Supplemental Material

Air Pollution, Clustering of Particulate Matter Components, and Breast Cancer in the Sister Study: A U.S.-Wide Cohort

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Supplemental Table S1. Air pollutants and risk of invasive premenopausal and postmenopausal breast cancer, Sister Study 2003-2009.

Air Pollutant[a]	N cases	Premenopausal Adjusted HR[b] (95% CI)	N cases	Postmenopausal Adjusted HR[c] (95% CI)
$PM_{2.5}$	412	1.07 (0.92, 1.24)	1789	1.02 (0.95, 1.09)
PM_{10}	412	0.94 (0.85, 1.04)	1789	1.01 (0.97, 1.06)
NO_2	412	0.97 (0.85, 1.10)	1786	1.03 (0.98, 1.10)

[a] HR for a unit increase in the IQR difference: $PM_{2.5}$=3.6 µg/m^3, PM_{10}=5.8 µg/m^3, NO_2=5.8 ppb
[b] Adjusted for age, race, education, and smoking status
[c] Adjusted for age, race, education, smoking status and postmenopausal hormone use

Supplemental Table S2. $PM_{2.5}$ and risk of invasive breast cancer with inclusion of interaction terms in the model, Sister Study 2003-2009.

Model	Adjusted HR[b] (95% CI)	Interaction p-value			
		PM2.5 *region	PM2.5 *cluster	PM2.5 *BMI	PM2.5 *education
$PM_{2.5}$*region interaction term only	0.90 (0.77, 1.04)	0.03	NE	NE	NE
$PM_{2.5}$*cluster interaction term only	1.00 (0.84, 1.18)	NE	0.3	NE	NE
Both $PM_{2.5}$*region and $PM_{2.5}$*cluster interaction terms	0.96 (0.8, 1.14)	0.04	0.4	NE	NE
$PM_{2.5}$*region, $PM_{2.5}$*cluster, and $PM_{2.5}$*BMI interaction terms	0.87 (0.71, 1.05)	0.03	0.3	0.01	NE
$PM_{2.5}$*region, $PM_{2.5}$*cluster, $PM_{2.5}$*BMI and $PM_{2.5}$*education interaction terms	0.87 (0.71, 1.06)	0.03	0.3	0.01	0.4

NE= not estimated

[a] HR for a unit increase in the IQR difference for 2006 $PM_{2.5}$=3.6 $\mu g/m^3$ among women in the Midwestern US region, Cluster 1, with a BMI <25, and educational attainment of at least a 4-year degree or higher.

[b] Adjusted for age, race, education, income, census-tract level income, marital status, parity, smoking status, body mass index and postmenopausal hormone use

Supplemental Table S3. Air pollutants and risk of invasive and DCIS breast cancer by length of time at residence, Sister Study 2003-2009.

		Invasive breast cancer					DCIS			
		< 10 years		>10 years			< 10 years		>10 years	
Air Pollutant[a]	N cases	Adjusted HR[b] (95% CI)	N cases	Adjusted HR[b] (95% CI)	p for heterogeniety	N cases	Adjusted HR[b] (95% CI)	N cases	Adjusted HR[b] (95% CI)	p for heterogeniety
$PM_{2.5}$	1032	0.99 (0.90, 1.08)	1174	1.07 (0.98, 1.17)	0.2	281	1.14 (0.96, 1.37)	336	1.17 (0.99, 1.38)	0.9
PM_{10}	1032	0.99 (0.93, 1.05)	1174	1.01 (0.95, 1.07)	0.6	281	1.11 (1.00, 1.23)	336	1.02 (0.92, 1.14)	0.3
NO_2	1031	1.00 (0.92, 1.09)	1172	1.04 (0.97, 1.11)	0.5	281	1.20 (1.04, 1.38)	336	1.28 (1.13, 1.44)	0.5

[a] HR for a unit increase in the IQR difference: $PM_{2.5}$=3.6 µg/m^3, PM_{10}=5.8 µg/m^3, NO_2=5.8 ppb
[b] Adjusted for age, race, education, smoking status and postmenopausal hormone use

Supplemental Table S4. Air pollutants and risk of invasive breast cancer by BMI, Sister Study 2003-2009.

				Invasive breast cancer				
		BMI <25			**BMI 25-<30**		**BMI ≥ 30**	
Air Pollutant[a]	**N cases**	**Adjusted HR**[b] **(95% CI)**	**N cases**	**Adjusted HR**[b] **(95% CI)**	**N cases**	**Adjusted HR**[b] **(95% CI)**	**p for heterogeneity**
$PM_{2.5}$	772	0.93 (0.84, 1.03)	722	0.99 (0.89, 1.11)	712	1.19 (1.06, 1.34)	0.02
PM_{10}	772	1.03 (0.96, 1.10)	722	0.98 (0.91, 1.06)	712	0.97 (0.90, 1.05)	0.4
NO_2	770	0.96 (0.87, 1.05)	721	1.01 (0.91, 1.11)	712	1.11 (1.01, 1.21)	0.1

[a] HR for a unit increase in the IQR difference: $PM_{2.5}$=3.6 µg/m^3, PM_{10}=5.8 µg/m^3, NO_2=5.8 ppb
[b] Adjusted for age, race, education, smoking status and postmenopausal hormone use

Supplemental Table S5. Air pollutants and risk of invasive and DCIS breast cancer by extent of breast cancer family history, Sister Study 2003-2009.

		Invasive breast cancer			
		1 first-degree relative with breast cancer		**>1 first-degree relative with breast cancer**	
Air Pollutant[a]	**N cases**	**Adjusted HR**[b] **(95% CI)**	**N cases**	**Adjusted HR**[b] **(95% CI)**	**p for heterogeneity**
$PM_{2.5}$	1435	1.05 (0.97, 1.13)	771	0.99 (0.89, 1.10)	0.6
PM_{10}	1435	1.02 (0.97, 1.07)	771	0.96 (0.89, 1.03)	0.2
NO_2	1434	1.03 (0.96, 1.10)	769	1.01 (0.92, 1.11)	0.9

[a] HR for a unit increase in the IQR difference: $PM_{2.5}$=3.6 µg/m^3, PM_{10}=5.8 µg/m^3, NO_2=5.8 ppb
[b] Adjusted for age, race, education, smoking status and postmenopausal hormone use

Supplemental Table S6. Air pollutants and risk of invasive and DCIS breast cancer by ever HRT, Sister Study 2003-2009.

Air Pollutant[a]		Invasive breast cancer			
		No HRT		HRT	
	N cases	Adjusted HR[b] (95% CI)	N cases	Adjusted HR[b] (95% CI)	p for heterogeneity
$PM_{2.5}$	1131	1.03 (0.94, 1.12)	1075	1.03 (0.94, 1.12)	0.9
PM_{10}	1131	1.00 (0.94, 1.06)	1075	1.00 (0.94, 1.06)	0.9
NO_2	1129	1.03 (0.95, 1.10)	1074	1.02 (0.94, 1.10)	0.9

[a] HR for a unit increase in the IQR difference: $PM_{2.5}$=3.6 µg/m³, PM_{10}=5.8 µg/m³, NO_2=5.8 ppb
[b] Adjusted for age, race, education and smoking status

Supplemental Table S7. Cluster membership by geographic region, Sister Study 2003-2009.

Cluster	Northeast N	Northeast Row %	Midwest N	Midwest Row %	South N	South Row %	West N	West Row %
1	794	6.14	10,022	77.5	2,118	16.3	0	0.0
2	7,139	51.3	1,632	11.7	4,282	30.8	861	6.2
3	0	0.0	473	4.7	9,507	95.3	0	0.0
4	0	0.0	0	0.0	0	0.00	4,077	100.0
5	0	0.0	0	0.0	10	0.3	4,065	99.7
6	149	14.5	875	85.4	1	0.1	0	0.0
7	0	0.0	45	3.2	40	2.8	1,341	94.0