

**Supplemental Material Table 1a Overview of final models by blood marker, all cities combined – The AIRGENE Study**

	Time-invariant variables
IL-6	City, age, alcohol intake, BMI, log(NT-proBNP), HDL cholesterol, number of myocardial infarctions, packyears of smoking, smoking status, systolic blood pressure, COPD, heart failure, pacemaker, HbA1c, arrhythmia,
Fibrinogen	City, sex, age, asthma, BMI, NT-proBNP, packyears of smoking, ratio HDL/ total cholesterol, HbA1c, stroke, arrhythmia, arthrosis, health status
CRP	City, age, sex, HbA1c, health status, BMI, log(NT-proBNP), cholesterol, chronic bronchitis, packyears of smoking, systolic blood pressure, number of myocardial infarctions, COPD, hypertension

**Supplemental Material Table 1b Overview of final models by blood marker and city – The AIRGENE Study**

	Meteorology / time-dependent variables	Time-invariant variables
IL-6		
Athens	trend, apparent temperature (mean of lags 2 to 3), relative humidity (lag 0)	arrhythmias, BMI, congestive heart failure, number of MI
Augsburg	trend, apparent temperature (mean of 0 to 3 day lags)	age, alcohol intake, BMI, log(NT-proBNP), congestive heart failure, HDL cholesterol, packyears of smoking
Barcelona	trend, apparent temperature (mean of lags 0 to 1), relative humidity (mean of 0 to 3 day lags)	age, alcohol intake, BMI, log(NT-proBNP), HDL cholesterol, number of myocardial infarctions, packyears of smoking, smoking status, systolic blood pressure
Helsinki	trend, apparent temperature (lag 0), hour of visit	age, arrhythmias, BMI, log(NT-proBNP), congestive heart failure, packyears of smoking, “uncontrolled” diabetes
Rome	trend, apparent temperature (lag 0), relative humidity (lag 0)	age, BMI, chronic bronchitis, hour of visit, packyears of smoking, systolic blood pressure, “uncontrolled” diabetes
Stockholm	trend, apparent temperature (mean of lag 0 and 1)	BMI, log(NT-proBNP), chronic bronchitis, HDL cholesterol, number of MI
Fibrinogen		
Augsburg	trend, apparent temperature (lag 0), relative humidity (mean of lags 0 to 3), hour of visit	age, BMI, NT-proBNP, packyears of smoking, ratio HDL/total cholesterol, sex
Barcelona	trend, apparent temperature (mean of lags 0 to 1), weekday	age, asthma,
Helsinki	trend, apparent temperature (mean of lags 0 to 1), relative humidity (mean of lags 0 to 1), hour of visit	age, asthma, BMI, NT-proBNP, packyears of smoking, ratio HDL/ total cholesterol, sex
Rome	trend, apparent temperature (mean of lags 0 to 3)	age, arthrosis, BMI, ratio HDL/ total cholesterol, sex, HbA1c, NT-proBNP, sex, stroke
Stockholm	trend, apparent temperature (mean of lags 0 to 3), weekday	age, BMI, NT-proBNP, packyears of smoking, ratio HDL/ total cholesterol, sex, HbA1c, arthrosis
CRP		
Athens	trend, apparent temperature (mean of lags 0 to 1), hour of visit	BMI, log(NT-proBNP), systolic blood pressure, „uncontrolled” diabetes
Augsburg	trend, apparent temperature (lag 0), relative humidity (mean of lags 0 to 1), hour of visit	BMI, log(NT-proBNP), cholesterol, chronic bronchitis, packyears of smoking
Barcelona	trend, apparent temperature (mean of lags 0 to 1)	BMI, log(NT-proBNP), chronic bronchitis, cholesterol, packyears of smoking
Helsinki	trend, apparent temperature (mean of lags 0 to 1)	age, BMI, hypertension, packyears of smoking, sex, systolic blood pressure, “uncontrolled” diabetes
Rome	trend, apparent temperature (mean of lags 0 to 3)	BMI, log(NT-proBNP), cholesterol
Stockholm	trend, apparent temperature (mean of lags 0 to 1)	age, BMI, log(NT-proBNP), cholesterol, packyears of smoking, sex, „uncontrolled” diabetes

### **Supplemental Material: Treatment of missing air pollution data in AIRGENE:**

- Valid data over 24h are those with at least 75% of the observations; for 8h values, at least 6 hours are requested; to calculate the maximum 8h moving average, at least 75% of the eight hour moving average values on that day have to be available.
- An improved formula over the APHEA method to replace missing values on the aggregate level is used:

A missing value on day  $i$  from monitor  $j$  is replaced by the period average of monitor  $j$  plus a standardized value of day  $i$  over all monitors multiplied by the period standard deviation of monitor  $j$ . This can be written as follows:

$$\hat{x}_{ij} = \bar{x}_{\cdot j} + \bar{z}_{i \cdot} s_{\cdot j}$$

where

$$\bar{z}_{i \cdot} = \frac{\sum_{j=1}^n \left( \frac{x_{ij} - \bar{x}_{\cdot j}}{s_{\cdot j}} \right)}{n}$$

In this manner we achieve estimates that consider not only differences in mean values, but also differences in variability between monitors.

- If all monitors are missing for one day, the averages from the day before and after will be taken. Longer periods of completely missing data will not be predicted. Prediction of missing data will be done in each centre.

**Supplemental Material Table 2a. Description of Air Pollution and Meteorology by City – The AIRGENE Study**

	Days, No.	Sites, No.	Mean	5th	25th	75th	95th
Helsinki (05/09/03 to 02/06/04)							
Particle number concentr. (PNC) [1/cm <sup>3</sup> ]	270	1	8534	3306	5834	10519	15077
PM <sub>2.5</sub> [µg/m <sup>3</sup> ]	270	1	8.2	2.8	4.7	10.3	19.4
PM <sub>10</sub> [µg/m <sup>3</sup> ]	268	2	17.1	6.1	10.5	20.7	36.1
CO [mg/m <sup>3</sup> ]	270	1	0.31	0.22	0.26	0.34	0.46
NO <sub>2</sub> [µg/m <sup>3</sup> ]	272	2	28.6	13.1	20.5	34.6	49.8
NO [µg/m <sup>3</sup> ]	272	2	12.5	1.8	4.5	14.3	40.7
SO <sub>2</sub> [µg/m <sup>3</sup> ]	259	1	4.2	0.4	1.9	5.9	10.1
O <sub>3</sub> (8h average) [µg/m <sup>3</sup> ]	272	2	46.8	10.4	26.1	66.4	89.0
Air temperat. (temp) [°C]	272	1	3.1	-7.6	-1.9	8.3	14.7
Relative humidity (rh) [%]	272	1	76	46	69	85	91
Apparent temp. (at) [°C]	272	1	0.4	-10.4	-4.6	5.7	12.1
Black Carbon	187	1	1.3	0.4	0.9	1.7	2.3
Stockholm (30/08/03 to 24/06/04)							
Particle number concentr. (PNC) [1/cm <sup>3</sup> ]	287	2	9748	4918	7247	11625	17578
PM <sub>2.5</sub> [µg/m <sup>3</sup> ]	286	1	8.8	4.6	6.0	10.3	19.1
PM <sub>10</sub> [µg/m <sup>3</sup> ]	286	1	17.8	7.3	11.0	21.7	40.3
CO [mg/m <sup>3</sup> ]	301	2	0.29	0.19	0.25	0.34	0.43
NO <sub>2</sub> [µg/m <sup>3</sup> ]	291	1	18.6	8.3	12.7	23.3	32.6
NO [µg/m <sup>3</sup> ]	291	2	4.9	-0.3	1.4	6.5	15.5
SO <sub>2</sub> [µg/m <sup>3</sup> ]	301	1	1.9	0.4	0.8	2.4	4.9
O <sub>3</sub> (8h average) [µg/m <sup>3</sup> ]	301	3	60.6	26.9	45.0	73.9	96.9
Air temperat. (temp) [°C]	301	1	4.7	-4.9	0.1	9.1	15.1
Relative humidity (rh) [%]	301	1	82	62	75	90	94
Apparent temp. (at) [°C]	301	1	2.6	-6.8	-2.4	7.0	14.2

	Days, No.	Sites, No.	Mean	5th	25th	75th	95th
Augsburg (14/05/03 to 24/02/04)							
Particle number concentr. (PNC) [1/cm <sup>3</sup> ]	198	1	11876	4835	7085	14440	25135
PM <sub>2.5</sub> [µg/m <sup>3</sup> ]	283	1	17.4	8.8	12.2	21.2	29.3
PM <sub>10</sub> [µg/m <sup>3</sup> ]	286	3	33.1	12.8	22.0	42.7	56.6
CO [mg/m <sup>3</sup> ]	287	2	0.58	0.36	0.43	0.66	1.00
NO <sub>2</sub> [µg/m <sup>3</sup> ]	287	3	40.0	24.1	32.7	46.5	61.2
NO [µg/m <sup>3</sup> ]	287	3	30.0	9.7	17.2	32.3	80.4
SO <sub>2</sub> [µg/m <sup>3</sup> ]	287	2	3.0	2.0	2.1	3.3	5.7
O <sub>3</sub> (8h average) [µg/m <sup>3</sup> ]	286	1	54.4	3.3	20.4	82.3	115.3
Air temperat. (temp) [°C]	285	1	10.2	-3.4	1.9	19.6	25.1
Relative humidity (rh) [%]	285	1	69	47	57	80	92
Apparent temp. (at) [°C]	285	1	8.5	-5.2	-0.8	18.0	24.1
Rome (20/09/03 to 15/07/04)							
Particle number concentr. (PNC) [1/cm <sup>3</sup> ]	277	2	35450	13799	21094	46963	69226
PM <sub>2.5</sub> [µg/m <sup>3</sup> ]	242	1	24.5	8.2	14.0	30.7	54.1
PM <sub>10</sub> [µg/m <sup>3</sup> ]	297	4	42.1	21.2	30.6	49.8	76.0
CO [mg/m <sup>3</sup> ]	297	6	1.40	0.78	1.02	1.66	2.47
NO <sub>2</sub> [µg/m <sup>3</sup> ]	297	6	67.0	44.2	56.9	76.3	90.8
NO [µg/m <sup>3</sup> ]	297	5	65.7	21.3	33.6	83.7	164.0
SO <sub>2</sub> [µg/m <sup>3</sup> ]	297	3	4.1	1.1	2.1	5.7	9.2
O <sub>3</sub> (8h average) [µg/m <sup>3</sup> ]	299	2	45.3	6.4	15.6	74.2	99.6
Air temperat. (temp) [°C]	299	1	13.4	3.7	8.8	17.9	23.9
Relative humidity (rh) [%]	299	1	80	56	72	89	95
Apparent temp. (at) [°C]	299	1	12.7	1.4	6.5	17.9	25.9

	Days, No.	Sites, No.	Mean	5th	25th	75th	95th
Barcelona (30/08/03 to 16/06/04)							
Particle number concentr. (PNC) [1/cm <sup>3</sup> ]	245	0	18133	4323	10492	24278	36526
PM <sub>2.5</sub> [µg/m <sup>3</sup> ]	274	1	24.2	6.6	13.5	29.7	62.7
PM <sub>10</sub> [µg/m <sup>3</sup> ]	274	1	40.7	14.3	25.1	49.2	88.7
CO [mg/m <sup>3</sup> ]	293	4	0.59	0.35	0.45	0.70	0.92
NO <sub>2</sub> [µg/m <sup>3</sup> ]	293	3	50.5	22.3	39.3	60.4	79.6
NO [µg/m <sup>3</sup> ]	293	3	37.7	10.7	18.2	51.6	88.4
SO <sub>2</sub> [µg/m <sup>3</sup> ]	293	4	4.7	1.9	3.1	5.5	9.6
O <sub>3</sub> (8h average) [µg/m <sup>3</sup> ]	293	2	28.2	1.4	5.9	45.0	76.5
Air temperat. (temp) [°C]	293	1	15.2	9.1	11.7	18.3	23.2
Relative humidity (rh) [%]	293	1	67	46	60	76	86
Apparent temp. (at) [°C]	293	1	14.1	6.6	9.6	18.1	24.6
Black Smoke [µg/m <sup>3</sup> ]	241	1	21.3	12.2	15.2	25.0	39.2
Athens (08/09/03 to 30/07/04)							
Particle number concentr. (PNC) [1/cm <sup>3</sup> ]	299		20589	7823	11872	26913	47573
PM <sub>2.5</sub> [µg/m <sup>3</sup> ]	306	1	23.0	8.0	14.9	29.1	46.0
PM <sub>10</sub> [µg/m <sup>3</sup> ]	325	4	38.5	17.0	27.1	46.4	64.6
CO [mg/m <sup>3</sup> ]	326	5	1.48	0.71	0.95	1.68	3.23
NO <sub>2</sub> [µg/m <sup>3</sup> ]	326	4	50.1	28.8	41.9	58.6	73.0
NO [µg/m <sup>3</sup> ]	326	4	41.8	8.3	14.1	49.4	144.6
SO <sub>2</sub> [µg/m <sup>3</sup> ]	326	2	10.3	3.5	5.8	12.9	23.2
O <sub>3</sub> (8h average) [µg/m <sup>3</sup> ]	326	6	59.8	22.1	37.5	80.1	100.2
Air temperat. (temp) [°C]	324	1	17.6	6.7	12.4	22.9	29.3
Relative humidity (rh) [%]	327	1	67	49	60	75	84
Apparent temp. (at) [°C]	324	1	15.1	4.0	9.8	20.3	26.8
Black Smoke [µg/m <sup>3</sup> ]	326	2	49.1	16.1	30.9	60.7	102.5

**Supplemental Material Table 2b. Correlations of Air Pollution and Meteorology by City – The AIRGENE Study**

	Correlation with										
Helsinki (05/09/03 to 02/06/04)	PNC	PM <sub>2.5</sub>	PM <sub>10</sub>	CO	NO <sub>2</sub>	NO	SO <sub>2</sub>	O <sub>3</sub>	temp	rh	at
Particle number concentr. (PNC) [1/cm <sup>3</sup> ]	1										
PM <sub>2.5</sub> [µg/m <sup>3</sup> ]	0.37	1									
PM <sub>10</sub> [µg/m <sup>3</sup> ]	0.43	0.72	1								
CO [mg/m <sup>3</sup> ]	0.50	0.53	0.36	1							
NO <sub>2</sub> [µg/m <sup>3</sup> ]	0.75	0.45	0.43	0.71	1						
NO [µg/m <sup>3</sup> ]	0.57	0.15	0.14	0.74	0.72	1					
SO <sub>2</sub> [µg/m <sup>3</sup> ]	0.39	0.37	0.22	0.46	0.51	0.43	1				
O <sub>3</sub> (8h average) [µg/m <sup>3</sup> ]	-0.02	0.05	0.21	-0.52	-0.20	-0.57	-0.26	1			
Air temperat. (temp) [°C]	-0.07	-0.06	0.06	-0.35	-0.21	-0.2	-0.12	0.23	1		
Relative humidity (rh) [%]	-0.20	0.01	-0.38	0.28	-0.08	0.19	-0.08	-0.52	-0.36	1	
Apparent temp. (at) [°C]	-0.07	-0.06	0.06	-0.35	-0.21	-0.2	-0.12	0.23	0.99	-0.36	1
Black Smoke [µg/m <sup>3</sup> ]	0.58	0.73	0.52	0.84	0.83	0.64	0.58	-0.24	-0.18	0.06	-0.18
Stockholm (30/08/03 to 24/06/04)	PNC	PM <sub>2.5</sub>	PM <sub>10</sub>	CO	NO <sub>2</sub>	NO	SO <sub>2</sub>	O <sub>3</sub>	temp	rh	at
Particle number concentr. (PNC) [1/cm <sup>3</sup> ]	1										
PM <sub>2.5</sub> [µg/m <sup>3</sup> ]	-0.15	1									
PM <sub>10</sub> [µg/m <sup>3</sup> ]	-0.13	0.84	1								
CO [mg/m <sup>3</sup> ]	0.16	0.54	0.36	1							
NO <sub>2</sub> [µg/m <sup>3</sup> ]	0.72	0.21	0.18	0.53	1						
NO [µg/m <sup>3</sup> ]	0.44	0.14	0.18	0.39	0.59	1					
SO <sub>2</sub> [µg/m <sup>3</sup> ]	0.30	0.38	0.31	0.31	0.35	0.09	1				
O <sub>3</sub> (8h average) [µg/m <sup>3</sup> ]	-0.35	0.19	0.33	-0.21	-0.35	-0.25	0.13	1			
Air temperat. (temp) [°C]	-0.35	0.12	0.21	-0.20	-0.29	-0.03	-0.39	0.14	1		
Relative humidity (rh) [%]	0.09	-0.01	-0.25	0.40	0.24	0.08	-0.06	-0.60	-0.41	1	
Apparent temp. (at) [°C]	-0.35	0.12	0.21	-0.20	-0.29	-0.03	-0.40	0.14	0.99	-0.40	1

	Correlation with										
	PNC	PM <sub>2.5</sub>	PM <sub>10</sub>	CO	NO <sub>2</sub>	NO	SO <sub>2</sub>	O <sub>3</sub>	temp	rh	at
Augsburg (14/05/03 to 24/02/04)											
Particle number concentr. (PNC) [1/cm <sup>3</sup> ]	1										
PM <sub>2.5</sub> [ $\mu\text{g}/\text{m}^3$ ]	0.35	1									
PM <sub>10</sub> [ $\text{mg}/\text{m}^3$ ]	0.41	0.93	1								
CO [ $\mu\text{g}/\text{m}^3$ ]	0.74	0.58	0.61	1							
NO <sub>2</sub> [ $\mu\text{g}/\text{m}^3$ ]	0.54	0.57	0.66	0.67	1						
NO [ $\mu\text{g}/\text{m}^3$ ]	0.74	0.25	0.35	0.82	0.54	1					
SO <sub>2</sub> [ $\mu\text{g}/\text{m}^3$ ]	0.77	0.42	0.43	0.63	0.51	0.60	1				
O <sub>3</sub> (8h average) [ $\mu\text{g}/\text{m}^3$ ]	-0.67	-0.08	-0.09	-0.66	-0.11	-0.73	-0.45	1			
Air temperat. (temp) [°C]	-0.61	0.12	0.12	-0.42	0.10	-0.50	-0.38	0.80	1		
Relative humidity (rh) [%]	0.23	-0.12	-0.14	0.34	-0.22	0.44	0.11	-0.74	-0.72	1	
Apparent temp. (at) [°C]	-0.61	0.11	0.12	-0.42	0.09	-0.50	-0.39	0.80	0.99	-0.71	1
Rome (20/09/03 to 15/07/04)	PNC	PM <sub>2.5</sub>	PM <sub>10</sub>	CO	NO <sub>2</sub>	NO	SO <sub>2</sub>	O <sub>3</sub>	temp	rh	at
Particle number concentr. (PNC) [1/cm <sup>3</sup> ]	1										
PM <sub>2.5</sub> [ $\mu\text{g}/\text{m}^3$ ]	0.59	1									
PM <sub>10</sub> [ $\mu\text{g}/\text{m}^3$ ]	0.55	0.72	1								
CO [ $\text{mg}/\text{m}^3$ ]	0.86	0.73	0.66	1							
NO <sub>2</sub> [ $\mu\text{g}/\text{m}^3$ ]	0.67	0.70	0.62	0.82	1						
NO [ $\mu\text{g}/\text{m}^3$ ]	0.86	0.67	0.58	0.97	0.79	1					
SO <sub>2</sub> [ $\mu\text{g}/\text{m}^3$ ]	0.71	0.53	0.48	0.66	0.56	0.63	1				
O <sub>3</sub> (8h average) [ $\mu\text{g}/\text{m}^3$ ]	-0.77	-0.38	-0.25	-0.70	-0.43	-0.74	-0.56	1			
Air temperat. (temp) [°C]	-0.57	-0.21	-0.11	-0.42	-0.28	-0.43	-0.57	0.65	1		
Relative humidity (rh) [%]	0.21	0.19	0.17	0.40	0.13	0.37	0.13	-0.47	-0.28	1	
Apparent temp. (at) [°C]	-0.56	-0.20	-0.11	-0.40	-0.28	-0.42	-0.57	0.63	0.99	-0.23	1

	Correlation with										
	PNC	PM <sub>2.5</sub>	PM <sub>10</sub>	CO	NO <sub>2</sub>	NO	SO <sub>2</sub>	O <sub>3</sub>	temp	rh	at
Barcelona (30/08/03 to 16/06/04)											
Particle number concentr. (PNC) [1/cm <sup>3</sup> ]	1										
PM <sub>2.5</sub> [ $\mu\text{g}/\text{m}^3$ ]	-0.10	1									
PM <sub>10</sub> [ $\mu\text{g}/\text{m}^3$ ]	0.04	0.85	1								
CO [mg/m <sup>3</sup> ]	0.66	0.28	0.32	1							
NO <sub>2</sub> [ $\mu\text{g}/\text{m}^3$ ]	0.54	0.21	0.35	0.68	1						
NO [ $\mu\text{g}/\text{m}^3$ ]	0.71	0.29	0.36	0.82	0.72	1					
SO <sub>2</sub> [ $\mu\text{g}/\text{m}^3$ ]	0.32	0.33	0.47	0.41	0.54	0.70	1				
O <sub>3</sub> (8h average) [ $\mu\text{g}/\text{m}^3$ ]	-0.70	-0.10	-0.09	-0.66	-0.44	-0.74	-0.35	1			
Air temperat. (temp) [°C]	-0.26	-0.02	0.10	-0.02	0.06	-0.28	-0.28	0.49	1		
Relative humidity (rh) [%]	-0.38	0.46	0.16	0.12	-0.09	-0.03	-0.20	-0.06	0.05	1	
Apparent temp. (at) [°C]	-0.30	0.02	0.12	-0.01	0.06	-0.29	-0.30	0.48	0.99	0.15	1
Black Smoke											
Athens (08/09/03 to 30/07/04)	PNC	PM <sub>2.5</sub>	PM <sub>10</sub>	CO	NO <sub>2</sub>	NO	SO <sub>2</sub>	O <sub>3</sub>	temp	rh	at
Particle number concentr. (PNC) [1/cm <sup>3</sup> ]	1										
PM <sub>2.5</sub> [ $\mu\text{g}/\text{m}^3$ ]	0.27	1									
PM <sub>10</sub> [ $\mu\text{g}/\text{m}^3$ ]	0.19	0.65	1								
CO [mg/m <sup>3</sup> ]	0.25	0.38	0.28	1							
NO <sub>2</sub> [ $\mu\text{g}/\text{m}^3$ ]	0.53	0.41	0.50	0.61	1						
NO [ $\mu\text{g}/\text{m}^3$ ]	0.30	0.32	0.22	0.94	0.60	1					
SO <sub>2</sub> [ $\mu\text{g}/\text{m}^3$ ]	0.65	0.33	0.27	0.36	0.57	0.41	1				
O <sub>3</sub> (8h average) [ $\mu\text{g}/\text{m}^3$ ]	-0.01	-0.21	0.05	-0.67	-0.05	-0.64	-0.06	1			
Air temperat. (temp) [°C]	-0.35	-0.01	0.41	-0.25	0.11	-0.32	-0.31	0.57	1		
Relative humidity (rh) [%]	0.23	0.09	-0.07	0.38	0.07	0.39	0.04	-0.53	-0.47	1	
Apparent temp. (at) [°C]	-0.35	-0.005	0.41	-0.25	0.11	-0.32	-0.31	0.57	0.99	-0.47	1
Black Smoke	0.33	0.39	0.33	0.77	0.59	0.75	0.46	-0.48	-0.25	0.41	-0.25







