



APPENDIX AVAILABLE ON REQUEST

Research Report 97

Identifying Subgroups of the General Population That May Be Susceptible to Short-Term Increases in Particulate Air Pollution: A Time-Series Study in Montreal, Quebec

Appendix L. Adequacy of Smoothing and Sensitivity Analyses

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Although this document was produced with partial funding by the United States Environmental Protection Agency under Assistance Award R824835 to the Health Effects Institute, it has not been subjected to the Agency's peer and administrative review and therefore may not necessarily reflect the views of the Agency, and no official endorsement by it should be inferred. The contents of this document also have not been reviewed by private party institutions, including those that support the Health Effects Institute; therefore, it may not reflect the views or policies of these parties, and no endorsement by them should be inferred.

This document was reviewed by the HEI Health Review Committee
but did not undergo the HEI scientific editing and production process.

Table L.1. Adequacy of a Linear Term to Represent Particulate Exposure as Compared to the LOESS Smooth

Cause of death	P-values from an approximate F- test that the non-linear component of the LOESS smooth for the particulate measure improves the fit over a simple linear parametric term (lag 0):									
	COH	TSP	Extinction	PM ₁₀	PM _{2.5}	Predicted PM _{2.5}	Sulfate from Sutton	Sulfate from PM _{2.5}	Predicted sulfate from PM _{2.5}	
Nonaccidental deaths	0.46	0.43	0.27	0.56	0.16	0.12	0.16	0.31	0.25	
Neoplasms	0.24	0.95	0.13	0.69	0.19	0.14	0.03	0.71	0.47	
Lung cancer	0.30	0.28	0.33	0.79	0.33	0.08	0.02	0.26	0.05	
Cardiovascular diseases	0.94	0.46	0.13	0.01	0.51	0.41	0.24	0.11	0.64	
Coronary artery disease	0.36	0.72	0.25	0.57	0.56	0.26	0.59	0.12	0.60	
Respiratory diseases	0.30	0.37	0.04	0.10	0.04	0.05	0.37	0.02	0.13	
Digestive diseases	0.34	0.36	0.46	N/C	0.38	0.50	0.86	0.63	0.92	
Accidents	0.40	0.30	0.49	0.03	N/C	0.60	0.48	0.02	0.76	
Other nonaccidental causes	0.59	0.10	0.31	0.50	0.10	0.64	0.52	0.86	0.89	
AIDS	0.00	0.25	0.00	N/C	N/C	0.18	0.53	N/C	0.42	
Diabetes	0.72	0.18	0.49	N/C	N/C	0.48	0.32	N/C	0.60	
Renal diseases	0.89	1.00	0.25	0.05	0.09	0.77	0.79	0.87	0.41	
Neurological diseases	1.00	0.15	0.32	N/C	0.31	0.35	0.90	N/C	0.87	

N/C, convergence of model not obtained.

Table L.2. Adequacy of a Linear Term to Represent Particulate Exposure as Compared to the LOESS Smooth

Cause of death	P-values from an approximate F- test that the non-linear component of the LOESS smooth for the particulate measure improves the fit over a simple linear parametric term (lag 1):									
	COH	TSP	Extinction	PM ₁₀	PM _{2.5}	Predicted PM _{2.5}	Sulfate from Sutton	Sulfate from PM _{2.5}	Predicted sulfate from PM _{2.5}	
Nonaccidental deaths	0.26	0.36	0.28	0.55	0.40	0.04	0.66	0.79	0.28	
Neoplasms	0.67	0.38	0.25	0.23	0.07	0.66	0.30	0.18	0.52	
Lung cancer	0.16	0.55	0.26	N/C	0.40	0.26	0.36	0.76	0.60	
Cardiovascular diseases	0.69	0.23	0.77	0.66	0.21	0.40	0.90	0.02	0.47	
Coronary artery disease	0.00	0.26	0.31	0.26	0.11	0.35	0.54	0.03	0.13	
Respiratory diseases	0.00	0.07	0.00	0.11	0.33	0.30	0.47	0.30	0.64	
Digestive diseases	0.63	0.14	0.27	0.57	N/C	0.44	0.25	N/C	0.63	
Accidents	0.38	0.59	0.64	N/C	N/C	0.89	0.22	N/C	0.58	
Other nonaccidental causes	0.71	0.11	0.57	0.41	0.57	0.44	0.27	0.67	0.32	
AIDS	0.18	0.28	0.05	N/C	N/C	0.39	0.30	0.24	0.73	
Diabetes	0.22	0.28	0.71	0.20	0.33	0.10	0.39	0.85	0.38	
Renal diseases	0.33	0.08	0.53	0.21	0.53	0.78	0.01	N/C	0.14	
Neurological diseases	0.67	0.50	0.35	0.31	N/C	0.84	0.91	N/C	0.42	

N/C, convergence of model not obtained.

Table L.3. Adequacy of a Linear Term to Represent Particulate Exposure as Compared to the LOESS Smooth

P-values from an approximate F - test that the non-linear component of the LOESS smooth for the particulate measure improves the fit over a simple linear parametric term (3-day mean):

Cause of death	COH	Extinction	Predicted		Predicted sulfate	
			PM _{2.5}	Sulfate from Sutton	from PM _{2.5}	
Nonaccidental deaths	0.02	0.01	0.03	0.71	0.12	
Neoplasms	0.23	0.19	0.39	0.11	0.41	
Lung cancer	0.58	0.03	0.13	0.30	0.17	
Cardiovascular diseases	0.50	0.05	0.60	0.13	0.65	
Coronary artery disease	0.05	0.76	0.88	0.16	0.08	
Respiratory diseases	0.51	0.42	0.23	0.12	0.06	
Digestive diseases	0.43	0.54	0.46	0.78	0.62	
Accidents	0.51	0.30	0.18	0.66	0.35	
Other nonaccidental causes	0.27	0.22	0.04	0.17	0.03	
AIDS	0.00	0.13	0.57	0.15	0.30	
Diabetes	0.59	0.79	0.21	0.55	0.72	
Renal diseases	0.38	0.17	0.16	0.06	0.25	
Neurological diseases	0.80	0.53	0.51	0.08	0.23	

N/E, not estimated.

Table L.4. Sensitivity Analyses: Effect of Different Temporal Filters (Loess(days,span=x)) on the Estimates of Excess Relative Risk across the Interquartile Range at Lag 0, Montreal, 1984-1993^a

Cause of death	COH			PM _{2.5}			Sulfate from Sutton		
	31day	91 day	151 day	31 day	91 day	151 day	31 day	91 day	151 day
Nonaccidental deaths	1.19*	1.44*	1.57*	1.37	0.77	0.89	0.63*	0.71*	0.85*
Neoplasms	1.33*	1.26*	1.15	4.00*	0.75	1.12	1.11*	1.01*	0.88*
Lung cancer	2.56*	2.30*	2.46*	N/C	4.23	2.77	0.89	0.30	0.34
Cardiovascular diseases	0.62	0.73	1.01	0.28	0.69	0.22	0.27	0.41	0.72
Coronary artery disease	0.91	1.48*	1.28	1.00	0.86	0.85	0.62	0.64	0.85
Respiratory diseases	3.31*	3.46*	3.92*	0.29	1.96	-0.02	0.58	0.87	1.32
Digestive diseases	1.16	0.01	0.10	N/C	4.47	4.50	3.48*	2.87*	3.00*
Accidents	0.44	1.49	1.05	-10.10*	-3.65	N/C	0.80	1.26	1.02
Other nonaccidental causes	3.26*	3.35*	3.50*	0.10	-0.39	N/C	0.70	0.69	0.65
AIDS	8.26*	9.21*	9.56*	N/C	N/C	N/C	1.38	0.53	0.02
Diabetes	4.03	4.31*	4.21*	N/C	10.45*	N/C	3.03*	3.20*	3.06*
Renal diseases	0.69	2.03	2.32	N/C	N/C	6.90	-0.95	0.35	0.35
Neurological conditions	3.21	2.73	2.79	N/C	N/C	-2.51	-0.89	-1.49	-0.61

^a Numbers in bold refer to the primary analyses. N/C, convergence of model not obtained.

* indicates a corrected t-value > 1.96.

Table L.5. Sensitivity Analyses: Effect of Different Meteorological Variables on the Estimates of Excess Relative Risk across the Interquartile Range at Lag 0, Montreal, 1984-1993

Cause of death	COH			PM _{2.5}			Sulfate from Sutton (1986-93)		
	Primary analysis	Single variable	None	Primary analysis	Single variable	None	Primary analysis	Single variable	None
Nonaccidental deaths	1.44*	1.46*	1.50*	0.77	0.75	1.83*	0.71*	0.93*	1.29*
Neoplasms	1.15	1.24*	1.40*	1.12	0.92	2.61	0.88*	1.09*	1.53*
Lung	2.46*	2.89*	2.79*	2.77	5.98*	5.26	0.34	1.37	1.24
Cardiovascular diseases	0.73	0.83	0.87	0.69	0.85	1.18*	0.41	0.88*	1.07*
Coronary arterydisease	1.28	1.17	1.06	0.85	0.90	1.37	0.85	0.66	0.73
Respiratory diseases	3.46*	3.79*	3.50*	1.96	1.74	0.88	0.87	1.07	1.39
Digestive diseases	0.10	0.19	0.39	4.50	5.11	5.33	3.00*	3.05*	2.60*
Accidents	1.05	2.23	2.36	N/C	-2.99	-2.96	1.02	1.67	1.73
Other nonaccidental causes	3.35*	3.12*	3.16*	-0.39	-0.73	1.82*	0.69	0.69	0.94
AIDS	9.56*	10.36*	9.46*	N/C	N/C	N/C	0.02	0.51	0.38
Diabetes	4.21*	3.86	4.56*	N/C	N/C	9.59*	3.06*	2.93*	2.91*
Renal diseases	2.32	2.26	2.08	6.90	5.90	N/C	0.35	0.25	0.10
Neurological conditions	2.79	2.68	3.16	-2.51	-2.75	-1.56	-0.61	-0.65	-0.48

* indicates a corrected t-value > 1.96. N/C, convergence of model not obtained.

Table L.6. Sensitivity Analyses: Effect of Different Gaseous Pollutants on the Estimates of Excess Relative Risk across the Interquartile Range of COH at Lag 0, Montreal, 1984-1993

Cause of death	Primary analysis (M ₁)	M ₂ =	M ₃ =	M ₄ =	M ₅ =	M ₆ =	M ₇ =	Model with the minimum AIC
		M ₁ + lo(SO ₂)	M ₁ + lo(CO)	M ₁ + lo(NO ₂)	M ₁ + lo(NO)	M ₁ + lo(O ₃)	lo(SO ₂) + lo(CO) + lo(N O ₂) + lo(NO) + lo(O ₃)	
Nonaccidental deaths	1.44*	1.11*	1.48*	1.31*	2.05*	1.66*	1.64*	M ₁
Neoplasms	1.15	0.50	1.10	1.10	2.40*	1.67*	1.70	M ₂
Lung cancer	2.46*	0.55	2.18	3.65*	2.86	2.37*	2.09	M ₂
Cardiovascular diseases	0.73	0.60	1.41	0.87	0.58	0.97	1.07	M ₁
Coronary artery disease	1.28	0.78	2.62*	1.43	1.58	1.73*	1.91	M ₁
Respiratory diseases	3.46*	3.09*	1.76	2.34	5.57*	2.42*	2.30	M ₁
Digestive diseases	0.10	-0.15	-1.60	-2.71	-0.77	0.27	-3.70	M ₄
Accidents	1.05	2.05	1.03	0.42	0.93	1.87	1.97	M ₆
Other nonaccidental causes	3.35*	2.61*	3.17*	4.18*	6.20*	3.15*	4.99*	M ₅
AIDS	9.56*	9.69*	4.51	13.47*	11.10*	11.67*	12.59*	M ₇
Diabetes	4.21*	2.56	2.24	3.13	8.27*	5.01*	3.75	M ₁
Renal diseases	2.32	-2.00	4.54	-0.37	2.92	2.06	-0.56	M ₂
Neurological conditions	2.79	3.58	2.70	5.65*	4.59	1.06	4.71	M ₁

* indicates a corrected t-value > 1.96. N/C, convergence of model not obtained.

Table L.7. Sensitivity Analyses: Effect of Different Gaseous Pollutants on the Estimates of Excess Relative Risk across the Interquartile Range of Lagged Exposure to Sulfate measured at the Sutton Acid Rain Monitoring Station at Lag 0, Montreal, 1984-1993

Cause of death	Primary analysis (M ₁)	M ₂ = M ₁ +lo(SO ₂)	M ₃ = M ₁ +lo(CO)	M ₄ = M ₁ +lo(NO ₂)	M ₅ = M ₁ +lo(NO)	M ₆ = M ₁ +lo(O ₃)	M ₇ = M ₁ + lo(SO ₂)+ lo(CO)+lo(N O ₂)+lo(NO) +lo(O ₃)		Model with the minimum AIC
							0.25	0.36	
Nonaccidental deaths	0.71*	0.61*	0.57*	0.58*	0.69*	0.40	0.25	M ₃	
Neoplasms	0.88*	0.71	0.74	0.92*	0.90*	0.63	0.36	M ₃	
Lung cancer	0.34	-0.37	0.10	0.21	0.31	-0.29	-0.74	M ₂	
Cardiovascular diseases	0.41	0.38	0.45	0.39	0.43	0.15	0.29	M ₁	
Coronary artery disease	0.85	0.85	1.02*	0.86	0.81	0.29	0.41	M ₁	
Respiratory diseases	0.87	0.53	0.50	0.43	0.80	-0.58	-1.07	M ₆	
Digestive diseases	3.00*	2.77*	2.89*	2.21	3.14*	2.55*	1.90	M ₄	
Accidents	1.02	1.16	1.03	1.11	1.27	1.02	1.16	M ₆	
Other nonaccidental causes	0.69	0.35	0.21	0.27	0.59	0.17	-0.38	M ₃	
AIDS	0.02	-0.39	-0.37	-0.60	-0.28	0.91	0.35	M ₃	
Diabetes	3.06*	2.56	2.45	2.39	3.02*	3.64*	2.46	M ₁	
Renal diseases	0.35	0.11	0.41	-0.33	0.22	1.47	0.53	M ₁	
Neurological conditions	-0.61	-0.70	-1.04	-1.05	-0.65	-2.85*	-3.23*	M ₃	

* indicates a corrected t-value > 1.96. N/C, convergence of model not obtained.

Table L.8. Sensitivity Analyses: Effect of Different Gaseous Pollutants on the Estimates of Excess Relative Risk across the Interquartile Range of Predicted PM_{2.5} at Lag 0, Montreal, 1984-1993

Cause of death	Primary analysis (M ₁)	M ₂ = M ₁ +lo(SO ₂)	M ₃ = M ₁ +lo(CO)	M ₄ = M ₁ +lo(NO ₂)	M ₅ = M ₁ +lo(NO)	M ₆ = M ₁ +lo(O ₃)	M ₇ = M ₁ + lo(SO ₂)+ lo(CO)+lo(N O ₂)+lo(NO) +lo(O ₃)		Model with the minimum AIC
							M ₁	M ₇	
Nonaccidental deaths	1.86*	1.89*	1.49*	1.96*	1.91*	1.66*	1.41*	M ₃	
Neoplasms	1.55*	1.21	1.49	2.06*	2.47*	1.62*	1.48	M ₆	
Lung cancer	1.56	-0.79	1.13	2.18	1.61	0.86	-0.18	M ₂	
Cardiovascular diseases	0.97	1.26	1.15	1.15	0.92	1.01	1.29	M ₄	
Coronary artery disease	1.04	1.54	1.98*	1.54	1.31	0.90	1.42	M ₁	
Respiratory diseases	3.58*	3.53*	1.91	3.35*	2.62	1.26	-0.09	M ₆	
Digestive diseases	4.47*	5.12*	4.63*	2.49	4.95*	3.83*	2.10	M ₄	
Accidents	1.08	2.18	2.33	1.63	2.30	1.59	2.75	M ₆	
Other nonaccidental causes	3.01*	2.87*	1.35	2.93*	2.63*	2.40*	1.28	M ₁	
AIDS	4.88	4.56	1.24	4.85	3.67	7.41*	5.42	M ₃	
Diabetes	5.48*	4.27	3.88	5.17	5.63*	5.42*	3.53	M ₁	
Renal diseases	-0.12	-0.40	1.16	-1.88	0.30	1.22	0.78	M ₁	
Neurological conditions	1.51	1.81	-0.69	0.67	0.15	-0.88	-3.18	M ₁	

* indicates a corrected t-value > 1.96. N/C, convergence of model not obtained.

Table L.9. List of Drugs Used in the Definitions of the Respiratory and Cardiovascular Indices^a

	Dates used
Respiratory indices	
Definite airways disease	
<u>Bronchodilators (beta-agonists, etc.), anticholinergics, theophylline</u>	
Aminophylline	1979-1993
Buflinone	1979-1982
Dyphylline	1979-1984
Fenoterol (bromhydrate)	1979-1993
Hydroxyethyltheophylline	1979
Ipratropium (bromure)	1983-1993
Isoproterenol (chlorhydrate)	1979-1993
Isoproterenol (chlorhydrate) / phenylephrine (bitartrate)	1979-1992
Isoproterenol (chlorhydrate) / phenylephrine (chlorhydrate)	1979-1991
Isoproterenol (sulfate)	1979-1993
Orciprenaline (sulfate)	1979-1993
Oxtriphylline	1983-1993
Procaterol hemihydrate (chlorhydrate)	1991-1993
Pseudo-ephedrine (chlorhydrate)	1979-1981
Salbutamol	1979-1993
Salbutamol (sulfate)	1979-1993
Terbutaline (sulfate de)	1979-1993
Theophyllinate (choline)	1979-1983
Theophylline	1979-1993
Theophylline (calcium aminoacetate)	1979-1993
Theophylline (sodium aminoacetate)	1979-1985
<u>Systemic and inhaled corticosteroids, sodium chromoglycate (chromolyn)</u>	
Beclomethasone (dipropionate)	1979-1993
Betamethasone	1979-1993
Betamethasone (acetate)	1979-1985
Betamethasone (benzoate)	1979-1993
Betamethasone (dipropionate)	1979-1993
Betamethasone (dipropionate) / salicylic (acid)	1983-1990
Betamethasone (phosphate disodium)	1979-1985
Betamethasone (phosphate sodium)	1986-1993
Betamethasone (valérate)	1979-1993

Continued...

Table L.9. continued.

	Dates used
Airways disease (definite), (continued)	
<u>Systemic and inhaled corticosteroids, sodium chromoglycate (chromolyn)</u>	
Budesonide	1989-1993
Cortisone (acetate)	1979-1993
Cromoglycate disodium	1979-1988
Cromoglycate sodium	1979-1993
Desoxycorticosterone	1979-1980
Dexamethasone	1979-1993
Dexamethasone (phosphate sodium)	1979-1993
Dexamethasone (sodium phosphate)	1979-1993
Dexamethasone (tebutate)	1979-1987
Flunisolide	1979-1993
Hydrocortisone	1979-1993
Hydrocortisone (acetate)	1979-1993
Hydrocortisone (acetate) / urea	1982-1993
Hydrocortisone (acetate) / zinc oxide	1979
Hydrocortisone (succinate sodium)	1979-1993
Hydrocortisone (valerate)	1979-1993
Hydrocortisone / atropine (sulfate)	1979-1990
Hydrocortisone / salicylic (acid) / sulfur (colloidal)	1979-1981
Ketotifene (fumarate)	1991-1993
Methylprednisolone	1979-1993
Methylprednisolone (acetate)	1979-1993
Methylprednisolone (acetate) / lidocaine (chlorhydrate)	1979-1993
Methylprednisolone (disodium phosphate)	1979-1988
Methylprednisolone (sodium succinate)	1979-1993
Phosphate sodium betamethasone	1986
Prednisolone	1979-1993
Prednisolone (acetate)	1979-1993
Prednisolone (acetate) / atropine (sulfate)	1979-1993
Prednisolone (phosphate sodium)	1979-1993
Prednisone	1979-1993
Triamcinolone	1979-1993
Triamcinolone (acetone)	1979-1993
Triamcinolone (diacetate)	1979-1993
Triamcinolone (hexacetone)	1979-1993

Continued...

Table L.9. continued.

	Dates used
Cardiovascular indices	
Hypertension	
Acebutol (chlorhydrate)	1987-1993
Amiloride (chlorhydrate) / hydrochlorothiazide	1981-1993
Amlodipine (besylate)	1993
Atenolol	1984-1993
Bendroflumethiazide	1979-1993
Benzthiazide	1979-1981
Captopril	1982-1993
Chlorthalidone	1979-1993
Chlorthiazide	1979-1987
Clonidine (chlorhydrate)	1979-1993
Diltiazem (chlorhydrate)	1983-1993
Enalapril	1988-1993
Enalapril hydrochlorothiazide (maleate)	1991-1993
Felodipine	1992-1993
Hydralazine (chlorhydrate)	1979-1993
Hydrochlorothiazide	1979-1993
Indapamide (hemihydrate)	1983-1993
Labetalol (chlorhydrate)	1984-1993
Lisinopril	1991-1993
Lisinopril / hydrochlorothiazide	1993
Methazolamide	1979
Methyldopa	1979-1993
Metolazone	1979-1993
Metoprolol (tartar)	1979-1993
Minoxidil	1981-1993
Nadolol	1980-1993
Nicardipine (chlorhydrate)	1991-1993
Nifedipine	1983-1993
Oxprenolol (chlorhydrate)	1981-1993
Pindolol	1979-1993
Pindolol / hydrochlorothiazide	1986-1993
Prazosin (chlorhydrate)	1979-1993
Propranolol (chlorhydrate)	1979-1993
Quinapril (chlorhydrate)	1993
Rauwolfia serpentina	1979-1987
Reserpine	1979-1993
Sotalol (chlorhydrate)	1985-1993
Spirolactone / hydrochlorothiazide	1979-1993
Timolol (maleate)	1979-1993
Triamterene / hydrochlorothiazide	1979-1993
Verapamil (chlorhydrate)	1980-1981, 1983-1993

Table L.9. continued.

	Dates used
Congestive heart failure	
Amiloride (chlorhydrate) / hydrochlorothiazide	1981-1993
Benzthiazide	1979-1981
Chlorthalidone	1979-1993
Chlorthiazide	1979-1987
Hydrochlorothiazide	1979-1993
Indapamide (hemihydrate)	1983-1993
Methazolamide	1979
Metolazone	1979-1993
Spironolactone / hydrochlorothiazide	1979-1993
Triamterene / hydrochlorothiazide	1979-1993
Definite chronic coronary artery disease	
Dinitrate isosorbite	1979-1993
Trinitrate glyceryal	1979-1993
Trinitrate glyceryal (stabilised)	1983-1993

^a Names of drugs are translated from the French by the first author.
