

# Putting co-exposures on equal footing: an ecological analysis of same-scale air pollution and social factors on cardiovascular disease in New York City

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## SDI Methods

SDI Variable Inputs – ACS 2007-2011 census tract, 2010 Boundaries

<b>Income</b>
median household income (2011 inflation-adjusted dollars)
% of households living 200% of the poverty level
% receiving public assistance income (in the past 12 months)
% receiving food stamp/SNAP benefits (in the past 12 months)
% families with annual income <\$35,000 (2011 inflation-adjusted dollars)
% female householders with children aged < 18
% renter or owner housing costs in excess of 30% of household income (in the past 12 months)
% married
% households with annual income > \$50,000 (2011 inflation-adjusted dollars)
<b>Wealth</b>
median housing value
% homes that receive interest, dividend, or net rental income (in the past 12 months)
<b>Education</b> (among adults aged >= 25 years)
% residents with less than a high school diploma
% residents with a bachelor's degree or higher
<b>Employment/Occupation</b> (among adult labor force, aged 20-64)
% unemployed
% male unemployment
% not in the labor force
% adults in management or professional occupations
<b>Housing</b>
% renter occupied (among occupied housing units)
% vacant housing units (among total housing units)
% overcrowded (>1 occupant per room, among occupied housing units)

% residents who lived in the same house one year ago (population 1 year and older)
<b>Language</b>
% speak English than "very well" (among population $\geq$ 5 years old who speak a language other than English at home)
<b>Racial/Ethnic Composition</b>
% non-Hispanic black
% Hispanic
% non-Hispanic, non-white (calculated as $1 -$ % non-Hispanic white population)

Methods: followed same methodology in Shmool et al., 2015 paper.

- 25 census tract level variables (see table above). SDI input variables spanned all dimensions of SEP including: income, wealth, education, employment/occupation, housing, language, racial/ethnic composition
  - This list of variables include variables from Jessi's original SDI, the [MESA](#) [NSDI](#), and a few variables that I had already created
- The initial city-wide solution is the final SDI solution. There were no variables that loaded  $> \pm 0.40$  in two or more borough-level PCA solutions.
- The final SDI solution is based on census tracts retained eight ACS variables:
  - median household income
  - % of households living 200% of the poverty level
  - % receiving public assistance income
  - % receiving food stamp/SNAP benefits
  - % families with annual income  $<$  \$35,000
  - % renter or owner housing costs in excess of 30% of household income
  - % households with annual income  $>$  \$50,000
  - % residents with less than a high school diploma
- The final SDI component explained 53.43% of the overall variance
- Higher scores indicate greater tract-level socioeconomic deprivation
- IQR standardized with median=0, IQR=1, Range: -1.63, 2.39

## Material and Methods – United Hospital Fund (UHF) area

*Data.* A multi-step address validation and geocoding process [1] of residential addresses was used to assign 857,744 SPARCS inpatient cases to the UHF (n=34) associated with their residential address.

*Air Pollution* Near-residence annual-average exposures for each pollutant from NYCCAS spatial surfaces were quantified as the mean concentration from all centroids of 100 x 100 m grid cells that fell within a 300-m radial buffer around each case's residential location. To obtain UHF-level exposure estimates, we averaged the NYCCAS concentration estimates for all 100m centroids contained within each UHF.

*Social Factors.* We identified sets of spatially-correlated exposures at the UHF scale using unconstrained factor analysis with and without adjustment for spatial autocorrelation. These measures are described in detail elsewhere [2]. Briefly, we aggregated and re-formulated 27 administrative stressor indicators across six domains (SEP, violence/ crime, healthcare access, physical disorder, noise/ pollution, school-related stressors) to the 34 UHF neighborhoods. Among the 27 stressor indicators, we found three spatially-distinct factors that combined explain 92.7% of the overall variance. Factor 1 included indicators of violence and physical disorder. Factor 2 included crowding and poor resource access. Factor 3 included noise and air pollution complaints. The solution was robust to a reduced set of 21 indicators excluding highly-correlated variables.

*Statistical Analysis.* Age-adjusted CVD incidence rates per 100,000 population were calculated for UHF-areas using the 2000 U.S. Standard Population. All pollutants and social factors were IQR-standardized.

We quantified correlations among age-adjusted CVD incidence rates, average NO<sub>2</sub>, PM<sub>2.5</sub>, SO<sub>2</sub>, and O<sub>3</sub>, and social factors using Pearson correlation coefficients. We used negative binomial regression to model CVD as a function of each air pollutant separately, with and without adjustment for social factors. We modeled each pollutant and stressor (the stressor three factors from factor analysis at the UHF level) in separate unadjusted models. We then modeled each social factor with each air pollutant.

Sensitivity analyses were conducted to evaluate the consistency and stability of our estimates. We examined the impacts of spatial autocorrelation on bivariate measures of association using Simultaneous Autoregressive (SAR) models and Moran's *I* to assess autocorrelation in Ordinary Least Squares (OLS residuals).

**Table S1.** Fully-adjusted negative binomial models for each NO<sub>2</sub>-social factor combination vs. census tract CVD rate, additionally adjusted for the strongest predictor of CVD from the *other* two social factor categories (SDI in the economic/ material deprivation category, Violent Crime Rate in the exposure to crime category, and/or % non-Hispanic black in the racial/ ethnic composition category). Incident rate ratio (IRR) represents the change in CVD incidence rate per 1-IQR change in each covariate. Moran's I to assess spatial autocorrelation in residuals. N=1,981.

Negative Binomial Regression: NO <sub>2</sub>					
Exposures	IRR	(95% CI)	AIC	I	P
Pollutant	0.99	(0.98, 1.01)	38192	0.36	<0.0001
SDI	1.3	(1.27, 1.33)			
Pollutant	1.01	(0.99, 1.02)	38406	0.37	<0.0001
ICE: R & I	0.75	(0.74, 0.77)			
Pollutant	0.99	(0.97, 1)	38205	0.36	<0.0001
% < 200% FPL	1.33	(1.3, 1.36)			
Pollutant	1	(0.99, 1.02)	38387	0.35	<0.0001
Median Income	0.82	(0.81, 0.84)			
Pollutant	0.99	(0.98, 1.01)	38192	0.36	<0.0001
Violent Crime	1.12	(1.1, 1.14)			
Pollutant	1	(0.98, 1.01)	38224	0.37	<0.0001
Assault Rate	1.11	(1.09, 1.14)			
Pollutant	0.98	(0.96, 0.99)	38423	0.4	<0.0001
% non-Hispanic white	0.85	(0.83, 0.88)			
Pollutant	0.99	(0.98, 1.01)	38192	0.36	<0.0001
% non-Hispanic black	1.21	(1.18, 1.23)			
Pollutant	0.97	(0.96, 0.99)	38530	0.4	<0.0001
% Hispanic	0.99	(0.97, 1.02)			

Negative Binomial GLM with Spatial Filtering: NO <sub>2</sub>					
Exposures	IRR	(95% CI)	AIC	I	P
Pollutant	1	(0.98, 1.01)	37616	0.15	<0.0001
SDI	1.32	(1.29, 1.34)			
Pollutant	1	(0.98, 1.01)	37731	0.13	<0.0001
ICE: R & I	0.74	(0.73, 0.75)			
Pollutant	0.99	(0.97, 1.00)	37604	0.14	<0.0001
% < 200% FPL	1.32	(1.30, 1.35)			
Pollutant	1.02	(1, 1.03)	37746	0.12	<0.0001
Median Income	0.81	(0.8, 0.83)			
Pollutant	1	(0.98, 1.01)	37616	0.15	0.0001
Violent Crime	1.07	(1.05, 1.09)			
Pollutant	0.99	(0.98, 1.01)	37607	0.14	0.0001
Assault Rate	1.07	(1.05, 1.09)			
Pollutant	1	(0.98, 1.01)	37635	0.14	<0.0001
% non-Hispanic white	0.87	(0.84, 0.89)			
Pollutant	1	(0.98, 1.01)	37616	0.15	0.0001
% non-Hispanic black	1.21	(1.19, 1.23)			
Pollutant	0.99	(0.98, 1.01)	37702	0.14	<0.0001
% Hispanic	1.02	(1.00, 1.04)			

Moran's I and spatial filtering were estimated using queen's first order neighborhood matrix. IRR= incident rate ratio; 95% CI = 95% confidence interval; ICE: R & I = index of concentration at the extremes: race & income; SDI = social deprivation index. SDI and ICE are composite variables. AIC = Akaike Information Criterion.

**Table S2.** Fully-adjusted negative binomial models for each PM<sub>2.5</sub>-social factor combination vs. census tract CVD rate, additionally adjusted for the strongest predictor of CVD from the *other* two social factor categories (SDI in the economic/ material deprivation category, Violent Crime Rate in the exposure to crime category, and/or % non-Hispanic black in the racial/ ethnic composition category). Incident rate ratio (IRR) represents the change in CVD incidence rate per 1-IQR change in each covariate. Moran's I to assess spatial autocorrelation in residuals. N=1,981.

Negative Binomial Regression: PM <sub>2.5</sub>					
Exposures	IRR	(95% CI)	AIC	I	P
Pollutant	1.01	(0.99, 1.02)	38192	0.36	<0.0001
SDI	1.3	(1.27, 1.32)			
Pollutant	1.03	(1.02, 1.05)	38394	0.37	<0.0001
ICE: R & I	0.75	(0.74, 0.77)			
Pollutant	1	(0.98, 1.02)	38209	0.37	<0.0001
% < 200% FPL	1.32	(1.29, 1.35)			
Pollutant	1.03	(1.01, 1.05)	38376	0.35	<0.0001
Median Income	0.83	(0.81, 0.84)			
Pollutant	1.01	(0.99, 1.02)	38192	0.36	<0.0001
Violent Crime	1.12	(1.1, 1.14)			
Pollutant	1.01	(0.99, 1.03)	38223	0.37	<0.0001
Assault Rate	1.11	(1.09, 1.13)			
Pollutant	0.98	(0.96, 1)	38425	0.41	<0.0001
% non-Hispanic white	0.85	(0.83, 0.88)			
Pollutant	1.01	(0.99, 1.02)	38192	0.36	<0.0001
% non-Hispanic black	1.21	(1.18, 1.23)			
Pollutant	0.97	(0.95, 0.99)	38531	0.4	<0.0001
% Hispanic	1	(0.98, 1.02)			

Negative Binomial GLM with Spatial Filtering: PM <sub>2.5</sub>					
Exposures	IRR	(95% CI)	AIC	I	P
Pollutant	1.02	(1.00, 1.04)	37606	0.14	<0.0001
SDI	1.31	(1.29, 1.34)			
Pollutant	1.03	(1.01, 1.05)	37749	0.14	<0.0001
ICE: R & I	0.74	(0.73, 0.76)			
Pollutant	1	(0.98, 1.02)	37600	0.14	<0.0001
% < 200% FPL	1.33	(1.3, 1.36)			
Pollutant	1.04	(1.02, 1.06)	37742	0.12	<0.0001
Median Income	0.82	(0.8, 0.83)			
Pollutant	1.02	(1.00, 1.04)	37606	0.14	0.0001
Violent Crime	1.06	(1.05, 1.08)			
Pollutant	1.02	(1, 1.04)	37601	0.14	0.0001
Assault Rate	1.07	(1.05, 1.09)			
Pollutant	1.01	(0.99, 1.03)	37652	0.15	<0.0001
% non-Hispanic white	0.86	(0.84, 0.89)			
Pollutant	1.02	(1.00, 1.04)	37606	0.14	0.0001
% non-Hispanic black	1.2	(1.18, 1.23)			
Pollutant	1	(0.98, 1.02)	37722	0.15	<0.0001
% Hispanic	1.03	(1.01, 1.05)			

Moran's I and spatial filtering were estimated using queen's first order neighborhood matrix. IRR= incident rate ratio; 95% CI = 95% confidence interval; ICE: R & I = index of concentration at the extremes: race & income; SDI = social deprivation index. SDI and ICE are composite variables. AIC = Akaike Information Criterion.

**Table S3.** Fully-adjusted negative binomial models for each SO<sub>2</sub>-social factor combination vs. census tract CVD rate, additionally adjusted for the strongest predictor of CVD from the *other* two social factor categories (SDI in the economic/ material deprivation category, Violent Crime Rate in the exposure to crime category, and/or % non-Hispanic black in the racial/ ethnic composition category). Incident rate ratio (IRR) represents the change in CVD incidence rate per 1-IQR change in each covariate. Moran's I to assess spatial autocorrelation in residuals. N=1,981.

Negative Binomial Regression: SO <sub>2</sub>					
Exposures	IRR	(95% CI)	AIC	I	P
Pollutant	0.98	(0.96, 0.99)	38182	0.36	<0.0001
SDI	1.31	(1.29, 1.34)			
Pollutant	1	(0.99, 1.01)	38407	0.37	<0.0001
ICE: R & I	0.75	(0.74, 0.77)			
Pollutant	0.98	(0.97, 0.99)	38200	0.36	<0.0001
% < 200% FPL	1.34	(1.31, 1.37)			
Pollutant	1	(0.98, 1.01)	38388	0.35	<0.0001
Median Income	0.82	(0.81, 0.84)			
Pollutant	0.98	(0.96, 0.99)	38182	0.36	<0.0001
Violent Crime	1.12	(1.1, 1.14)			
Pollutant	0.98	(0.97, 0.99)	38216	0.37	<0.0001
Assault Rate	1.12	(1.09, 1.14)			
Pollutant	0.96	(0.95, 0.97)	38399	0.4	<0.0001
% non-Hispanic white	0.85	(0.82, 0.87)			
Pollutant	0.98	(0.96, 0.99)	38182	0.36	<0.0001
% non-Hispanic black	1.2	(1.18, 1.23)			
Pollutant	0.96	(0.94, 0.97)	38513	0.4	<0.0001
% Hispanic	1.01	(0.99, 1.03)			

Negative Binomial GLM with Spatial Filtering: SO <sub>2</sub>					
Exposures	IRR	(95% CI)	AIC	I	P
Pollutant	1	(0.98, 1.01)	37612	0.14	<0.0001
SDI	1.32	(1.3, 1.35)			
Pollutant	1.01	(0.99, 1.02)	37739	0.13	<0.0001
ICE: R & I	0.75	(0.73, 0.76)			
Pollutant	0.99	(0.98, 1.01)	37608	0.14	<0.0001
% < 200% FPL	1.33	(1.31, 1.36)			
Pollutant	1.01	(1, 1.02)	37747	0.12	<0.0001
Median Income	0.81	(0.8, 0.83)			
Pollutant	1	(0.98, 1.01)	37612	0.14	0.0001
Violent Crime	1.07	(1.05, 1.09)			
Pollutant	0.99	(0.98, 1)	37589	0.13	0.0001
Assault Rate	1.07	(1.05, 1.09)			
Pollutant	0.99	(0.98, 1)	37643	0.14	<0.0001
% non-Hispanic white	0.87	(0.84, 0.9)			
Pollutant	1	(0.98, 1.01)	37612	0.14	0.0001
% non-Hispanic black	1.2	(1.17, 1.22)			
Pollutant	0.99	(0.97, 1)	37697	0.14	<0.0001
% Hispanic	1.03	(1, 1.05)			

Moran's I and spatial filtering were estimated using queen's first order neighborhood matrix. IRR= incident rate ratio; 95% CI = 95% confidence interval; ICE: R & I = index of concentration at the extremes: race & income; SDI = social deprivation index. SDI and ICE are composite variables. AIC = Akaike Information Criterion.

**Table S4.** Fully-adjusted negative binomial models for each O<sub>3</sub>-social factor combination vs. census tract CVD rate, additionally adjusted for the strongest predictor of CVD from the *other* two social factor categories (SDI in the economic/ material deprivation category, Violent Crime Rate in the exposure to crime category, and/or % non-Hispanic black in the racial/ ethnic composition category). Incident rate ratio (IRR) represents the change in CVD incidence rate per 1-IQR change in each covariate. Moran's I to assess spatial autocorrelation in residuals. N=1,981.

Negative Binomial Regression: O <sub>3</sub>						Negative Binomial GLM with Spatial Filtering: O <sub>3</sub>					
Exposures	IRR	(95% CI)	AIC	I	P	Exposures	IRR	(95% CI)	AIC	I	P
Pollutant	1.01	(0.99, 1.02)	38192	0.36	<0.0001	Pollutant	1.01	(0.99, 1.02)	37598	0.13	<0.0001
SDI	1.3	(1.27, 1.33)				SDI	1.32	(1.3, 1.35)			
Pollutant	0.99	(0.98, 1.01)	38406	0.37	<0.0001	Pollutant	1.01	(1, 1.03)	37737	0.13	<0.0001
ICE: R & I	0.75	(0.74, 0.77)				ICE: R & I	0.74	(1.01, 0.76)			
Pollutant	1.01	(1, 1.03)	38205	0.36	<0.0001	Pollutant	1.01	(1, 1.03)	37592	0.14	<0.0001
% < 200% FPL	1.33	(1.3, 1.36)				% < 200% FPL	1.33	(1.3, 1.36)			
Pollutant	1	(0.98, 1.01)	38388	0.35	<0.0001	Pollutant	0.99	(0.98, 1.01)	37742	0.12	<0.0001
Median Income	0.82	(0.81, 0.84)				Median Income	0.81	(1.01, 0.83)			
Pollutant	1.01	(0.99, 1.02)	38192	0.36	<0.0001	Pollutant	1.01	(0.99, 1.02)	37598	0.13	0.0001
Violent Crime	1.12	(1.1, 1.14)				Violent Crime	1.07	(1.05, 1.09)			
Pollutant	1	(0.99, 1.02)	38224	0.37	<0.0001	Pollutant	1.01	(1, 1.03)	37604	0.14	0.0001
Assault Rate	1.11	(1.09, 1.14)				Assault Rate	1.07	(1.05, 1.09)			
Pollutant	1.01	(1, 1.03)	38427	0.41	<0.0001	Pollutant	1	(0.99, 1.02)	37639	0.14	<0.0001
% non-Hispanic white	0.85	(0.83, 0.88)				% non-Hispanic white	0.87	(1.01, 0.9)			
Pollutant	1.01	(0.99, 1.02)	38192	0.36	<0.0001	Pollutant	1.01	(0.99, 1.02)	37598	0.13	0.0001
% non-Hispanic black	1.21	(1.18, 1.23)				% non-Hispanic black	1.2	(1.18, 1.23)			
Pollutant	1.02	(1, 1.04)	38535	0.4	<0.0001	Pollutant	1	(0.99, 1.02)	37703	0.14	<0.0001
% Hispanic	0.99	(0.97, 1.01)				% Hispanic	1.02	(1.01, 1.03)			

Moran's I and spatial filtering were estimated using queen's first order neighborhood matrix. IRR= incident rate ratio; 95% CI = 95% confidence interval; ICE: R & I = index of concentration at the extremes: race & income; SDI = social deprivation index. SDI and ICE are composite variables. AIC = Akaike Information Criterion.

**Table S5.** Descriptive statistics for air pollutants and social factors at UHF scale (N=34).

	Minimum	Mean	Maximum	Std Dev
Age-Adjusted CVD/100,000	868.4	1669.5	3013.19	555.66
PM <sub>2.5</sub>	8.84	10.43	13.72	1.17
O <sub>3</sub>	21.1	27.26	30.81	2.08
NO <sub>2</sub>	1.77	4.55	9.49	2.05
SO <sub>2</sub>	15.82	24.03	37.54	4.73
Factor1 'Violence & Physical Disorder'	-0.65	0.08	1.3	0.58
Factor2 'Crowding & Poor Resource Access'	-1.34	0.06	1.75	0.85
Factor3 'Noise & Air Pollution Complaints'	-0.77	0.31	4.56	1.05

**Table S6.** Pearson correlations of pollutants, social factors, and CVD rates at UHF scale (N=34)

	CVD	PM <sub>2.5</sub>	O <sub>3</sub>	NO <sub>2</sub>	SO <sub>2</sub>	Factor1	Factor2	Factor3
CVD	1.00							
PM <sub>2.5</sub>	-0.07	1.00						
O <sub>3</sub>	0.14	-0.94	1.00					
NO <sub>2</sub>	-0.09	0.93	-0.97	1.00				
SO <sub>2</sub>	0.02	0.76	-0.70	0.63	1.00			
Factor1	0.80	-0.06	0.09	-0.05	0.11	1.00		
Factor2	0.36	0.07	0.08	-0.02	0.15	0.01	1.00	
Factor3	-0.02	0.78	-0.75	0.78	0.42	0.02	-0.01	1.00

**Table S7.** Unadjusted negative binomial models regression models for UHF-area average pollutant concentrations and social stressors on age-adjusted CVD rates (not mutually adjusted). Incident rate ratio (IRR) represents the change in CVD incidence rate that occurs with a 1-IQR change in each covariate. N = 34.

	IRR	95% CI	AIC
NO <sub>2</sub> (ppb)	0.96	(0.85, 1.09)	525
PM <sub>2.5</sub> (µg/m <sup>3</sup> )	0.97	(0.84, 1.11)	526
SO <sub>2</sub> (ppb)	1.01	(0.89, 1.14)	526
Ozone (ppb)	1.05	(0.95, 1.16)	525
Factor 1	1.53	(1.37, 1.71)	492
Factor 2	1.16	(1.03, 1.31)	520
Factor 3	0.99	(0.88, 1.11)	526

IRR= incidence rate ratio. 95% CI= 95% Confidence Interval. AIC = Akaike Information Criterion.

**Table S8.** Mutually-adjusted negative binomial regression models for UHF-area average pollutant concentrations and social stressors on age-adjusted CVD rates. Incident rate ratio (IRR) represents the change in CVD incidence rate that occurs with a 1-IQR change in each covariate. N = 34.

	IRR	95% CI	AIC		IRR	95% CI	AIC
NO <sub>2</sub>	0.96	(0.89, 1.03)	492	PM <sub>2.5</sub>	0.96	(0.89, 1.04)	493
<b>Factor 1</b>	1.53	(1.37, 1.71)		<b>Factor 1</b>	1.53	(1.37, 1.71)	
NO <sub>2</sub>	0.95	(0.85, 1.06)	522	PM <sub>2.5</sub>	0.94	(0.83, 1.06)	521
<b>Factor 2</b>	1.16	(1.03, 1.31)		<b>Factor 2</b>	1.17	(1.04, 1.32)	
NO <sub>2</sub>	0.92	(0.76, 1.12)	527	PM <sub>2.5</sub>	0.94	(0.77, 1.15)	527
<b>Factor 3</b>	1.05	(0.88, 1.25)		<b>Factor 3</b>	1.03	(0.87, 1.22)	
	IRR	95% CI	AIC		IRR	95% CI	AIC
SO <sub>2</sub>	0.96	(0.89, 1.03)	492	O <sub>3</sub>	1.04	(0.98, 1.10)	492
<b>Factor 1</b>	1.55	(1.39, 1.73)		<b>Factor 1</b>	1.53	(1.37, 1.70)	
SO <sub>2</sub>	0.97	(0.86, 1.08)	522	O <sub>3</sub>	1.05	(0.96, 1.14)	521
<b>Factor 2</b>	1.17	(1.04, 1.33)		<b>Factor 2</b>	1.16	(1.03, 1.31)	
SO <sub>2</sub>	1.01	(0.89, 1.16)	528	O <sub>3</sub>	1.09	(0.95, 1.26)	526
<b>Factor 3</b>	0.99	(0.87, 1.12)		<b>Factor 3</b>	1.07	(0.91, 1.25)	

IRR= incidence rate ratio. 95% CI= 95% Confidence Interval. AIC = Akaike Information Criterion.

**Table S9.** Negative binomial regression models testing bivariate measures of association between CVD and pollutant or social stressor across UHF-34 neighborhoods. Moran's I to assess autocorrelation in model residuals.

Negative Binomial Regression						Negative Binomial GLM with Spatial Filtering					
Exposures	IRR	(95% CI)	AIC	I	P	Exposures	IRR	(95% CI)	AIC	I	P
NO <sub>2</sub>	0.96	(0.85, 1.09)	525	0.29	0.01	NO <sub>2</sub>	0.90	(0.82, 1)	517	0.16	0.10
PM <sub>2.5</sub>	0.97	(0.84, 1.11)	526	0.30	0.01	PM <sub>2.5</sub>	0.87	(0.78, 0.97)	514	0.10	0.23
SO <sub>2</sub>	1.01	(0.89, 1.14)	526	0.31	0.01	SO <sub>2</sub>	0.99	(0.9, 1.1)	512	0.12	0.19
O <sub>3</sub>	1.05	(0.95, 1.16)	525	0.29	0.01	O <sub>3</sub>	1.10	(1.02, 1.19)	516	0.17	0.09
Factor 1	1.53	(1.37, 1.71)	492	0.19	0.07	Factor 1	1.57	(1.37, 1.8)	493	0.18	0.09
Factor 2	1.16	(1.03, 1.31)	520	0.36	0.00	Factor 2	1.19	(1.1, 1.29)	498	0.05	0.34
Factor 3	0.99	(0.88, 1.11)	526	0.30	0.01	Factor 3	0.93	(1.05, 1.01)	518	0.18	0.08

Moran's I and spatial filtering were estimated using queen's first order neighborhood matrix. IRR= incident rate ratio; 95% CI = 95% confidence interval; AIC = Akaike Information Criterion.

**Table S10.** Fully-adjusted negative binomial regression models for NO<sub>2</sub>-social factor combination vs. census tract CVD and ischemic heart disease (IHD) rate, adjusted for SDI, Violent Crime Rate, and non-Hispanic black (except where each is the main social factor of interest in model). Incident rate ratio (IRR) represents the change in CVD or IHD incidence rate that occurs with a 1-IQR change in each covariate. N = 1,981.

Exposures	All CVD			IHD		
	IRR	(95% CI)	AIC	IRR	(95% CI)	AIC
NO <sub>2</sub>	0.99	(0.98, 1.01)	38192	0.95	(0.93, 0.97)	33282
SDI	1.30	(1.27, 1.33)		1.25	(1.22, 1.28)	
NO <sub>2</sub>	1.01	(0.99, 1.02)	38406	0.98	(0.96, 1)	33480
ICE: R & I	0.75	(0.74, 0.77)		0.88	(0.86, 0.91)	
NO <sub>2</sub>	0.99	(0.97, 1)	38205	0.95	(0.93, 0.96)	33287
% < 200% FPL	1.33	(1.3, 1.36)		1.27	(1.24, 1.31)	
NO <sub>2</sub>	1.00	(0.99, 1.02)	38387	0.96	(0.94, 0.98)	33315
Median Income	0.82	(0.81, 0.84)		0.83	(0.81, 0.85)	
NO <sub>2</sub>	0.99	(0.98, 1.01)	38192	0.95	(0.93, 0.97)	33282
Violent Crime	1.12	(1.1, 1.14)		1.12	(1.09, 1.14)	
NO <sub>2</sub>	1.00	(0.98, 1.01)	38224	0.96	(0.94, 0.98)	33310
Assault Rate	1.11	(1.09, 1.14)		1.10	(1.08, 1.13)	
NO <sub>2</sub>	0.98	(0.96, 0.99)	38423	0.95	(0.94, 0.97)	33283
% non-Hispanic white	0.85	(0.83, 0.88)		1.06	(1.02, 1.1)	
NO <sub>2</sub>	0.99	(0.98, 1.01)	38192	0.95	(0.93, 0.97)	33282
% non-Hispanic black	1.21	(1.18, 1.23)		0.96	(0.94, 0.98)	
NO <sub>2</sub>	0.97	(0.96, 0.99)	38530	0.96	(0.94, 0.97)	33287
% Hispanic	0.99	(0.97, 1.02)		1.03	(1, 1.06)	

IRR= incident rate ratio; 95% CI = 95% confidence interval; ICE: R & I = index of concentration at the extremes: race & income; SDI = social deprivation index. SDI and ICE are composite variables. AIC = Akaike Information Criterion.