reported.

Empty cells or missing confidence intervals indicate that the information was not reported in the original epidemiological study. When applicable, estimates from older studies are replaced by revised analyses addressing S-Plus GAM convergence criteria.

Mortality, hospital admissions, and emergency room visits are only presented for all-cause, cardiovascular, and respiratory disease, for ease of presentation, unless a study did not report any of those endpoints. For studies with multiple endpoints not available in other studies, a single representative endpoint is provided. For studies that did not include a total population estimate, values are provided for a single population stratification reported in the study.

Reference numbers refer to the bibliography in the main text.

Web Table 1: Time-series mortality, all-cause

Location	Meas.	PM <sub>2.5</sub>	EC	OC	Sulfate	Nitrate	Units	Single/ multi?	Ref.
West Midlands	EE (CI)	0.6 (-1.5, 2.7)	0.6 (-1.5, 2.7)		-0.4 (-2.3, 1.5)		17.7, 16.7, 5.8 $\mu\text{g}/\text{m}^3$	Single	(12)
London	EE (CI)	-0.04 (-0.46, 0.39)	0.12 (-0.26, 0.51)		0.29 (-0.34, 0.92)	0.03 (-0.47, 0.53)	11, 3.4, 2.4, 3.4 $\mu\text{g}/\text{m}^3$	Single	(13)
Santa Clara	RR (CI)	1.09 (1.02, 1.17)	1.02 (0.99, 1.05)		1.05 (1.01, 1.10)	1.07 (1.03, 1.12)	28 $\mu\text{g}/\text{m}^3$ , 0.9 COH, 2.8, 8.0 $\mu\text{g}/\text{m}^3$	Single	(23)
Atlanta	Coeff (SE)	0.00398 (0.00161)	0.01024 (0.00993)	0.00142 (0.00644)	0.00920 (0.00495)	0.00342 (0.01662)	1 $\mu\text{g}/\text{m}^3$	Single	(27)
Philadelphia	AR (p-value)	0.0186 (p < 0.055)	0.0112 (p < 0.055)		0.0112 (p > 0.055)		N/A	Single	(28)
Detroit	RR (CI)	1.027 (0.974, 1.083)			1.015 (0.972, 1.059)		11 $\mu\text{g}/\text{m}^3$ , 47 nmole/ $\text{m}^3$	Single	(30)
Boston	EE (CI)		2.3 (1.2, 3.4)		1.1 (0.01, 2.0)		0.2 g/m, 2.3 $\mu\text{g}/\text{m}^3$	Single	(33)
Boston	EE (CI)		2.2 (0.16, 4.2)		0.45 (-0.45, 1.6)		0.2 g/m, 2.3 $\mu\text{g}/\text{m}^3$	Multi	(33)
California	EE (CI)	0.82 (-0.25, 1.9)	0.66 (-0.55, 1.89)	0.64 (-0.44, 1.73)	0.18 (-1.16, 1.55)	1.13 (-0.06, 2.35)	14.6, 0.8, 4.6, 1.5, 5.5 $\mu\text{g}/\text{m}^3$	Single	(38)
6 cities	EE (CI)	1.2 (0.8, 1.6)			1.5 (0.8, 2.3)		10 $\mu\text{g}/\text{m}^3$	Single	(46)
Elizabeth	Coeff (SE)	0.0007 (0.0015)			-0.0023 (0.0048)			Single	(48)
Newark	Coeff (SE)	0.0017 (0.0003)			0.0061 (0.0018)			Single	(48)
Camden	Coeff (SE)	0.0022 (0.0011)			0.0020 (0.0025)			Single	(48)
Vancouver	EE (CI)	4.5 (-0.3, 9.5)	1.1 (-0.9, 3.1)		2.9 (-4.4, 10.8)		15.7 $\mu\text{g}/\text{m}^3$ , 0.4 COH, 3.3 $\mu\text{g}/\text{m}^3$	Single	(49)

Web Table 2: Time-series mortality, CVD

Location	Meas.	PM <sub>2.5</sub>	EC	OC	Sulfate	Nitrate	Units	Single/ multi?	Ref.
Phoenix	RR (CI)	1.06 (1.02, 1.10)	1.05 (1.01, 1.10)	1.04 (1.00, 1.08)			8.5, 1.2, 3.0 µg/m <sup>3</sup>	Single	(11)
West Midlands	EE (CI)	0.9 (-2.1, 4.0)	1.5 (-1.5, 4.7)		-1.3 (-4.0, 1.5)		17.7, 16.7, 5.8 µg/m <sup>3</sup>	Single	(12)
Santa Clara	RR (CI)	1.07 (0.95, 1.21)	1.03 (0.99, 1.07)		1.04 (0.97, 1.11)	1.09 (1.02, 1.17)	28 µg/m <sup>3</sup> , 0.9 COH, 2.8, 8.0 µg/m <sup>3</sup>	Single	(23)
Detroit	RR (CI)	1.032 (0.954, 1.116)			1.013 (0.950, 1.080)		11 µg/m <sup>3</sup> , 47 nmole/m <sup>3</sup>	Single	(30)
Boston	EE (CI)		1.5 (-0.4, 3.4)		-0.2 (-1.5, 1.0)		0.2 g/m, 2.3 µg/m <sup>3</sup>	Single	(33)
California	EE (CI)	1.55 (- 0.02, 3.14)	2.07 (0.29, 3.87)	1.55 (- 0.06, 3.18)	1.01 (- 1.01, 3.08)	1.52 (- 0.24, 3.31)	14.6, 0.8, 4.6, 1.5, 5.5 µg/m <sup>3</sup>	Single	(38)
California, high school graduates	EE (CI)	1 (-2, 3)	0 (-2, 2)	-0.5 (- 2.5, 1.5)	1.5 (-1, 4.5)	1 (-2, 3)	14.6, 0.8, 4.6, 1.5, 5.5 µg/m <sup>3</sup>	Single	(41)
California, non-high school graduates	EE (CI)	6 (2, 11)	4.5 (0.5, 9)	4.5 (1, 9)	2.5 (-2, 7)	4.5 (-0.5, 9)	14.6, 0.8, 4.6, 1.5, 5.5 µg/m <sup>3</sup>	Single	(41)
Vancouver	EE (CI)	3.0 (-4.2, 10.8)	0.3 (-2.6, 3.3)		2.9 (-7.8, 15)		15.7 µg/m <sup>3</sup> , 0.4 COH, 3.3 µg/m <sup>3</sup>	Single	(49)

Web Table 3: Time-series mortality, respiratory

Location	Meas.	PM <sub>2.5</sub>	EC	OC	Sulfate	Nitrate	Units	Single/ multi?	Ref.
West Midlands	EE (CI)	-0.1 (-5.4, 5.5)	0.1 (-4.8, 5.2)		-1.8 (-6.4, 3.0)		17.7, 16.7, 5.8 µg/m <sup>3</sup>	Single	(12)
Santa Clara	RR (CI)	1.13 (0.89, 1.44)	1.10 (1.02, 1.18)		1.15 (1.01, 1.30)	1.1 (0.95, 1.27)	28 µg/m <sup>3</sup> , 0.9 COH, 2.8, 8.0 µg/m <sup>3</sup>	Single	(23)
Detroit	RR (CI)	1.033 (0.854, 1.249)			1.056 (0.899, 1.245)		11 µg/m <sup>3</sup> , 47 nmole/m <sup>3</sup>	Single	(30)
Boston	EE (CI)		3.7 (0.1, 7.4)		2.1 (-1.1, 5.3)		0.2 g/m, 2.3 µg/m <sup>3</sup>	Single	(33)
California	EE (CI)	1.44 (-1.50, 4.48)	1.17 (-2.23, 4.69)	0.99 (-2.13, 4.21)	1.76 (-2.20, 5.89)	1.96 (-1.91, 5.99)	14.6, 0.8, 4.6, 1.5, 5.5 µg/m <sup>3</sup>	Single	(38)
Vancouver	EE (CI)	10 (-4.7, 26.8)	3.7 (-1.7, 9.3)		8.3 (-12.3, 33.8)		15.7 µg/m <sup>3</sup> , 0.4 COH, 3.3 µg/m <sup>3</sup>	Single	(49)

Web Table 4: Cohort mortality

Outcome	Location	Meas.	PM <sub>2.5</sub>	EC	OC	Sulfate	Nitrate	Units	Single/ multi?	Ref.
All-cause	Netherlands	RR (CI)	1.06 (0.97, 1.16)	1.05 (1.00, 1.11)				10, 10 µg/m <sup>3</sup>	Single	(15)
All-cause	National	Coeff (SE)	0.00611 (0.00691)	0.1664 (0.05884)	-0.001 (0.022)	0.00909 (0.01537)	0.03751 (0.01517)	1 µg/m <sup>3</sup>	Single	(29)
All-cause	National	Coeff (SE)		0.1126 (0.0664)			0.02602 (0.01678)	1 µg/m <sup>3</sup>	Multi	(29)
All-cause	California	HR (CI)	1.49 (1.28, 1.74)	1.10 (1.03, 1.19)	1.70 (1.53, 1.87)	1.49 (1.30, 1.71)	1.40 (1.20, 1.65)	6.1, 0.16, 1.0, 1.3, 3.6 µg/m <sup>3</sup>	Single	(39)
CVD	Netherlands	RR (CI)	1.04 (0.90, 1.21)	1.04 (0.95, 1.13)				10, 10 µg/m <sup>3</sup>	Single	(15)
Respiratory	California	HR (CI)	1.39 (0.91, 2.11)	0.94 (0.75, 1.16)	1.55 (1.18, 2.02)	1.61 (1.13, 2.31)	1.39 (0.90, 2.13)	6.1, 0.16, 1.0, 1.3, 3.6 µg/m <sup>3</sup>	Single	(39)
Respiratory	Netherlands	RR (CI)	1.07 (0.75, 1.52)	1.22 (0.99, 1.50)				10, 10 µg/m <sup>3</sup>	Single	(15)

Web Table 5: Hospital admissions

Outcome	Location	Meas.	PM <sub>2.5</sub>	EC	OC	Sulfate	Nitrate	Units	Single/ multi?	Ref.
CVD	West Midlands	EE (CI)	-0.5 (-2.6, 1.6)	1.0 (-1.0, 3.1)		0.3 (-1.5, 2.1)		17.7, 16.7, 5.8 µg/m <sup>3</sup>	Single	(12)
CVD	Toronto	RR (t-value)	1.031 (1.80)	1.062 (5.63)		1.017 (1.56)		11 µg/m <sup>3</sup> , 0.25 10 <sup>3</sup> ln ft, 40 nmol/m <sup>3</sup>	Single	(18)
CVD, > 65	106 US Counties	EE (CI)		25.8 (4.4, 47.2)	-7 (23, -38)	-18 (8, -38)	15 (-15, 45)	1.7, 9.0, 9.3, 9.7 % of total mass	Single	(16)
Respiratory	West Midlands	EE (CI)	1.2 (-0.9, 3.4)	2.1 (-0.1, 4.2)		0.8 (-1.3, 2.9)		17.7, 16.7, 5.8 µg/m <sup>3</sup>	Single	(12)
Respiratory	Toronto	RR (t-value)	1.037 (3.29)	1.037 (5.36)		1.029 (4.07)		11 µg/m <sup>3</sup> , 0.25 10 <sup>3</sup> ln ft, 40 nmol/m <sup>3</sup>	Single	(18)
Respiratory, > 65	106 US Counties	EE (CI)		511 (80.7, 941)	350 (-350, 1000)	-350 (-800, 150)	30 (-600, 600)	1.7, 9.0, 9.3, 9.7 % of total mass	Single	(16)
Respiratory, children	California	EE (CI)	4.1 (1.8, 6.4)	5.4 (0.8, 10.3)	3.4 (1.1, 5.7)	3.0 (0.4, 5.7)	3.3 (1.1, 5.5)	14.6, 0.8, 4.5, 1.5, 5.7 µg/m <sup>3</sup>	Single	(40)
Myocardial infarction	Boston	EE (CI)	8.65 (1.22, 15.38)	8.34 (0.21, 15.82)				16.32, 1.69 µg/m <sup>3</sup>	Single	(50)

Web Table 6: Emergency room visits

Outcome	Location	Meas.	PM <sub>2.5</sub>	EC	OC	Sulfate	Nitrate	Units	Single/ multi?	Ref.
CVD	Atlanta	RR (CI)	1.033 (1.010, 1.056)	1.020 (1.005, 1.036)	1.026 (1.006, 1.046)	1.003 (0.968, 1.039)		10, 1, 2, 5 µg/m <sup>3</sup>	Single	(34)
Respiratory	Atlanta	RR (CI)	1.016 (0.997, 1.035)	0.999 (0.987, 1.011)	1.011 (0.997, 1.025)	0.998 (0.968, 1.028)		10, 1, 2, 5 µg/m <sup>3</sup>	Single	(43)
Respiratory	National	EE (CI)	0.44 (- 0.36, 1.23)	0.4 (-0.1, 0.9)	0.82 (0.22, 1.44)	0.7 (-0.1, 1.5)	0.0 (-0.5, 0.5)	9.4, 0.4, 3.2, 3.1, 1.6 µg/m <sup>3</sup>	Single	(8)
Respiratory	National	EE (CI)		0.0 (-0.9, 0.9)	1.07 (0.12, 2.04)	0.9 (-0.1, 1.7)	-0.1 (-0.6, 0.4)	9.4, 0.4, 3.2, 3.1, 1.6 µg/m <sup>3</sup>	Multi	(8)
Respiratory	Atlanta	RR (CI)	1.005 (0.996, 1.015)	0.996 (0.988, 1.003)	0.997 (0.990, 1.005)	1.020 (1.010, 1.030)	0.999 (0.991, 1.006)	IQR increase, not reported	Single	(44)
CVD	National	EE (CI)	0.64 (0.12, 1.15)	0.72 (0.43, 1.01)	0.66 (0.29, 1.02)	0.4 (0.0, 0.9)	0.46 (0.17, 0.75)	9.4, 0.4, 3.2, 3.1, 1.6 µg/m <sup>3</sup>	Single	(8)
CVD	National	EE (CI)		0.8 (0.34, 1.27)	0.63 (0.06, 1.19)	0.0 (-0.5, 0.5)	0.25 (-0.1, 0.6)	IQR: 9.4, 0.4, 3.2, 3.1, 1.6 µg/m <sup>3</sup>	Multi	(8)
CVD	Atlanta	RR (CI)	1.022 (1.007, 1.038)	1.025 (1.013, 1.037)	1.024 (1.013, 1.035)	1.007 (0.994, 1.019)	1.002 (0.990, 1.014)	IQR increase, not reported	Single	(44)

Web Table 7: Miscellaneous respiratory outcomes

Outcome	Location	Meas.	PM <sub>2.5</sub>	EC	OC	Sulfate	Nitrate	Units	Single/ multi?	Ref.
Asthma development	British Columbia	OR (CI)	1.01 (0.99, 1.03)	1.14 (1.01, 1.29)				1 µg/m <sup>3</sup> , 10 <sup>-5</sup> /m in absorbance	Single	(20)
Asthma development	Munich	OR (CI)	1.12 (0.94, 1.29)	1.56 (1.03, 2.37)				1 µg/m <sup>3</sup> , 0.2 x 10 <sup>-5</sup> /m in absorbance	Single	(35)
Cough in first year of life	Munich	OR (CI)	1.34 (1.11, 1.61)	1.32 (1.10, 1.59)				1.5 µg/m <sup>3</sup> , 0.4 x 10 <sup>-5</sup> /m	Single	(24)
Exhaled NO, asthmatics	Mexico	EE (CI)	3 (-8, 15)	2 (-10, 17)				5.1, 5.1 µg/m <sup>3</sup>	Single	(26)
FEV1	Vancouver	EE (CI)	-1.1 (-3.4, 1.3)			-0.3 (-1.3, 0.8)		10, 1 µg/m <sup>3</sup>	Single	(17)
Outpatient visits for pediatric asthma	Atlanta	RR (CI)	1.043 (0.979, 1.111)	1.046 (1.004, 1.091)	1.049 (1.006, 1.093)	1.017 (0.954, 1.084)		9.1, 1.25, 2.4, 3.4 µg/m <sup>3</sup>	Single	(47)
Wheeze, children	NYC	EE (p-value)	-0.13 (0.03)	0.02 (0.66)				2.1, 0.29 µg/m <sup>3</sup>	Single	(42)



Web Table 8: Miscellaneous cardiovascular and pre-term birth outcomes

Outcome	Location	Meas.	PM <sub>2.5</sub>	EC	OC	Sulfate	Nitrate	Units	Single/ multi?	Ref.
Arrhythmia (SVE)	Steubenville	OR (CI)	1.42 (0.99, 2.04)	1.15 (0.73, 1.81)		1.70 (1.12, 2.57)		IQR: 10, 4.2, 0.5 µg/m <sup>3</sup>	Single	(45)
BP, diastolic	Los Angeles	EE (CI)	2.06 (0.86, 3.26)	2.38 (0.99, 3.76)	4.57 (1.91, 7.23)			16, 1.02, 5.2 µg/m <sup>3</sup>	Single	(22)
BP, systolic	Los Angeles	EE (CI)	3.37 (1.15, 5.60)	3.14 (0.57, 5.71)	6.03 (1.00, 11.06)			16, 1.02, 5.2 µg/m <sup>3</sup>	Single	(22)
DNA (LINE-1) methylation	Boston	% of ΔSD (CI)	-0.13 (-0.19, -0.06)	-0.11 (-0.18, -0.04)		-0.04 (-0.12, 0.04)		3.9, 0.26, 1.4 µg/m <sup>3</sup>	Single	(14)
Flow-mediated dilation	Boston	EE (CI)	-6.2 (-13, 1)	-9.3 (-17.8, 0.2)		-9.0 (-14.9, -2.7)		IQR increase, not reported	Single	(36)
HRV/LF	Steubenville	EE (CI)	-10.7 (-20.1, -0.3)	-4.7 (-12.7, 4.0)		-8.4 (-17.0, 1.2)		13.4, 0.6, 5.1 µg/m <sup>3</sup>	Single	(31)
HRV/SDNN	Taiwan	EE (CI)	-3.96 (-7.08, -0.84)		-1.31 (-4.11, 1.49)	-2.02 (-5.40, 1.35)		53, 7.8, 14.6 µg/m <sup>3</sup>	Single	(19)
HRV/SDNN	Steubenville	EE (CI)	-4.0 (-7.0, -0.9)	1.5 (-1.1, 4.1)		-3.3 (-6.0, -0.5)		13.4, 0.6, 5.1 µg/m <sup>3</sup>	Single	(32)
ICD firing	London	OR (CI)	1.012 (0.919-1.115)	0.992 (0.916-1.074)		1.025 (1.003-1.047)		10, 10, 1 µg/m <sup>3</sup>	Single	(51)
T-wave amplitude	Erfurt	EE (CI)	-6.46 (-10.88, -2.04)	-4.67 (-10.0, 0.67)	-4.31 (-10.07, 1.44)			16.4, 2.3, 0.7 µg/m <sup>3</sup>	Single	(25)
VCAM-1	Boston	EE (CI)	11.8 (3.5, 20.7)	27.5 (12.0, 45.2)		-0.46 (-1.99, 1.09)		7.6, 0.6, 2.2 µg/m <sup>3</sup>	Single	(37)
Pre-term birth	Atlanta	RR (CI)	1.00 (0.96, 1.03)	1.04 (0.98, 1.10)	1.01 (0.95, 1.08)	1.09 (1.01, 1.19)	0.98 (0.90, 1.08)	6.0, 0.7, 1.7, 3.0, 0.75 µg/m <sup>3</sup>	Single	(21)