

SUPPLEMENT

Daily Associations of Air Pollution and Pediatric Asthma Risk using the Biomedical REAI-Time Health Evaluation (BREATHE) Kit

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Supplement Table S1. Descriptive statistics of participants characteristics (N=40).

Characteristics	Statistics
Medications taken in the last 12 months	
Short-acting beta ₂ -agonist bronchodilators [N (%)]	
No	11 (27.5)
Regularly, every day	4 (10.0)
Occasionally, as needed	25 (62.5)
Long-acting beta ₂ -agonist bronchodilators [N (%)]	
No	40 (100.0)
Corticosteroids [N (%)]	
No	28 (70.0)
Regularly, every day	12 (30.0)
Oral steroid medication [N (%)]	
No	25 (62.5)
Yes	15 (37.5)
Have allergies [N (%)]	
No	8 (20.0)
Yes	27 (67.5)
Missing	5 (12.5)
Any biological parents ever been diagnosed with asthma [N (%)]	
No	25 (62.5)
Yes	10 (25.0)
Missing	5 (12.5)
Anyone currently smoke cigarettes, or anything other than cigarettes (e-cigarettes, cigars, pipes, hookah's, tobacco products, other) at the home on a regular basis [N (%)]	
No	37 (92.5)
Missing	3 (7.5)
Child ever smoked electronic cigarettes/e-cigarettes or other electronic nicotine devices (e-hookah, e-cigars, etc.) [N (%)]	
No	34 (85.0)
Missing	6 (15.0)
Mother have any problems during the pregnancy [N (%)]	
An infection	1 (2.5)
Early labor	7 (17.5)
High blood pressure	2 (5.0)
High blood sugar	6 (15.0)
None of these	18 (45.0)
Missing	6 (15.0)

Mother use during pregnancy [N (%)]	
Cigarettes	0 (0)
Drugs	1 (2.5)
None of these	36 (90)
Missing	3 (7.5)
Kitchen fan over the cooking stove, range, oven or elsewhere in the kitchen [N (%)]	
No	5 (12.5)
Yes	32 (80.0)
Missing	3 (7.5)
Child own pets [N (%)]	
No	15 (37.5)
Yes	22 (55.0)
Missing	3 (7.5)
Any sports in a typical week [N (%)]	
No	7 (17.5)
Yes	29 (72.5)
Missing	4 (10.0)
Days play outdoors for at least half an hour in a typical week [N (%)]	
No	6 (15.0)
Yes	31 (77.5)
Missing	3 (7.5)

Supplement Table S2. Descriptive statistics of daily (6am-6am) air pollution exposures and meteorology.

Environmental exposure	N (person-days)	Mean	Std Dev	Min - Max
Personal Exposure (measured)				
PM _{2.5} ($\mu\text{g}/\text{m}^3$)	182	6.9	9.1	0.3 - 64.7
Temperature (°C)	182	27.4	2.2	22.5 - 33.2
Relative Humidity (%)	182	45.9	8.1	15.3 - 61.1
Ambient Pollutants (modeled)				
PM _{2.5} ($\mu\text{g}/\text{m}^3$)	359	9.5	3.7	1.0 - 21.1
NO ₂ (ppb)	356	7.6	4.6	0.27 - 35.9
NO _x (ppb)	345	9.5	6.1	0.27 - 36.0
NO (ppb)	345	1.8	2.4	0 - 17.3
O ₃ (ppb)	359	32.3	9.2	7.7 - 64.7
Temperature (°C)	342	18.0	4.0	8.2 - 32.2
Relative Humidity (%)	342	69.7	19.1	8.2 - 95.8
Traffic-related Pollutants (modeled)				
PM _{2.5} ($\mu\text{g}/\text{m}^3$)	338	0.7	0.7	0.1 - 4.8
NO ₂ (ppb)	338	4.9	7.1	0 - 42.8
NO _x (ppb)	338	10.6	14.7	0.1 - 88.9

Supplement Table S3. Exposure (daily average, 6am-6am) Spearman correlation matrix

	Personal			Ambient			Traffic-related		
	PM _{2.5}	NO ₂	NO _x	NO	O ₃	PM _{2.5}	NO ₂	NO _x	PM _{2.5}
Personal PM _{2.5}	1.00	0.05	-0.03	-0.03	-0.10	0.39*	0.15	0.14	0.14
Ambient NO ₂		1.00	0.98*	0.67*	-0.40*	0.21*	0.19*	0.20*	0.24*
Ambient NO _x			1.00	0.78*	-0.37*	0.18*	0.16*	0.17*	0.21*
Ambient NO				1.00	-0.25*	0.24*	-0.05	-0.03	-0.01
Ambient O ₃					1.00	-0.03	-0.22*	-0.23*	-0.24*
Ambient PM _{2.5}						1.00	0.09	0.08	0.09
Traffic-related NO ₂							1.00	0.99*	0.98*
Traffic-related NO _x								1.00	0.99*
Traffic-related PM _{2.5}									1.00

*P<0.05 from Wald-based tests of Spearman correlation coefficient

Supplement Table S4. Change in %predicted morning, evening or daily averaged FEV₁ (forced expiratory volume in 1 second) per standard deviation change in pollutant exposure.

Exposure	Morning %Predicted FEV ₁			Evening %Predicted FEV ₁			Daily %Predicted FEV ₁		
	Estimate (95% CI)	P-value	N (person-days)	Estimate (95% CI)	P-value	N (person-days)	Estimate (95% CI)	P-value	N (person-days)
Personal PM _{2.5} ($\mu\text{g}/\text{m}^3$)									
Lag 0 [#]	2.89 (-0.18, 5.96)	0.070	86	-1.31 (-4.37, 1.75)	0.405	74	-1.81 (-4.40, 0.79)	0.182	52
Lag 1 [#]	-0.21 (-3.89, 3.47)	0.912	72	-0.04 (-3.47, 3.39)	0.982	68	0.33 (-2.72, 3.38)	0.832	46
Lag 2 [#]	-2.22 (-6.63, 2.19)	0.329	63	8.21 (-11.22, 27.63)	0.412	57	11.44 (-13.28, 36.16)	0.373	39
Traffic-related PM _{2.5} ($\mu\text{g}/\text{m}^3$)									
Lag 0	-1.50 (-5.03, 2.03)	0.408	123	-2.55 (-5.64, 0.54)	0.110	101	1.06 (-6.29, 8.42)	0.778	69
Lag 1	-3.91 (-7.36, -0.47)	0.029	112	1.59 (-2.33, 5.50)	0.430	88	-1.49 (-5.56, 2.59)	0.478	62
Lag 2	-5.57 (-12.22, 1.08)	0.105	95	0.94 (-2.76, 4.64)	0.619	77	-3.00 (-6.64, 0.63)	0.114	55
Traffic-related NO _x (ppb)									
Lag 0	-1.08 (-5.19, 3.02)	0.607	123	-2.56 (-5.98, 0.86)	0.146	101	1.92 (-7.86, 11.71)	0.702	69
Lag 1	-5.05 (-9.32, -0.78)	0.023	112	1.10 (-3.07, 5.26)	0.607	88	-1.81 (-5.97, 2.35)	0.399	62
Lag 2	-5.38 (-12.74, 1.98)	0.156	95	1.12 (-2.95, 5.20)	0.591	77	-2.91 (-6.83, 1.01)	0.153	55
Traffic-related NO ₂ (ppb)									
Lag 0	-0.38 (-4.10, 3.34)	0.843	123	-2.21 (-5.33, 0.91)	0.168	101	3.03 (-6.48, 12.53)	0.535	69
Lag 1	-4.81 (-8.65, -0.97)	0.016	112	0.98 (-2.78, 4.75)	0.611	88	-1.60 (-5.30, 2.11)	0.402	62
Lag 2	-4.75 (-11.70, 2.21)	0.185	95	1.06 (-2.65, 4.77)	0.577	77	-2.60 (-6.15, 0.95)	0.159	55
Ambient PM _{2.5} ($\mu\text{g}/\text{m}^3$)									
Lag 0	-2.60 (-5.96, 0.76)	0.133	132	2.03 (-0.71, 4.77)	0.150	110	1.55 (-1.62, 4.73)	0.342	76
Lag 1	-1.18 (-4.75, 2.38)	0.517	116	-2.43 (-6.18, 1.31)	0.207	96	-1.07 (-4.86, 2.72)	0.582	66
Lag 2	-0.25 (-3.93, 3.43)	0.896	101	-0.96 (-4.36, 2.45)	0.584	84	0.55 (-2.87, 3.96)	0.754	59
Ambient O ₃ (ppb)									

Lag 0	-4.11 (-6.86, -1.36)	0.004	132	-2.65 (-5.19, -0.10)	0.045	110	-3.45 (-6.42, -0.47)	0.027	76
Lag 1	-1.25 (-4.13, 1.62)	0.395	116	-4.90 (-7.94, -1.85)	0.002	96	-4.92 (-8.44, -1.40)	0.009	66
Lag 2	-2.94 (-5.93, 0.05)	0.057	101	-1.16 (-4.45, 2.12)	0.490	84	0.90 (-3.27, 5.07)	0.674	59
Ambient NO_x (ppb)									
Lag 0	-0.34 (-3.79, 3.11)	0.849	125	2.11 (-1.06, 5.28)	0.196	102	2.70 (-1.24, 6.64)	0.185	70
Lag 1	-2.18 (-5.67, 1.31)	0.225	113	2.76 (-1.23, 6.75)	0.179	89	-0.96 (-5.33, 3.42)	0.671	63
Lag 2	-0.73 (-4.58, 3.12)	0.712	96	1.84 (-2.99, 6.67)	0.458	78	-1.10 (-6.81, 4.61)	0.708	55
Ambient NO (ppb)									
Lag 0	-0.52 (-4.29, 3.25)	0.786	125	2.64 (-0.77, 6.05)	0.133	102	2.17 (-1.80, 6.14)	0.289	70
Lag 1	-2.10 (-5.71, 1.52)	0.259	113	1.76 (-2.10, 5.61)	0.375	89	-0.93 (-4.79, 2.94)	0.641	63
Lag 2	-0.70 (-4.66, 3.25)	0.729	96	-0.07 (-6.14, 6.00)	0.982	78	-1.55 (-8.64, 5.55)	0.672	55
Ambient NO₂ (ppb)									
Lag 0	0.04 (-2.80, 2.87)	0.981	130	1.90 (-1.23, 5.04)	0.238	107	2.33 (-1.63, 6.28)	0.254	74
Lag 1	-2.03 (-5.70, 1.63)	0.280	115	3.15 (-0.94, 7.24)	0.136	94	-0.79 (-5.32, 3.74)	0.735	65
Lag 2	-0.96 (-4.71, 2.79)	0.616	100	2.07 (-2.33, 6.47)	0.361	82	-1.52 (-6.72, 3.68)	0.570	58

*Effect estimates were scaled to a standard deviation change in pollutant concentrations as follows: personal PM_{2.5}: 9.1 µg/m³; Traffic-related PM_{2.5}: 0.7 µg/m³; Traffic-related NO_x: 14.7 ppb; Traffic-related NO₂: 7.1 ppb; Ambient PM_{2.5}: 3.7 µg/m³; Ambient O₃: 9.2 ppb; Ambient NO_x: 6.1 ppb; Ambient NO: 2.4 ppb; Ambient NO₂: 4.6 ppb.

#Lag 0 was defined as preceding 24 hours and lags 1 and 2 days were defined as the average of the 25th to 48th hour (lag 1) and the average of the 49th to 72nd hour (lag 2).

Supplement Table S5. Change in %predicted morning, evening or daily PEF (peak expiratory flow rate) (per standard deviation change) in pollutant exposure.

Exposure	Morning %Predicted PEF			Evening %Predicted PEF			Daily %Predicted PEF		
	Estimate (95% CI)	P-value	N (person -days)	Estimate (95% CI)	P-value	N (person -days)	Estimate (95% CI)	P-value	N (person -days)
Personal PM_{2.5} (µg/m³)									
Lag 0 [#]	0.94 (-2.15, 4.03)	0.553	86	-1.91 (-5.33, 1.51)	0.278	74	-2.31 (-5.07, 0.46)	0.112	52
Lag 1 [#]	-1.03 (-4.56, 2.50)	0.570	72	-0.07 (-4.26, 4.11)	0.973	68	-1.09 (-4.38, 2.20)	0.520	46
Lag 2 [#]	-2.72 (-7.06, 1.61)	0.225	63	1.73 (-17.05, 20.52)	0.857	57	4.28 (-19.51, 28.08)	0.727	39
Traffic PM_{2.5} (µg/m³)									
Lag 0	-3.97 (-7.69, -0.26)	0.039	123	-2.59 (-5.92, 0.74)	0.131	101	-6.68 (-14.32, 0.96)	0.093	69
Lag 1	-3.35 (-6.89, 0.19)	0.067	112	-0.24 (-4.37, 3.90)	0.911	88	-1.30 (-5.49, 2.88)	0.544	62
Lag 2	-6.27 (-12.75, 0.21)	0.062	95	-1.24 (-4.64, 2.15)	0.475	77	-2.99 (-6.36, 0.38)	0.090	55
Traffic NO_x (ppb)									
Lag 0	-3.59 (-7.92, 0.74)	0.108	123	-2.45 (-6.12, 1.23)	0.196	101	-7.76 (-17.99, 2.48)	0.144	69
Lag 1	-4.91 (-9.28, -0.54)	0.030	112	-0.74 (-5.11, 3.64)	0.743	88	-1.54 (-5.79, 2.72)	0.483	62
Lag 2	-6.04 (-13.22, 1.14)	0.104	95	-0.99 (-4.73, 2.75)	0.606	77	-2.81 (-6.43, 0.80)	0.136	55
Traffic NO₂ (ppb)									
Lag 0	-2.75 (-6.69, 1.20)	0.175	123	-2.11 (-5.46, 1.24)	0.220	101	-6.61 (-16.60, 3.39)	0.201	69
Lag 1	-4.57 (-8.51, -0.63)	0.026	112	-0.58 (-4.54, 3.38)	0.774	88	-1.32 (-5.09, 2.45)	0.497	62
Lag 2	-5.44 (-12.22, 1.33)	0.120	95	-0.82 (-4.22, 2.57)	0.637	77	-2.55 (-5.82, 0.72)	0.135	55
Ambient PM_{2.5} (µg/m³)									
Lag 0	-2.40 (-5.96, 1.16)	0.190	132	2.48 (-0.41, 5.37)	0.096	110	0.37 (-3.11, 3.86)	0.835	76
Lag 1	-0.27 (-3.80, 3.27)	0.883	116	-0.69 (-4.60, 3.23)	0.731	96	-0.96 (-4.71, 2.79)	0.617	66
Lag 2	-0.70 (-4.21, 2.81)	0.697	101	-0.52 (-3.69, 2.65)	0.749	84	0.65 (-2.55, 3.85)	0.692	59
Ambient O₃ (ppb)									
Lag 0	-1.96 (-4.97, 1.05)	0.205	132	-1.09 (-3.86, 1.67)	0.440	110	-2.19 (-5.51, 1.14)	0.203	76
Lag 1	-0.80 (-3.65, 2.05)	0.583	116	-1.96 (-5.28, 1.37)	0.252	96	-4.13 (-7.69, 0.57)	0.102	66
Lag 2	-2.22 (-5.03, 0.59)	0.126	101	-0.49 (-3.56, 2.58)	0.756	84	0.42 (-3.46, 4.30)	0.834	59

Ambient NO _x (ppb)										
Lag 0	-0.22 (-3.85, 3.41)	0.906	125	1.08 (-2.33, 4.49)	0.537	102	2.21 (-1.98, 6.40)	0.306	70	
Lag 1	-0.21 (-3.71, 3.29)	0.907	113	0.56 (-3.70, 4.81)	0.798	89	-0.12 (-4.64, 4.40)	0.958	63	
Lag 2	-0.68 (-4.43, 3.07)	0.724	96	1.80 (-2.69, 6.29)	0.435	78	3.63 (-1.65, 8.91)	0.185	55	
Ambient NO (ppb)										
Lag 0	0.10 (-3.86, 4.06)	0.959	125	1.94 (-1.74, 5.62)	0.305	102	1.41 (-2.82, 5.63)	0.517	70	
Lag 1	0.33 (-3.30, 3.95)	0.860	113	0.06 (-4.02, 4.14)	0.978	89	-0.79 (-4.71, 3.12)	0.693	63	
Lag 2	-0.16 (-4.07, 3.74)	0.935	96	0.26 (-5.40, 5.92)	0.928	78	3.87 (-2.80, 10.54)	0.262	55	
Ambient NO ₂ (ppb)										
Lag 0	-0.25 (-3.24, 2.75)	0.872	130	0.81 (-2.55, 4.18)	0.637	107	2.21 (-2.02, 6.44)	0.310	74	
Lag 1	-0.48 (-4.13, 3.18)	0.798	115	1.29 (-3.04, 5.61)	0.561	94	0.78 (-3.95, 5.50)	0.749	65	
Lag 2	-0.53 (-4.18, 3.11)	0.776	100	2.24 (-1.86, 6.34)	0.289	82	2.91 (-2.08, 7.90)	0.260	58	

*Effect estimates were scaled to a standard deviation change in pollutant concentrations as follows: personal PM_{2.5}: 9.1 µg/m³; Traffic-related PM_{2.5}: 0.7 µg/m³; Traffic-related NO_x: 14.7 ppb; Traffic-related NO₂: 7.1 ppb; Ambient PM_{2.5}: 3.7 µg/m³; Ambient O₃: 9.2 ppb; Ambient NO_x: 6.1 ppb; Ambient NO: 2.4 ppb; Ambient NO₂: 4.6 ppb.

#Lag 0 was defined as preceding 24 hours and lags 1 and 2 days were defined as the average of the 25th to 48th hour (lag 1) and the average of the 49th to 72nd hour (lag 2).

Supplement Table S6. Change in %predicted morning, evening or daily FEV₁ (forced expiratory volume in 1 second) per standard deviation change in pollutant exposure on lag 0 day adjusted personal relative humidity, Hispanic ethnicity, and daily control inhaler use.

	Morning %Predicted FEV ₁			Evening %Predicted FEV ₁			Average Daily %Predicted FEV ₁		
	Estimate	95% CI	P-value	Estimate	95% CI	P-value	Estimate	95% CI	P-value
Personal PM _{2.5} ($\mu\text{g}/\text{m}^3$)	2.32	-1.05, 5.68	0.183	-1.78	-6.50, 2.94	0.464	-3.57	-8.33, 1.20	0.153
Traffic-related PM _{2.5} ($\mu\text{g}/\text{m}^3$)	0.26	-4.03, 4.55	0.905	-1.00	-4.92, 2.91	0.618	0.36	-4.72, 5.43	0.891
Traffic-related NO _x (ppb)	0.48	-4.02, 4.97	0.836	-1.49	-5.58, 2.60	0.479	-0.22	-5.95, 5.52	0.941
Traffic-related NO ₂ (ppb)	2.24	-2.08, 6.55	0.314	-1.19	-5.30, 2.92	0.572	1.02	-4.76, 6.81	0.732
Ambient PM _{2.5} ($\mu\text{g}/\text{m}^3$)	-3.47	-6.95, 0.01	0.056	1.6	-2.31, 5.51	0.426	-1.72	-6.04, 2.61	0.443
Ambient O ₃ (ppb)	-4.73	-7.98, -1.47	0.006	-2.61	-6.22, 1.00	0.163	-3.19	-7.46, 1.09	0.155
Ambient NO _x (ppb)	-0.87	-4.98, 3.25	0.682	1.1	-3.50, 5.70	0.642	2.26	-3.65, 8.18	0.460
Ambient NO (ppb)	-2.22	-6.17, 1.74	0.277	1.41	-3.14, 5.97	0.547	0.65	-5.46, 6.77	0.836
Ambient NO ₂ (ppb)	-0.09	-4.03, 3.84	0.963	0.83	-3.81, 5.48	0.727	2.48	-3.22, 8.19	0.401

*Effect estimates were scaled to a standard deviation change in pollutant concentrations as follows: personal PM_{2.5}: 9.1 $\mu\text{g}/\text{m}^3$; Traffic-related PM_{2.5}: 0.7 $\mu\text{g}/\text{m}^3$; Traffic-related NO_x: 14.7 ppb; Traffic-related NO₂: 7.1 ppb; Ambient PM_{2.5}: 3.7 $\mu\text{g}/\text{m}^3$; Ambient O₃: 9.2 bbp; Ambient NO_x: 6.1 ppb; Ambient NO: 2.4 ppb; Ambient NO₂: 4.6

Supplement Table S7. Change in %predicted morning, evening or daily PEF (peak expiratory flow rate) (per standard deviation change) in pollutant exposure on lag 0 day adjusted personal relative humidity, Hispanic ethnicity, and daily control inhaler use.

	Morning %Predicted PEF			Evening %Predicted PEF			Averaged Daily %Predicted PEF		
	Estimate	95%CI	P-value	Estimate	95%CI	P-value	Estimate	95%CI	P-value
Personal PM _{2.5} ($\mu\text{g}/\text{m}^3$)	0.33	-3.13, 3.78	0.854	-2.24	-7.51, 3.03	0.409	-3.63	-8.67, 1.41	0.169
Traffic-related PM _{2.5} ($\mu\text{g}/\text{m}^3$)	-3.42	-7.66, 0.83	0.121	-3.83	-8.05, 0.40	0.083	-4.89	-9.21, -0.56	0.037
Traffic-related NO _x (ppb)	-2.60	-7.06, 1.86	0.259	-4.41	-8.81, -0.01	0.056	-5.80	-10.70, -0.91	0.029
Traffic-related NO ₂ (ppb)	-1.52	-5.85, 2.81	0.495	-4.31	-8.73, 0.12	0.063	-5.19	-10.27, -0.11	0.057
Ambient PM _{2.5} ($\mu\text{g}/\text{m}^3$)	-1.98	-5.63, 1.67	0.292	3.15	-1.10, 7.41	0.153	-2.14	-6.47, 2.19	0.342
Ambient O ₃ (ppb)	-2.31	-5.82, 1.20	0.202	-1.03	-5.09, 3.04	0.623	-4.30	-8.55, -0.05	0.057
Ambient NO _x (ppb)	0.07	-4.03, 4.17	0.975	0.05	-5.19, 5.29	0.985	1.43	-4.98, 7.85	0.666
Ambient NO (ppb)	-0.22	-4.20, 3.75	0.912	2.10	-3.09, 7.28	0.433	0.24	-6.61, 7.08	0.946
Ambient NO ₂ (ppb)	-0.20	-4.24, 3.84	0.923	-0.87	-6.08, 4.35	0.746	2.00	-3.82, 7.82	0.506

*Effect estimates were scaled to a standard deviation change in pollutant concentrations as follows: personal PM_{2.5}: 9.1 $\mu\text{g}/\text{m}^3$; Traffic-related PM_{2.5}: 0.7 $\mu\text{g}/\text{m}^3$; Traffic-related NO_x: 14.7 ppb; Traffic-related NO₂: 7.1 ppb; Ambient PM_{2.5}: 3.7 $\mu\text{g}/\text{m}^3$; Ambient O₃: 9.2 bpb; Ambient NO_x: 6.1 ppb; Ambient NO: 2.4 ppb; Ambient NO₂: 4.6 ppb

Supplement Table S8. Associations between daily air pollutant exposures and count of rescue inhaler puffs used (rate ratios per standard deviation change in pollutant).

Exposure	Rate Ratio (95% CI)	P-value	N (person-days)
Personal PM _{2.5} ($\mu\text{g}/\text{m}^3$)			
Lag 0 [#]	1.09 (0.80, 1.50)	0.580	86
Lag 1 [#]	1.34 (0.77, 2.35)	0.306	81
Lag 2 [#]	1.16 (0.91, 1.47)	0.238	77
Traffic PM _{2.5} ($\mu\text{g}/\text{m}^3$)			
Lag 0	0.48 (0.26, 0.88)	0.021	166
Lag 1	0.68 (0.30, 1.53)	0.352	154
Lag 2	0.56 (0.23, 1.39)	0.217	143
Traffic NO _x (ppb)			
Lag 0	0.33 (0.13, 0.84)	0.023	166
Lag 1	0.47 (0.13, 1.72)	0.261	154
Lag 2	0.48 (0.12, 1.92)	0.307	143
Traffic NO ₂ (ppb)			
Lag 0	0.34 (0.14, 0.84)	0.022	166
Lag 1	0.50 (0.15, 1.71)	0.276	154
Lag 2	0.74 (0.22, 2.45)	0.624	143
Ambient PM _{2.5} ($\mu\text{g}/\text{m}^3$)			
Lag 0	1.45 (0.90, 2.33)	0.127	167
Lag 1	0.78 (0.42, 1.47)	0.448	155
Lag 2	2.56 (0.89, 4.71)	0.187	144
Ambient O ₃ (ppb)			
Lag 0	1.52 (1.02, 2.27)	0.046	167
Lag 1	0.99 (0.59, 1.68)	0.982	155
Lag 2	0.80 (0.48, 1.32)	0.384	144
Ambient NO _x (ppb)			
Lag 0	1.61 (1.23, 2.11)	0.001	166
Lag 1	0.79 (0.59, 1.07)	0.134	155
Lag 2	0.42 (0.26, 1.09)	0.145	144
Ambient NO (ppb)			
Lag 0	1.80 (1.37, 2.35)	0.000	166
Lag 1	1.01 (0.85, 1.21)	0.902	155
Lag 2	0.45 (0.17, 1.33)	0.208	144
Ambient NO ₂ (ppb)			
Lag 0	1.20 (0.85, 1.68)	0.302	166
Lag 1	0.46 (0.29, 1.12)	0.198	155
Lag 2	0.45 (0.28, 1.11)	0.186	144

*Effect estimates were scaled to a standard deviation change in pollutant concentrations as follows: personal PM_{2.5}: 9.1 $\mu\text{g}/\text{m}^3$; Traffic-related PM_{2.5}: 0.7 $\mu\text{g}/\text{m}^3$; Traffic-related NO_x: 14.7 ppb; Traffic-related NO₂: 7.1 ppb; Ambient PM_{2.5}: 3.7 $\mu\text{g}/\text{m}^3$; Ambient O₃: 9.2 ppb; Ambient NO_x: 6.1 ppb; Ambient NO: 2.4 ppb; Ambient NO₂: 4.6 ppb.

[#]Lag 0 was defined as preceding 24 hours and lags 1 and 2 days were defined as the average of the 25th to 48th hour (lag 1) and the average of the 49th to 72nd hour (lag 2).

Supplement Table S9. Associations between same-day (lag 0) daily air pollutant exposures and asthma symptoms (odds ratio per standard deviation change in pollutant).

Did you wake up last night because of your asthma?			
Exposure	Estimate (95% CI)	P-value	N (person-days)
Personal PM _{2.5}	0.71 (0.11, 4.64)	0.724	52
Traffic-related PM _{2.5}	0.52 (0.15, 1.85)	0.315	85
Traffic-related NO _x	0.52 (0.16, 1.70)	0.283	85
Traffic-related NO ₂	0.38 (0.09, 1.56)	0.183	85
Ambient PM _{2.5}	1.73 (0.60, 5.00)	0.315	87
Ambient O ₃	1.19 (0.43, 3.31)	0.737	87
Ambient NO _x	0.51 (0.06, 4.03)	0.525	87
Ambient NO	0.15 (0.00, 4.73)	0.285	87
Ambient NO ₂	0.79 (0.14, 4.62)	0.794	87
How many times did you use your inhaler during the night?			
Personal PM _{2.5}	0.39 (0.05, 3.08)	0.379	52
Traffic-related PM _{2.5}	0.95 (0.37, 2.42)	0.914	85
Traffic-related NO _x	0.79 (0.33, 1.92)	0.609	85
Traffic-related NO ₂	0.61 (0.22, 1.68)	0.343	85
Ambient PM _{2.5}	0.63 (0.23, 1.72)	0.374	87
Ambient O ₃	0.97 (0.47, 1.99)	0.927	87
Ambient NO _x	0.77 (0.27, 2.22)	0.633	87
Ambient NO	1.36 (0.48, 3.87)	0.571	87
Ambient NO ₂	0.52 (0.15, 1.77)	0.301	87
How much of the time did your asthma keep you from getting as much done at school or at home today?			
Personal PM _{2.5}	0.99 (0.42, 2.35)	0.986	52
Traffic-related PM _{2.5}	1.24 (0.50, 3.04)	0.642	81
Traffic-related NO _x	1.11 (0.53, 2.33)	0.791	81
Traffic-related NO ₂	1.09 (0.52, 2.27)	0.826	81
Ambient PM _{2.5}	0.70 (0.25, 2.00)	0.509	83
Ambient O ₃	1.13 (0.45, 2.81)	0.798	83
Ambient NO _x	1.15 (0.38, 3.43)	0.808	83
Ambient NO	1.48 (0.53, 4.14)	0.458	83
Ambient NO ₂	0.95 (0.30, 2.96)	0.929	83
Did your chest feel tight because of asthma today?			
Personal PM _{2.5}	0.85 (0.51, 1.42)	0.549	92
Traffic-related PM _{2.5}	0.94 (0.61, 1.45)	0.796	151
Traffic-related NO _x	0.97 (0.65, 1.43)	0.874	151
Traffic-related NO ₂	0.95 (0.65, 1.38)	0.794	151
Ambient PM _{2.5}	1.01 (0.57, 1.79)	0.969	154
Ambient O ₃	0.81 (0.53, 1.25)	0.349	154
Ambient NO _x	1.24 (0.67, 2.31)	0.496	153
Ambient NO	1.13 (0.55, 2.33)	0.746	153

Ambient NO ₂	1.29 (0.72, 2.30)	0.399	154
Did you feel wheezy because of your asthma today?			
Personal PM _{2.5}	0.93 (0.46, 1.88)	0.840	92
Traffic-related PM _{2.5}	1.37 (0.74, 2.57)	0.320	151
Traffic-related NO _x	1.17 (0.60, 2.28)	0.653	151
Traffic-related NO ₂	1.16 (0.61, 2.20)	0.661	151
Ambient PM _{2.5}	1.08 (0.45, 2.57)	0.862	154
Ambient O ₃	0.61 (0.32, 1.14)	0.122	154
Ambient NO _x	1.35 (0.63, 2.88)	0.437	153
Ambient NO	1.33 (0.57, 3.11)	0.513	153
Ambient NO ₂	1.33 (0.64, 2.75)	0.444	154
Did you have trouble breathing because of your asthma today?			
Personal PM _{2.5}	0.88 (0.44, 1.75)	0.720	92
Traffic-related PM _{2.5}	0.85 (0.53, 1.36)	0.490	151
Traffic-related NO _x	0.73 (0.42, 1.27)	0.261	151
Traffic-related NO ₂	0.73 (0.43, 1.25)	0.252	151
Ambient PM _{2.5}	1.00 (0.55, 1.81)	0.999	154
Ambient O ₃	0.96 (0.61, 1.52)	0.875	154
Ambient NO _x	1.10 (0.58, 2.11)	0.763	153
Ambient NO	0.87 (0.40, 1.88)	0.730	153
Ambient NO ₂	1.22 (0.66, 2.24)	0.529	154
Did you cough because of your asthma today?			
Personal PM _{2.5}	1.17 (0.68, 2.01)	0.581	92
Traffic-related PM _{2.5}	1.45 (0.84, 2.48)	0.181	151
Traffic-related NO _x	1.26 (0.74, 2.16)	0.402	151
Traffic-related NO ₂	1.34 (0.80, 2.27)	0.271	151
Ambient PM _{2.5}	0.87 (0.47, 1.61)	0.654	154
Ambient O ₃	0.66 (0.40, 1.09)	0.106	154
Ambient NO _x	1.44 (0.75, 2.76)	0.273	153
Ambient NO	1.46 (0.71, 3.03)	0.309	153
Ambient NO ₂	1.37 (0.74, 2.55)	0.318	154
How much of a problem was your asthma when you ran, exercise or play sports today?			
Personal PM _{2.5}	0.66 (0.04, 10.20)	0.767	49
Traffic-related PM _{2.5}	1.36 (0.76, 2.45)	0.302	83
Traffic-related NO _x	1.34 (0.70, 2.58)	0.383	83
Traffic-related NO ₂	1.23 (0.68, 2.24)	0.499	83
Ambient PM _{2.5}	1.11 (0.52, 2.39)	0.782	84
Ambient O ₃	1.23 (0.62, 2.43)	0.558	84
Ambient NO _x	1.15 (0.52, 2.54)	0.731	84
Ambient NO	1.15 (0.50, 2.67)	0.746	84
Ambient NO ₂	1.16 (0.53, 2.53)	0.718	84
Did you feel scared that you might have trouble breathing because of your asthma today?			
Personal PM _{2.5}	1.36 (0.70, 2.66)	0.365	85

Traffic-related PM _{2.5}	1.83 (1.03, 3.24)	0.042	138
Traffic-related NO _x	1.38 (0.88, 2.15)	0.163	138
Traffic-related NO ₂	1.31 (0.86, 2.00)	0.206	138
Ambient PM _{2.5}	0.76 (0.33, 1.72)	0.507	140
Ambient O ₃	1.02 (0.56, 1.84)	0.961	140
Ambient NO _x	1.74 (0.77, 3.92)	0.184	140
Ambient NO	1.35 (0.55, 3.32)	0.512	140
Ambient NO ₂	1.88 (0.85, 4.19)	0.124	140
Have you avoided strenuous activities, or had to slow down or stop exercising because of your asthma today?			
Personal PM _{2.5}	0.71 (0.18, 2.84)	0.635	85
Traffic-related PM _{2.5}	1.12 (0.66, 1.88)	0.680	138
Traffic-related NO _x	0.98 (0.56, 1.71)	0.938	138
Traffic-related NO ₂	0.96 (0.55, 1.67)	0.880	138
Ambient PM _{2.5}	0.67 (0.33, 1.36)	0.271	140
Ambient O ₃	1.00 (0.60, 1.67)	0.986	140
Ambient NO _x	0.78 (0.38, 1.58)	0.485	140
Ambient NO	0.86 (0.37, 2.01)	0.733	140
Ambient NO ₂	0.76 (0.39, 1.49)	0.424	140

*Effect estimates were scaled to a standard deviation change in pollutant concentrations as follows: personal PM_{2.5}: 9.1 µg/m³; Traffic-related PM_{2.5}: 0.7 µg/m³; Traffic-related NO_x: 14.7 ppb; Traffic-related NO₂: 7.1 ppb; Ambient PM_{2.5}: 3.7 µg/m³; Ambient O₃: 9.2 ppb; Ambient NO_x: 6.1 ppb; Ambient NO: 2.4 ppb; Ambient NO₂: 4.6 ppb;

Supplement Table S10. Associations between same-day (lag 0) personal PM_{2.5} and ambient O₃ in models adjusted for personal relative humidity, Hispanic ethnicity, Parental asthma status, and Caretaker education (fully adjusted) versus models adjusted for personal relative humidity and Hispanic ethnicity (final models as presented in main analysis). Effects are on original scale per unit change in pollutant, for morning FEV₁ lung function, chest feeling tight symptom, and rescue inhaler use outcomes to demonstrate the impact of adjustments on final reported effects.

A. Morning FEV₁

Variables	Fully Adjusted Model		Final Model	
	Estimate	95% CI	Estimate	95% CI
Personal PM _{2.5}	0.284	[0.070, 0.638]	0.319	[0.026, 0.665]
Relative Humidity	0.382	[-0.439, 1.203]	0.089	[-0.581, 0.760]
Hispanic Ethnicity (No)	33.5	[-23.0, 90.0]	17.1	[-7.1, 41.2]
Hispanic Ethnicity (Yes)	22.2	[-30.9, 75.3]	2.3	[-21.2, 25.9]
Hispanic Ethnicity (missing)	Reference			
Parent Asthma Status (No)	-33.2	[-80.8, 14.4]		
Parent Asthma Status (Yes)	-44.7	[-94.4, 5.1]		
Parent Asthma Status (missing)	Reference			
Caretaker education (College)	7.8	[-19.0, 34.6]		
Caretaker education (Don't know)	-4.3	[-82.3, 74.7]		
Caretaker education (Graduate School)	8.3	[-12.2, 28.7]		
Caretaker education (High School or GED)	23.0	[-27.7, 73.7]		
Caretaker education (Some college)	Reference			
Ambient O ₃	-0.469	[-0.777, -0.161]	-0.448	[-0.750, -0.145]
Relative Humidity	0.201	[-0.493, 0.895]	0.130	[-0.447, 0.708]
Hispanic Ethnicity (No)	28.5	[-21.4, 78.4]	21.9	[0.1, 43.6]
Hispanic Ethnicity (Yes)	17.1	[-29.7, 63.9]	7.2	[-13.9, 28.3]
Hispanic Ethnicity (missing)	Reference			
Parent Asthma Status (No)	-6.5	[-39.3, 26.4]		
Parent Asthma Status (Yes)	-16.8	[-51.5, 18.0]		
Parent Asthma Status (missing)	Reference			
Caretaker education (College)	7.8	[-12.9, 28.6]		
Caretaker education (Don't know)	15.1	[-51.6, 81.9]		
Caretaker education (Graduate School)	11.5	[-6.1, 29.1]		
Caretaker education (High School or GED)	12.8	[-30.3, 55.9]		
Caretaker education (Some college)	Reference			

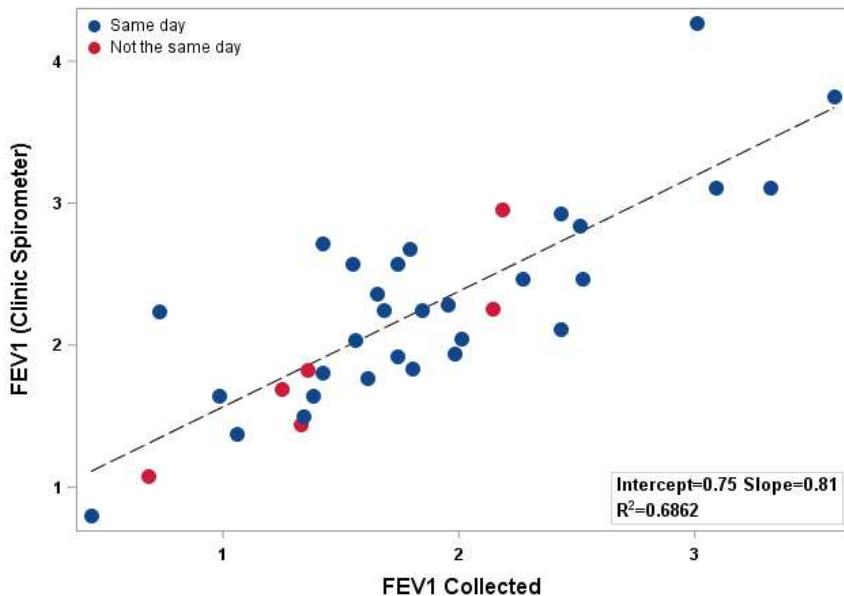
B. Chest Feels Tight because of Asthma Symptom

Variables	Fully Adjusted Model		Final Model	
	Estimate	95% CI	Estimate	95% CI
Personal PM _{2.5}		Model did not converge	-0.008	[-0.036, 0.019]
Relative Humidity			0.042	[-0.062, 0.145]
Hispanic Ethnicity (No)			2.4	[-1.8, 6.6]
Hispanic Ethnicity (Yes)			0.8	[-3.5, 5.0]
Hispanic Ethnicity (missing)			Reference	
Parent Asthma Status (No)				
Parent Asthma Status (Yes)				
Parent Asthma Status (missing)				
Caretaker education (College)				
Caretaker education (Don't know)				
Caretaker education (Graduate School)				
Caretaker education (High School or GED)				
Caretaker education (Some college)				
Ambient O ₃	-0.021	[-0.071, 0.028]	-0.022	[-0.068, 0.024]
Relative Humidity	0.032	[-0.070, 0.135]	0.019	[-0.069, 0.108]
Hispanic Ethnicity (No)	2.2	[-3.0, 7.4]	0.9	[-2.1, 3.9]
Hispanic Ethnicity (Yes)	0.7	[-4.6, 6.0]	-0.3	[-3.3, 2.8]
Hispanic Ethnicity (missing)	Reference			
Parent Asthma Status (No)	-0.784	[-5.834, 4.266]		
Parent Asthma Status (Yes)	-1.734	[-6.633, 3.164]		
Parent Asthma Status (missing)	Reference			
Caretaker education (College)	0.033	[-3.975, 4.042]		
Caretaker education (Don't know)	0.766	[-4.860, 6.392]		
Caretaker education (Graduate School)	-0.086	[-3.752, 3.578]		
Caretaker education (High School or GED)	2.088	[-2.883, 7.060]		
Caretaker education (Some college)	Reference			

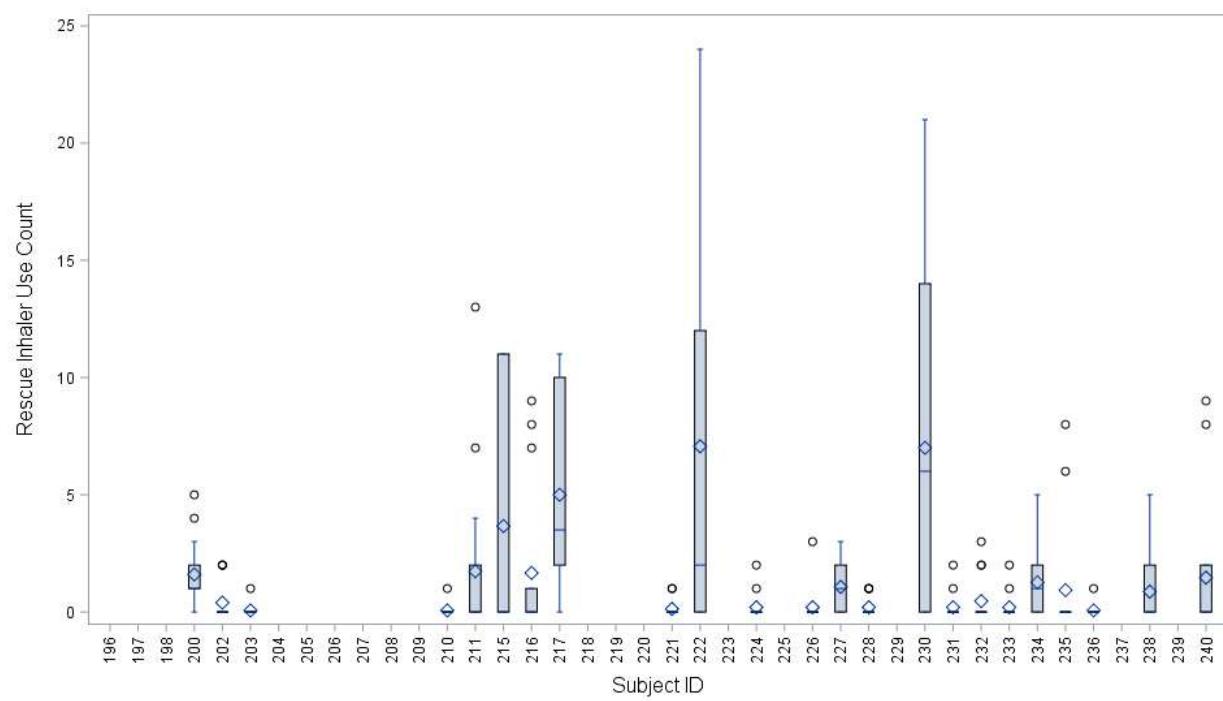
C. Rescue Inhaler Use

Variables	Fully Adjusted Model		Final Model	
	Estimate	95% CI	Estimate	95% CI
Personal PM _{2.5}	0.002	[-0.021, 0.026]	0.005	[-0.012, 0.022]
Relative Humidity	-0.022	[-0.141, 0.095]	0.001	[-0.095, 0.096]
Hispanic Ethnicity (No)	2.2	[-4.7, 9.0]	1.3	[-2.2, 4.7]
Hispanic Ethnicity (Yes)	-0.4	[-8.0, 7.1]	-0.4	[-3.9, 3.1]
Hispanic Ethnicity (missing)	Reference			
Parent Asthma Status (No)	-0.667	[-6.372, 5.039]		
Parent Asthma Status (Yes)	-0.775	[-7.100, 5.551]		
Parent Asthma Status (missing)	Reference			
Caretaker education (College)	2.648	[-3.050, 8.347]		
Caretaker education (Don't know)	2.217	[-5.202, 9.637]		
Caretaker education (Graduate School)	0.984	[-4.592, 6.561]		
Caretaker education (High School or GED)	2.054	[-8.220, 12.328]		
Caretaker education (Some college)	Reference			
Ambient O ₃	-0.002	[-0.020, 0.016]	-0.001	[-0.019, 0.017]
Relative Humidity	0.001	[-0.055, 0.056]	0.001	[-0.051, 0.053]
Hispanic Ethnicity (No)	1.7	[-2.1, 5.4]	0.2	[-2.2, 2.6]
Hispanic Ethnicity (Yes)	0.3	[-3.5, 4.1]	-2.0	[-4.4, 0.4]
Hispanic Ethnicity (missing)	Reference			
Parent Asthma Status (No)	-2.735	[-5.948, 0.476]		
Parent Asthma Status (Yes)	-2.142	[-5.717, 1.432]		
Parent Asthma Status (missing)	Reference			
Caretaker education (College)	1.095	[-1.481, 3.671]		
Caretaker education (Don't know)	1.671	[-2.392, 5.732]		
Caretaker education (Graduate School)	1.081	[-1.895, 4.058]		
Caretaker education (High School or GED)	1.308	[-3.996, 6.612]		
Caretaker education (Some college)	Reference			

Supplement Figure S1. Comparison between forced expiratory volume in one second (FEV₁) collected at recruitment with the Asma-1 BT sensor used in the BREATHE Kit and the clinic spirometer tested FEV₁ on same or closest previous day to recruitment (units of L/s).

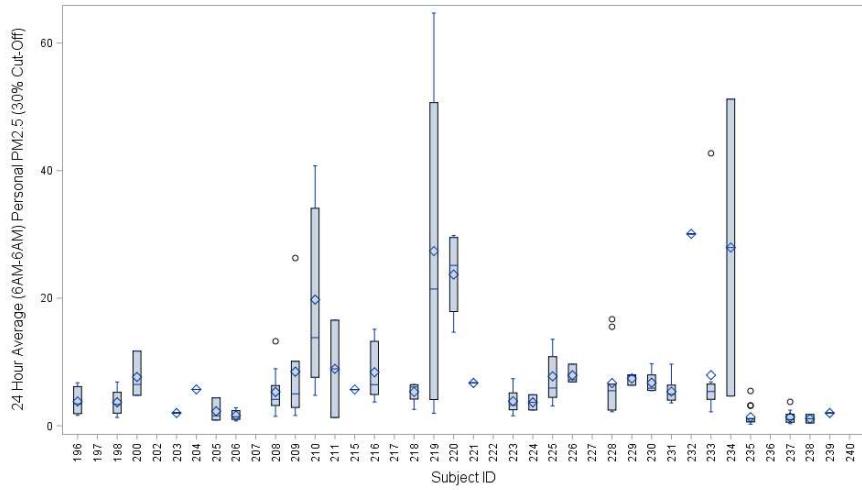


Supplement Figure S2. Rescue inhaler use daily count distribution across all subjects.

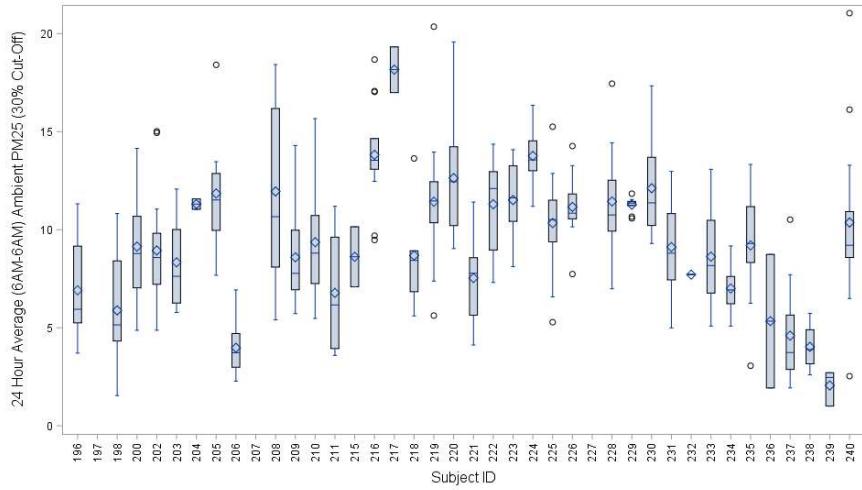


Supplement Figure S3. Distribution of daily average personal (measured), ambient (modeled) and traffic-related (modeled) PM_{2.5} exposures in $\mu\text{g}/\text{m}^3$ across all subjects.

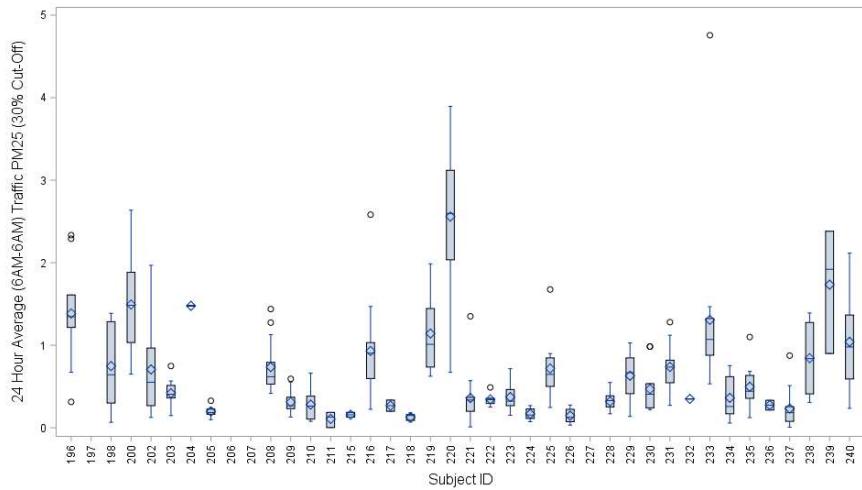
Personal



Ambient



Traffic-related



Supplement Figure S4. Results of single- and two-pollutant models (rate ratio and 95% CI per standard deviation increase in exposure) for daily count of rescue inhaler use in relation to traffic-related PM_{2.5}, NO, and NO_x exposure in the last 24 hours (lag 0).

