Supplemental Online Content

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This supplemental material has been provided by the authors to give readers additional information about their work.

eMethods: CDC PLACES Multi-Level Regression and Poststratification Approach

CDC PLACES produced prevalence rates for each outcome through multi-level logistic regression models including individual-level age (13 categories), sex (2 categories), race or ethnicity (8 categories), and education (4 categories) from the Behavioral Risk Factor Surveillance System, county-level percentage of adults below 150% of the federal poverty level from the 5-year American Community Survey, and state-level and county-level random effects.[1] Model parameters were applied to the same age-race or ethnicity-sex categories (n = 208) for each small area to estimate the predicted probability for each outcome using the multi-level logistic model formula. Prevalence estimates were then calculated by multiplying the predicted probability for each outcome by the corresponding population for each area from 2010 Census population counts.

Validation studies conducted by the CDC at the county-level, city-level, and census tract-level have demonstrated strong concordance between model-based estimates and direct survey estimates.[2,3]

eTable 1: Detailed Description of the Environmental Burden Index

Domains	Indicators	Indicator Descriptions
Air Pollution	Ozone	Data Year: 2014-2016 Mean annual number of days with maximum 8-hour average ozone concentration over the National Ambient Air Quality Standard (NAAQS), averaged over three years.
	$PM_{2.5}$	Data Year: 2014-2016 Mean annual percent of days with daily 24-hour average $PM_{2.5}$ concentrations over the National Ambient Air Quality Standard (NAAQS), averaged over three years.
	Diesel Particulate Matter	Data Year: 2014 Diesel particulate matter concentrations in air, $\mu g/m^3$.
	Air Toxics Cancer Risk	Data Year: 2014 Lifetime cancer risk from inhalation of air toxics. Air toxics cancer risk is a composite measure assessing the cancer risk associated with inhaling 140 different hazardous air pollutants (HAPs).
Hazardous and Toxic Sites	National Priority List Sites	Data Year: 2021 Proportion of tract area within 1-mile buffer of EPA National Priority List (NPL) sites, which are designated by the U.S. EPA as priorities through hazard assessment, nomination by states or territories, or issuance of a health advisory by the Agency for Toxic Substance and Disease Registry.
	Toxic Release Inventory Sites	Data Year: 2021 Proportion of tract area within 1-mile buffer of Toxic Release Inventory (TRI) sites, facilities with 10 or more full time employees which operate within certain industrial sectors and annually either 1) manufacture more than 25,000 pounds of listed chemicals or 2) used more than 10,000 pounds of listed chemicals.
	Treatment, Storage, and Disposal Sites	Data Year: 2021 Proportion of tract area within 1-mile buffer of EPA Treatment, Storage, and Disposal Facilities (TSDF), sites responsible for handling hazardous wastes such as manufacturing by-products, cleaning fluids, or pesticides throughout the process of collection, transfer, and ultimately disposal.
	Risk Management Plan Sites	Data Year: 2021 Proportion of tract area within 1-mile buffer of EPA Risk Management Plan (RMP) sites, which include ~12,500 of the nation's most high-risk facilities that produce, use, or store significant amounts of certain highly toxic or flammable chemicals.
	Coal Mines	Data Year: 2021

		Proportion of tract area within 1-mile buffer of a coal mine.
	Lead Mines	Data Year: 2021 Proportion of tract area within 1-mile buffer of an active lead mine.
Built Environment	Recreational Parks	Data Year: 2020 Proportion of tract area not within 1-mile buffer of a park, recreational area, or public forest.
	Houses Built Pre-1980	Data Year: 2015-2019 Proportion of occupied housing units built prior to 1980. While lead-based paint was banned in 1978, housing built around that time or prior often contain underlying layers of lead-based paint.
	Walkability	Data Year: 2021 National Walkability Index Score, which quantifies "the safety and desirability of walking routes."
Transportation Infrastructure	High-Volume Roads	Data Year: 2020 Proportion of tract area within 1-mile buffer of a high-volume street or road, such as an interstate highway.
	Railways	Data Year: 2020 Proportion of tract area within 1-mile buffer of a railway, a significant source of noise pollution.
	Airports	Data Year: 2020 Proportion of tract area within 1-mile buffer of an airport, a significant source of noise pollution.
Water Pollution	Impaired Surface Water	Data Year: 2019 Percent of tract watershed area classified as impaired. Surface waters such as rivers and lakes are important for recreation and fishing, and impairment of these waters can constitute a potential nuisance or even hazard to nearby residents. Waters may be classified as impaired due to elevated levels of waterborne pathogens or significant contamination by toxic substances.

eTable 2: Detailed Description of the Social Vulnerability Index

Domains	Indicators (2015-2019)	Indicator Descriptions
Racial/Ethnic Minority Status	Minority Status	Percent of population that is a racial or ethnic minority (all persons except White, non-Hispanics).
Socioeconomic Status	Poverty	Percent of population with income below 200% of federal poverty level.
	No High School Diploma	Percent of population (age 25+) with no high school diploma.
	Unemployment	Percent of population age 16 and older who are unemployed.
	Housing Tenure	Percent of housing units that are renter-occupied.
	Housing Burdened Lower-Income Households	Percent of households with annual income less than $75,000 who are considered burdened by housing costs (pay greater than 30% of monthly income on housing expenses).
	Lack of Health Insurance	Percent of civilian, noninstitutionalized population who have no health insurance.
	Lack of Broadband Access	Percent of households with no internet subscription.
Household Characteristics	Age 65 and Older	Percent of population aged 65 and older.
	Age 17 and Younger	Percent of population aged 17 and younger.
	Civilian with a Disability	Percent of civilian, noninstitutionalized population with a disability.
	Speaks English "Less than Well"	Percent of persons (age 5 and older) who speak English "less than well."
Housing Type	Group Quarters	Percentage of persons living in group quarters (includes college residence halls, residential treatment centers, group homes, military barracks, correctional facilities, and worker's dormitories).
	Mobile Homes	Percentage of total housing units designated as mobile homes.

eTable 3: Cardiovascular Risk Factor and Disease Prevalence by Neighborhood Environmental Burden and Social Vulnerability[a]

Outcomes	Adjusted Risk Difference, % (95% CI)[b]				Interaction P Value[e]
	Social Vulnerability Index Quartile				
	First[c] (Lowest)	Second	Third	Fourth[d] (Highest)	
Cardiovascular Risk Factors					
Hypertension	0.13 (0.08-0.18)	0.16 (0.11-0.21)	0.19 (0.13-0.25)	0.49 (0.40-0.57)	<0.001
Diabetes	0.05 (0.02-0.07)	0.10 (0.07-0.13)	0.16 (0.11-0.20)	0.44 (0.37-0.50)	<0.001
Obesity	0.05 (0.00-0.11)	0.10 (0.04-0.15)	0.17 (0.10-0.24)	0.52 (0.42-0.62)	<0.001
Cardiovascular Diseases					
Coronary Heart Disease	0.05 (0.03-0.07)	0.06 (0.05-0.08)	0.06 (0.04-0.08)	0.16 (0.13-0.20)	<0.001
Stroke	0.02 (0.01-0.03)	0.03 (0.02-0.04)	0.03 (0.02-0.05)	0.13 (0.10-0.15)	<0.001

[a] Estimates were derived from mixed-effects linear regression models weighted for population size, including county-level random effects, and adjusting for social vulnerability index (SVI) quartile, age (% 18-29, 30-44, 40-64, and 65+ years), sex (% female), rurality, region (Midwest, Northeast, South, or West), and health care access (number of cardiovascular disease physicians per 100,000 population, number of primary care physicians per 100,000 population, and % of adults having received a routine checkup last year). Estimates indicate increase in adjusted risk of cardiovascular risk factor and disease prevalence per increase in environmental burden quartile.

[b] Per increase in environmental burden quartile.

[c] Least socially vulnerable neighborhoods.

[d] Most socially vulnerable neighborhoods.

[e] Interaction between environmental burden quartile and SVI quartile.

eTable 4: Domains of Environmental Burden and Cardiovascular Risk Factor and Disease Prevalence by Neighborhood Social Vulnerability[a,b]

Outcomes	Air Pollution	Hazardous and Toxic Sites	Built Environment	Transportation Infrastructure	Water Pollution
Adjusted Risk Difference, % (95% CI)[c]					
Fourth SVI Quartile (Highest)					
Hypertension	0.43 (0.27, 0.60)	0.22 (0.16, 0.28)	0.20 (0.12, 0.28)	0.12 (0.03, 0.21)	0.17 (0.08, 0.26)
Diabetes	0.52 (0.37, 0.66)	0.17 (0.12, 0.22)	0.09 (0.02, 0.16)	0.12 (0.04, 0.19)	0.17 (0.07, 0.27)
Obesity	0.45 (0.23, 0.67)	0.24 (0.17, 0.30)	0.23 (0.12, 0.34)	0.12 (0.01, 0.22)	0.28 (0.15, 0.41)
Coronary Heart Disease	0.07 (0.01, 0.13)	0.07 (0.05, 0.10)	0.05 (0.01, 0.09)	0.06 (0.02, 0.09)	0.07 (0.03, 0.10)
Stroke	0.10 (0.06, 0.14)	0.06 (0.04, 0.07)	0.02 (-0.01, 0.04)	0.04 (0.02, 0.07)	0.03 (0.00, 0.05)
Third SVI Quartile					
Hypertension	0.04 (-0.08, 0.16)	0.08 (0.04, 0.13)	0.54 (0.46, 0.62)	0.06 (0.02, 0.11)	0.01 (-0.05, 0.08)
Diabetes	0.15 (0.08, 0.22)	0.05 (0.02, 0.08)	0.29 (0.24, 0.35)	0.05 (0.02, 0.08)	0.05 (0.00, 0.11)
Obesity	-0.10 (-0.25, 0.05)	0.09 (0.03, 0.15)	0.57 (0.47, 0.66)	0.04 (-0.02, 0.10)	0.06 (-0.04, 0.16)
Coronary Heart Disease	-0.04 (-0.08, 0.01)	0.02 (0.01, 0.04)	0.19 (0.15, 0.22)	0.02 (0.01, 0.04)	0.04 (0.01, 0.06)
Stroke	0.00 (-0.02, 0.02)	0.01 (0.00, 0.02)	0.10 (0.08, 0.12)	0.02 (0.01, 0.03)	0.00 (-0.01, 0.01)
Second SVI Quartile					
Hypertension	-0.04 (-0.14, 0.06)	0.06 (0.03, 0.10)	0.58 (0.53, 0.63)	0.08 (0.04, 0.12)	-0.09 (-0.15, -0.04)
Diabetes	0.06 (0.00, 0.12)	0.03 (0.01, 0.05)	0.28 (0.25, 0.31)	0.04 (0.02, 0.06)	-0.02 (-0.06, 0.01)
Obesity	-0.18 (-0.31, -0.05)	0.07 (0.02, 0.11)	0.55 (0.48, 0.62)	0.04 (-0.01, 0.09)	-0.10 (-0.17, -0.03)
Coronary Heart Disease	-0.02 (-0.06, 0.01)	0.02 (0.00, 0.03)	0.21 (0.19, 0.23)	0.04 (0.02, 0.05)	0.02 (0.00, 0.04)
Stroke	-0.01 (-0.02, 0.01)	0.01 (0.00, 0.02)	0.10 (0.09, 0.11)	0.02 (0.01, 0.02)	-0.01 (-0.02, 0.00)
First SVI Quartile (Lowest)					
Hypertension	-0.09 (-0.22, 0.03)	0.07 (0.03, 0.10)	0.57 (0.51, 0.63)	0.05 (0.01, 0.09)	-0.14 (-0.22, -0.06)
Diabetes	-0.01 (-0.08, 0.05)	0.03 (0.01, 0.05)	0.21 (0.19, 0.24)	0.01 (-0.01, 0.03)	-0.09 (-0.13, -0.04)

Obesity	-0.31 (-0.44, -0.17)	0.04 (0.00, 0.08)	0.50 (0.44, 0.55)	0.04 (0.00, 0.08)	-0.16 (-0.26, -0.06)
Coronary Heart Disease	-0.02 (-0.06, 0.02)	0.02 (0.01, 0.03)	0.20 (0.17, 0.22)	0.02 (0.01, 0.03)	-0.01 (-0.03, 0.01)
Stroke	-0.01 (-0.03, 0.00)	0.01 (0.00, 0.02)	0.10 (0.09, 0.11)	0.01 (0.00, 0.02)	-0.02 (-0.03, -0.01)

SVI: Social Vulnerability Index

[a] Estimates were derived from mixed-effects linear regression models weighted for population size and including county-level random effects.

[b] Adjusted differences were obtained from models that adjusted for age (% 18-29, 30-44, 40-64, and 65+ years), sex (% female), rurality, region (Midwest, Northeast, South, or West), and health care access (number of cardiovascular disease physicians per 100,000 population, number of primary care physicians per 100,000 population, and % of adults having received a routine checkup last year).

[c] Per increase in quartile of each environmental burden domain.

eFigure 1: Neighborhood Environmental Burden and Arthritis Prevalence[a,b]

EB Quartile	Prevalence, % mean (SD)	Difference, % (95%CI)	P Value	
First	26.54 (6.7)	0 [Reference]	-	
Second	25.99 (6.4)	-0.16 (-0.32–0.01)	0.06	
Third	25.56 (6.3)	-0.12 (-0.34–0.09)	0.26	
Fourth	25.10 (6.8)	-0.07 (-0.38–0.25)	0.69	
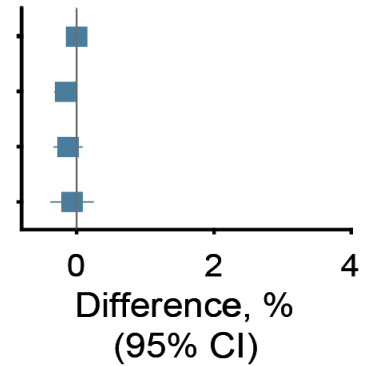
Difference, %
(95% CI)

EB: Environmental Burden, Adj. Difference: Adjusted Difference
[a] Arthritis was defined based on self-report of a clinical diagnosis of arthritis, rheumatoid arthritis, gout, lupus, or fibromyalgia by a health care provider.
[b] Differences between neighborhoods by environmental burden quartile were estimated using mixed-effects linear regression models weighted for population size and including county-level random effects.

eFigure 2: Neighborhood Environmental Burden and Cardiovascular Risk Factor and Disease Prevalence Adjusting for Continuous Social Vulnerability Index[a,b,c]
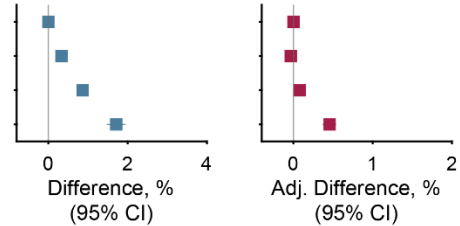
A. Hypertension

EB Quartile	Prevalence, % mean (SD)	Difference, % (95%CI)	P Value	Adj. Difference, % (95%CI)	P Value
First	32.14 (7.0)	0 [Reference]	-	0 [Reference]	-
Second	32.19 (6.9)	0.24 (0.04–0.44)	0.02	0.03 (-0.05–0.11)	0.43
Third	32.35 (7.1)	0.74 (0.48–1.00)	<.001	0.14 (0.05–0.24)	<.001
Fourth	32.84 (8.0)	1.43 (1.02–1.85)	<.001	0.59 (0.46–0.71)	<.001
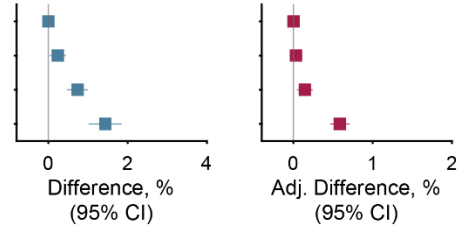
B. Diabetes

EB Quartile	Prevalence, % mean (SD)	Difference, % (95%CI)	P Value	Adj. Difference, % (95%CI)	P Value
First	10.68 (3.3)	0 [Reference]	-	0 [Reference]	-
Second	10.81 (3.4)	0.33 (0.22–0.44)	<.001	-0.03 (-0.09–0.02)	0.23
Third	11.25 (3.7)	0.86 (0.72–1.01)	<.001	0.08 (0.01–0.15)	0.02
Fourth	12.19 (4.3)	1.71 (1.48–1.95)	<.001	0.46 (0.37–0.54)	<.001

C. Obesity

| EB Quartile	Prevalence, % mean (SD)	Difference, % (95%CI)	P Value	Adj. Difference, % (95%CI)	P Value
First	30.87 (6.1)	0 [Reference]	-	0 [Reference]	-
Second	31.83 (6.4)	0.75 (0.56–0.95)	<.001	-0.14 (-0.24–-0.04)	0.01
Third	32.42 (6.9)	1.68 (1.46–1.91)	<.001	-0.06 (-0.20–0.08)	0.40
Fourth	33.58 (7.6)	3.32 (2.99–3.66)	<.001	0.52 (0.35–0.68)	<.001
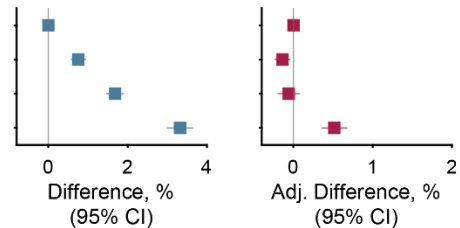
D. Coronary Heart Disease

EB Quartile	Prevalence, % mean (SD)	Difference, % (95%CI)	P Value	Adj. Difference, % (95%CI)	P Value
First	6.82 (2.4)	0 [Reference]	-	0 [Reference]	-
Second	6.63 (2.1)	0.10 (0.04–0.17)	<.001	0.02 (-0.01–0.05)	0.17
Third	6.58 (2.0)	0.27 (0.18–0.35)	<.001	0.06 (0.02–0.10)	<.001
Fourth	6.67 (2.2)	0.54 (0.42–0.66)	<.001	0.19 (0.14–0.25)	<.001
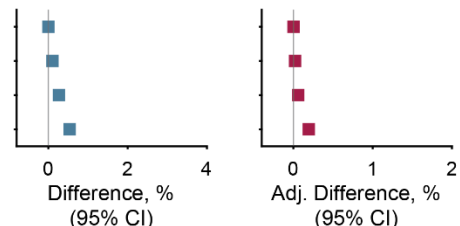
E. Stroke

EB Quartile	Prevalence, % mean (SD)	Difference, % (95%CI)	P Value	Adj. Difference, % (95%CI)	P Value
First	3.31 (1.1)	0 [Reference]	-	0 [Reference]	-
Second	3.31 (1.1)	0.11 (0.07–0.15)	<.001	-0.00 (-0.02–0.02)	0.96
Third	3.42 (1.2)	0.27 (0.22–0.32)	<.001	0.03 (0.01–0.05)	0.01
Fourth	3.65 (1.5)	0.51 (0.43–0.59)	<.001	0.13 (0.10–0.17)	<.001
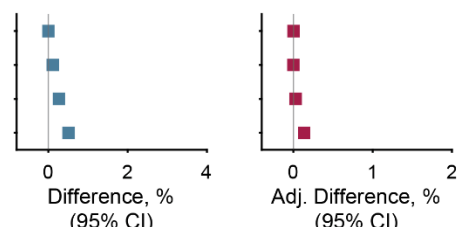
EB: Environmental Burden, Adj. Difference: Adjusted Difference
[a] Differences between neighborhoods by environmental burden quartile were estimated using mixed-effects linear regression models weighted for population size and including county-level random effects.
[b] Adjusted differences were obtained from models that adjusted for social vulnerability index, age (% 18-29, 30-44, 40-64, and 65+ years), sex (% female), rurality, region (Midwest, Northeast, South, or West), and health care access (number of cardiovascular disease physicians per 100,000 population, number of primary care physicians per 100,000 population, and % of adults having received a routine checkup last year).
[c] Error bars represent 95% confidence intervals.

eFigure 3: Neighborhood Environmental Burden and Cardiovascular Risk Factor and Disease Prevalence Adjusting for Current Smoking Rate[a,b,c]
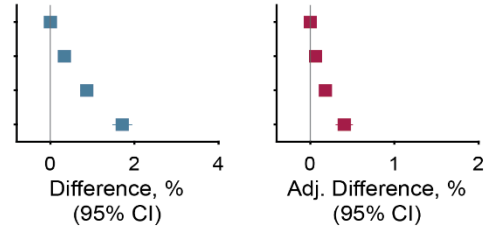
A. Hypertension

EB Quartile	Prevalence, % mean (SD)	Difference, % (95%CI)	P Value	Adj. Difference, % (95%CI)	P Value
First	32.14 (7.0)	0 [Reference]	-	0 [Reference]	-
Second	32.18 (6.9)	0.24 (0.04–0.44)	0.02	0.17 (0.11–0.24)	<.001
Third	32.34 (7.1)	0.74 (0.48–1.00)	<.001	0.29 (0.22–0.36)	<.001
Fourth	32.83 (8.0)	1.43 (1.02–1.85)	<.001	0.51 (0.44–0.58)	<.001
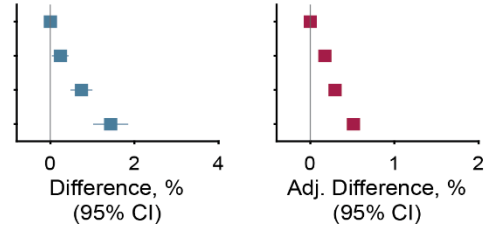
B. Diabetes

EB Quartile	Prevalence, % mean (SD)	Difference, % (95%CI)	P Value	Adj. Difference, % (95%CI)	P Value
First	10.68 (3.3)	0 [Reference]	-	0 [Reference]	-
Second	10.81 (3.4)	0.33 (0.22–0.44)	<.001	0.06 (0.02–0.11)	0.01
Third	11.25 (3.7)	0.86 (0.72–1.01)	<.001	0.18 (0.12–0.24)	<.001
Fourth	12.19 (4.3)	1.71 (1.48–1.95)	<.001	0.40 (0.30–0.51)	<.001

C. Obesity

| EB Quartile	Prevalence, % mean (SD)	Difference, % (95%CI)	P Value	Adj. Difference, % (95%CI)	P Value
First	30.86 (6.1)	0 [Reference]	-	0 [Reference]	-
Second	31.82 (6.4)	0.75 (0.56–0.95)	<.001	0.01 (-0.08–0.10)	0.86
Third	32.42 (6.9)	1.68 (1.46–1.91)	<.001	0.08 (-0.04–0.19)	0.17
Fourth	33.57 (7.6)	3.32 (2.99–3.66)	<.001	0.35 (0.25–0.46)	<.001
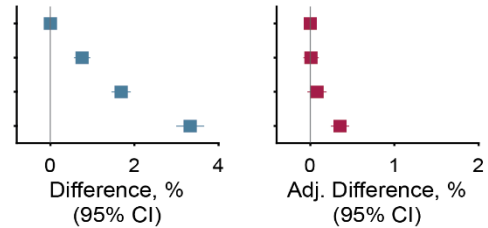
D. Coronary Heart Disease

EB Quartile	Prevalence, % mean (SD)	Difference, % (95%CI)	P Value	Adj. Difference, % (95%CI)	P Value
First	6.82 (2.4)	0 [Reference]	-	0 [Reference]	-
Second	6.63 (2.1)	0.10 (0.04–0.17)	<.001	0.06 (0.04–0.09)	<.001
Third	6.57 (2.1)	0.27 (0.18–0.35)	<.001	0.10 (0.07–0.13)	<.001
Fourth	6.66 (2.2)	0.54 (0.42–0.66)	<.001	0.16 (0.12–0.19)	<.001
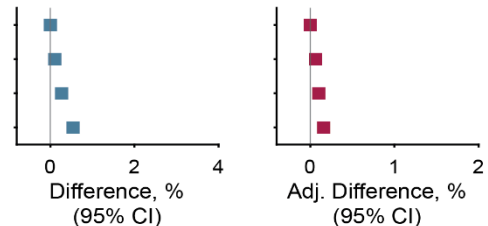
E. Stroke

EB Quartile	Prevalence, % mean (SD)	Difference, % (95%CI)	P Value	Adj. Difference, % (95%CI)	P Value
First	3.31 (1.1)	0 [Reference]	-	0 [Reference]	-
Second	3.31 (1.1)	0.11 (0.07–0.15)	<.001	0.04 (0.02–0.05)	<.001
Third	3.42 (1.2)	0.27 (0.22–0.32)	<.001	0.07 (0.05–0.08)	<.001
Fourth	3.65 (1.5)	0.51 (0.43–0.59)	<.001	0.12 (0.10–0.13)	<.001
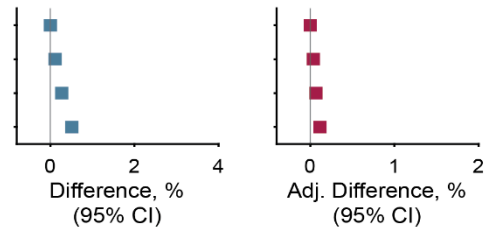
EB: Environmental Burden; Adj. Difference: Adjusted Difference
[a] Differences between neighborhoods by environmental burden quartile were estimated using mixed-effects linear regression models weighted for population size and including county-level random effects.
[b] Adjusted differences were obtained from models that adjusted for social vulnerability index quartile, age (% 18-29, 30-44, 40-64, and 65+ years), sex (% female), rurality, region (Midwest, Northeast, South, or West), health care access (number of cardiovascular disease physicians per 100,000 population, number of primary care physicians per 100,000 population, and % of adults having received a routine checkup last year), and rate of current smoking among adults (smoked ≥ 100 cigarettes in lifetime and currently smoke every day or some days).
[c] Error bars represent 95% confidence intervals.

eReferences

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