

Heart

Acute and recent air pollution exposure and cardiovascular events at labour and delivery

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Supplemental Table 1. The discharge diagnosis codes used to identify maternal cardiovascular events at labor/delivery.

Outcome	International Classification of Diseases, version 9 code
Ischemic heart disease	
Acute myocardial infarction	410
Other acute and subacute forms of ischemic heart disease	411
Angina pectoris	413
Certain sequelae of myocardial infarction, not elsewhere classified	429.7
Stroke	
Subarachnoid hemorrhage	430
Intracerebral hemorrhage	431
Other and unspecified intracranial hemorrhage	432
Occlusion and stenosis of precerebral arteries	433
Occlusion of cerebral arteries	434
Transient cerebral ischemia	435
Acute, but ill-defined cerebrovascular disease	436
Cerebrovascular disorder in the puerperium	674.0
Complications of the administration of anesthetic or other sedation in labor and delivery –	668.2
Central nervous system complications	
Complications affecting specified body systems, not elsewhere classified – Other nervous system complications	997.09
Heart failure	428
Cardiac arrest/failure	
Cardiac arrest	427.5
Complications of the administration of anesthetic or other sedation in labor and delivery –	668.1
Cardiac complications	
Other complications of obstetrical surgery and procedures	669.4
Complications affecting specified body systems, not elsewhere classified – Cardiac complications	997.1
Unspecified cardiovascular events	
Other cardiovascular diseases with postpartum complication	648.62 and 648.64

Supplemental Table 2. The concentrations of criteria pollutants in the week prior to delivery in the Consortium on Safe Labor.^a

	Lag (days)							
	0	1	2	3	4	5	6	7
PM ₁₀	21.0 (0.0-98.7) [14.0]	21.0 (0.0-98.7) [14.0]	20.8 (0.0-98.7) [13.9]	20.7 (0.0-98.7) [13.8]	20.7 (0.0-98.7) [13.8]	20.8 (0.0-98.7) [13.8]	20.9 (0.0-98.7) [14.0]	21.0 (0.0-98.7) [14.0]
PM _{2.5}	9.9 (0.0-63.9) [9.1]	9.9 (0.0-63.9) [9.0]	9.9 (0.0-63.9) [9.0]	9.9 (0.0-63.9) [8.9]	9.9 (0.0-63.9) [8.9]	9.9 (0.0-63.9) [8.9]	10.0 (0.0-63.9) [9.0]	9.9 (0.0-63.9) [9.1]
Ozone	29.7 (0.2-79.8) [17.9]	29.8 (0.2-79.8) [17.8]	29.9 (0.2-79.8) [17.8]	29.9 (0.2-79.8) [17.7]	29.9 (0.2-79.8) [17.7]	29.9 (0.2-79.8) [17.7]	29.8 (0.2-79.8) [17.8]	29.7 (0.2-79.8) [17.8]
CO	481.7 (82.4- 2694.2) [297.6]	481.3 (82.4- 2694.2) [297.7]	479.1 (82.4- 2694.2) [296.8]	478.0 (82.4- 2694.2) [296.1]	478.9 (82.4- 2694.2) [296.2]	479.4 (82.4- 2694.2) [295.6]	481.4 (82.4- 2694.2) [296.9]	482.2 (82.4- 2694.2) [298.5]
NO _x	19.6 (1.8-255.7) [27.8]	19.3 (1.8-255.7) [27.9]	19.0 (1.8-255.7) [27.3]	18.8 (1.8-255.7) [27.0]	18.9 (1.8-255.7) [27.1]	19.0 (1.8-255.7) [27.2]	19.3 (1.8-255.7) [27.8]	19.6 (1.8-255.8) [27.8]
SO ₂	2.8 (0.0-40.5) [3.0]	2.8 (0.0-40.5) [3.0]	2.8 (0.0-40.5) [3.0]	2.8 (0.0-40.5) [3.0]	2.8 (0.0-40.5) [2.9]	2.8 (0.0-40.5) [2.9]	2.8 (0.0-40.5) [3.0]	2.8 (0.0-40.5) [3.0]
Elemental carbon	0.3 (0.0-6.1) [0.5]	0.3 (0.0-6.1) [0.5]	0.3 (0.0-6.1) [0.5]	0.3 (0.0-6.1) [0.5]	0.3 (0.0-6.1) [0.5]	0.3 (0.0-6.1) [0.5]	0.3 (0.0-6.1) [0.5]	0.3 (0.0-6.1) [0.5]
Organic compounds	0.7 (0.0-8.5) [0.9]	0.7 (0.0-8.5) [0.9]	0.7 (0.0-8.5) [0.9]	0.7 (0.0-8.5) [0.9]	0.7 (0.0-8.5) [0.9]	0.7 (0.0-8.5) [0.9]	0.7 (0.0-8.5) [0.9]	0.7 (0.0-8.5) [0.9]
Ammonium particles	0.8 (0.0-11.0) [1.3]	0.8 (0.0-11.0) [1.3]	0.8 (0.0-11.0) [1.3]	0.8 (0.0-11.0) [1.3]	0.8 (0.0-11.0) [1.2]	0.8 (0.0-11.0) [1.2]	0.8 (0.0-11.0) [1.3]	0.8 (0.0-11.0) [1.3]
Dust particles	1.5 (0.1-21.5) [1.5]	1.5 (0.1-21.5) [1.6]	1.5 (0.1-21.5) [1.6]	1.5 (0.1-21.5) [1.5]	1.4 (0.1-21.5) [1.5]	1.4 (0.1-21.5) [1.5]	1.5 (0.1-21.5) [1.5]	1.5 (0.1-21.5) [1.5]
Sulfate particles	1.9 (0.0-27.8) [2.6]	1.9 (0.0-27.8) [2.6]	1.9 (0.0-27.8) [2.6]	1.9 (0.0-27.8) [2.6]	1.9 (0.0-27.8) [2.6]	1.9 (0.0-27.8) [2.6]	1.9 (0.0-27.8) [2.6]	1.9 (0.0-27.8) [2.6]
Nitrate particles	0.3 (0.0-22.8) [1.2]	0.3 (0.0-22.8) [1.2]	0.3 (0.0-22.8) [1.2]	0.3 (0.0-22.8) [1.2]	0.3 (0.0-22.8) [1.2]	0.3 (0.0-22.8) [1.2]	0.3 (0.0-22.8) [1.2]	0.3 (0.0-22.8) [1.2]

Abbreviations: CO=carbon monoxide, NO_x=nitrogen oxides, PM₁₀=particulate matter <10 µm in aerodynamic diameter, PM_{2.5}=particulate matter <2.5 µm in aerodynamic diameter, SO₂=sulfur dioxide. ^aThe concentrations are presented as median (min-max) [interquartile range] and are in µg/m³ for PM₁₀, PM_{2.5}, elemental carbon, organic compounds, and ammonium, sulfate, nitrate and dust particles and in parts per billion for ozone, CO, NO_x,SO₂. Concentrations for elemental carbon, organic compounds, and ammonium, sulfate, nitrate and dust particles are based solely on modeled air quality data. Other concentrations are based on modeled data fused with observed air quality data.

Supplemental Table 3. The concentrations of air toxics in the week prior to delivery in the Consortium on Safe Labor.^a

	Lag (days)							
	0	1	2	3	4	5	6	7
Acenaphthene	3.45*10 ⁻⁵	3.44*10 ⁻⁵	3.41*10 ⁻⁵	3.39*10 ⁻⁵	3.38*10 ⁻⁵	3.40*10 ⁻⁵	3.43*10 ⁻⁵	3.45*10 ⁻⁵
Acenaphthylene	2.24*10 ⁻⁴	2.25*10 ⁻⁴	2.25*10 ⁻⁴	2.23*10 ⁻⁴	2.22*10 ⁻⁴	2.23*10 ⁻⁴	2.24*10 ⁻⁴	2.25*10 ⁻⁴
Anthracene	4.57*10 ⁻⁵	4.55*10 ⁻⁵	4.54*10 ⁻⁵	4.54*10 ⁻⁵	4.53*10 ⁻⁵	4.52*10 ⁻⁵	4.55*10 ⁻⁵	4.55*10 ⁻⁵
Benzene	0.322	0.322	0.323	0.321	0.319	0.32	0.321	0.322
1,3-butadiene	8.02*10 ⁻³	8.09*10 ⁻³	8.16*10 ⁻³	8.17*10 ⁻³	8.12*10 ⁻³	8.02*10 ⁻³	7.96*10 ⁻³	7.99*10 ⁻³
Benz[a]anthracene	7.66*10 ⁻⁷	7.53*10 ⁻⁷	7.40*10 ⁻⁷	7.34*10 ⁻⁷	7.39*10 ⁻⁷	7.52*10 ⁻⁷	7.64*10 ⁻⁷	7.56*10 ⁻⁷
Benz[a]pyrene	9.78*10 ⁻¹⁰	1.00*10 ⁻⁹	9.36*10 ⁻¹⁰	9.43*10 ⁻¹⁰	1.01*10 ⁻⁹	9.97*10 ⁻¹⁰	1.03*10 ⁻⁹	1.04*10 ⁻⁹
Ethylbenzene	0.136	0.136	0.136	0.135	0.134	0.135	0.135	0.135
Chrysene	1.22*10 ⁻⁵	1.22*10 ⁻⁵	1.22*10 ⁻⁵	1.22*10 ⁻⁵	1.22*10 ⁻⁵	1.22*10 ⁻⁵	1.23*10 ⁻⁵	1.23*10 ⁻⁵
Cyclohexane	0.0331	0.033	0.033	0.0329	0.0329	0.033	0.033	0.033
Fluoranthene	6.11*10 ⁻⁵	6.12*10 ⁻⁵	6.10*10 ⁻⁵	6.06*10 ⁻⁵	6.04*10 ⁻⁵	6.07*10 ⁻⁵	6.11*10 ⁻⁵	6.13*10 ⁻⁵
Fluorene	7.59*10 ⁻⁵	7.60*10 ⁻⁵	7.56*10 ⁻⁵	7.49*10 ⁻⁵	7.47*10 ⁻⁵	7.52*10 ⁻⁵	7.57*10 ⁻⁵	7.60*10 ⁻⁵
Indeno[1,2,3-Cd]pyrene	3.31*10 ⁻¹⁷	3.31*10 ⁻¹⁷	3.31*10 ⁻¹⁷	3.33*10 ⁻¹⁷	3.32*10 ⁻¹⁷	3.32*10 ⁻¹⁷	3.33*10 ⁻¹⁷	3.33*10 ⁻¹⁷
Methyl-tertiary-butyl ether	0.0175	0.0175	0.0175	0.0174	0.0173	0.0173	0.0173	0.0174
M-xylene	0.143	0.142	0.143	0.142	0.142	0.142	0.142	0.142
Naphthalene	8.57*10 ⁻³	8.58*10 ⁻³	8.58*10 ⁻³	8.54*10 ⁻³	8.54*10 ⁻³	8.55*10 ⁻³	8.59*10 ⁻³	8.57*10 ⁻³
N-hexane	0.152	0.151	0.152	0.151	0.15	0.15	0.15	0.151
Methyl-ethyl ketone	0.148	0.148	0.148	0.147	0.146	0.146	0.147	0.147
O-xylene	0.131	0.132	0.132	0.131	0.131	0.131	0.131	0.131
Phenanthrene	2.56*10 ⁻⁴	2.57*10 ⁻⁴	2.55*10 ⁻⁴	2.54*10 ⁻⁴	2.53*10 ⁻⁴	2.54*10 ⁻⁴	2.56*10 ⁻⁴	2.57*10 ⁻⁴
Propene	0.126	0.127	0.127	0.127	0.126	0.126	0.125	0.126
P-xylene	0.139	0.139	0.139	0.138	0.138	0.138	0.138	0.138
Pyrene	4.61*10 ⁻⁵	4.61*10 ⁻⁵	4.60*10 ⁻⁵	4.53*10 ⁻⁵	4.55*10 ⁻⁵	4.57*10 ⁻⁵	4.61*10 ⁻⁵	4.62*10 ⁻⁵
Sesquiterpene	2.35*10 ⁻⁶	2.30*10 ⁻⁶	2.24*10 ⁻⁶	2.17*10 ⁻⁶	2.18*10 ⁻⁶	2.26*10 ⁻⁶	2.36*10 ⁻⁶	2.36*10 ⁻⁶
Styrene	1.95*10 ⁻³	1.96*10 ⁻³	1.98*10 ⁻³	1.99*10 ⁻³	1.97*10 ⁻³	1.95*10 ⁻³	1.94*10 ⁻³	1.94*10 ⁻³
Toluene	0.804	0.806	0.807	0.803	0.8	0.802	0.802	0.804

^aThe concentrations are presented as the 75th percentile and are based on the full cohort with 223,502 pregnancies. All data are in parts per billion and are based on modeled air quality data.

Supplemental Table 5. Simulated corrected odds ratio of cardiovascular event per interquartile range increase in NO_x exposure five days prior to delivery (with reported odds ratio of 1.165 with increasing exposure) for a range of prevalence of an unmeasured confounder among women with and without events.

Prevalence of unmeasured confounder		Odds between the unmeasured confounder and the exposure										
Pregnancies without events	Pregnancies with events	1.05	1.1	1.2	1.3	1.4	1.5	1.6	1.7	1.8	1.9	2.0
0.01	0.05	1.147	1.126	1.047	0.969	0.903	0.919	0.875	0.879	0.831	0.873	0.953
0.05		1.168	1.170	1.186	1.169	1.197	1.184	1.216	1.206	1.222	1.263	1.253
0.1		1.190	1.203	1.269	1.383	1.502	1.501	1.645	1.717	1.719	1.700	1.779
0.2		1.221	1.305	1.533	1.714	1.997	2.198	2.258	2.464	2.573	2.774	2.715
0.4		1.301	1.479	1.883	2.332	2.804	3.036	3.209	3.801	4.217	4.512	5.120
0.6		1.373	1.634	2.176	2.867	3.352	3.987	4.212	5.087	6.325	5.500	6.244
0.8		1.428	1.731	2.345	3.079	3.698	4.146	4.837	6.285	5.755	7.176	8.105
0.01	0.1	1.127	1.073	0.903	0.744	0.727	0.639	0.601	0.510	0.526	0.556	0.502
0.05		1.148	1.114	1.044	0.956	0.993	0.886	0.858	0.789	0.838	0.824	0.814
0.1		1.171	1.164	1.130	1.146	1.153	1.093	1.116	1.220	1.121	1.152	1.160
0.2		1.206	1.270	1.364	1.425	1.555	1.543	1.688	1.867	1.761	1.766	1.854
0.4		1.278	1.425	1.707	1.874	2.173	2.339	2.432	2.567	2.607	2.638	2.850
0.6		1.338	1.563	1.961	2.336	2.350	2.777	2.883	2.817	3.016	3.172	3.189
0.8		1.419	1.639	2.195	2.542	2.653	2.774	3.108	3.342	3.217	3.431	3.556
0.01	0.2	1.093	0.984	0.761	0.594	0.459	0.344	0.310	0.262	0.246	0.204	0.207
0.05		1.114	1.040	0.857	0.767	0.662	0.569	0.515	0.443	0.344	0.342	0.286
0.1		1.117	1.075	0.949	0.900	0.780	0.794	0.721	0.653	0.640	0.588	0.573
0.2		1.174	1.164	1.181	1.141	1.092	1.104	1.116	1.118	1.172	1.072	1.127
0.4		1.236	1.329	1.410	1.511	1.519	1.560	1.567	1.657	1.799	1.715	1.693
0.6		1.298	1.393	1.688	1.867	1.780	1.973	1.925	2.036	1.969	2.088	1.969
0.8		1.361	1.508	1.889	1.987	2.050	2.180	2.129	2.229	2.212	2.299	2.218
0.01	0.4	1.033	0.880	0.638	0.434	0.314	0.263	0.186	0.155	0.134	0.113	0.106
0.05		1.028	0.927	0.702	0.562	0.410	0.306	0.249	0.199	0.164	0.147	0.124
0.1		1.056	0.959	0.771	0.662	0.535	0.454	0.376	0.309	0.260	0.231	0.200
0.2		1.093	1.024	0.927	0.804	0.771	0.734	0.652	0.593	0.550	0.509	0.475
0.4		1.170	1.174	1.145	1.179	1.144	1.142	1.102	1.087	1.065	1.102	1.050

0.6		1.224	1.279	1.313	1.387	1.410	1.355	1.446	1.400	1.427	1.418	1.411
0.8		1.278	1.374	1.416	1.517	1.542	1.545	1.601	1.585	1.598	1.566	1.617
0.01		0.945	0.808	0.525	0.373	0.247	0.203	0.134	0.112	0.103	0.088	0.086
0.05		1.001	0.833	0.625	0.454	0.340	0.255	0.186	0.153	0.124	0.099	0.090
0.1		1.018	0.869	0.669	0.532	0.428	0.342	0.279	0.236	0.177	0.154	0.115
0.2	0.6	1.039	0.938	0.790	0.711	0.593	0.542	0.472	0.407	0.369	0.312	0.284
0.4		1.106	1.063	1.000	0.953	0.921	0.893	0.890	0.827	0.843	0.814	0.821
0.6		1.170	1.152	1.151	1.169	1.132	1.160	1.154	1.121	1.100	1.107	1.121
0.8		1.214	1.252	1.286	1.280	1.271	1.285	1.309	1.343	1.335	1.308	1.328
0.01		0.930	0.758	0.472	0.309	0.225	0.169	0.115	0.090	0.087	0.084	0.056
0.05		0.946	0.789	0.562	0.383	0.288	0.209	0.161	0.131	0.109	0.087	0.074
0.1		0.962	0.813	0.601	0.467	0.361	0.285	0.225	0.175	0.137	0.118	0.100
0.2	0.8	0.996	0.869	0.709	0.599	0.514	0.438	0.373	0.330	0.269	0.242	0.206
0.4		1.057	0.980	0.894	0.834	0.784	0.754	0.712	0.695	0.659	0.657	0.617
0.6		1.111	1.075	1.035	1.010	0.993	0.992	0.974	0.990	0.969	0.978	0.962
0.8		1.160	1.154	1.166	1.163	1.163	1.166	1.159	1.161	1.145	1.155	1.148
0.01		0.878	0.708	0.465	0.307	0.218	0.157	0.124	0.097	0.085	0.060	0.067
0.05		0.916	0.744	0.507	0.361	0.259	0.191	0.154	0.123	0.096	0.085	0.075
0.1		0.938	0.766	0.565	0.425	0.320	0.255	0.193	0.160	0.134	0.104	0.088
0.2	0.95	0.975	0.846	0.653	0.547	0.461	0.390	0.332	0.275	0.233	0.199	0.169
0.4		1.034	0.938	0.834	0.766	0.715	0.676	0.641	0.610	0.583	0.558	0.536
0.6		1.079	1.028	0.974	0.936	0.910	0.901	0.887	0.892	0.880	0.865	0.851
0.8		1.130	1.112	1.089	1.076	1.080	1.075	1.065	1.061	1.062	1.057	1.064