

**Neighborhood-level Measures of Socioeconomic Status are More Correlated with Individual-level Measures in Urban Areas
Compared to Less Urban Areas**

Supplementary Materials

Table of Contents

Supplemental Table 1. Census data variables and factor score coefficients used to calculate the 2013 Area Deprivation Index (ADI)

Supplemental Table 2. Characteristics of respondents missing household income by county, SEPA-HHS 2010, 2012 and BLS-HHS 2011 (N = 4,764)

Supplemental Table 3. Characteristics of respondents missing address or geocode information by county, SEPA-HHS 2010, 2012 and BLS-HHS 2011 (N = 1,673)

Supplemental Table 4. Adjusted relative risk (RR) of fair/poor health associated with individual-level SES measures

Supplemental Table 5. Adjusted relative risk (RR) of obesity associated with individual-level SES measures

Supplemental Table 6. Relative risk (RR) of fair/poor health associated with obesity and the magnitude of confounding by individual-level SES.

Supplemental Table 7. Comparison of the agreement (Spearman's ρ) between relative income and neighborhood advantage aggregated at the level of census tracts and Zip Code Tabulation Areas (ZCTAs)

Supplemental Fig. 1. Counties surveyed by SEPA-HHS and BLS-HHS shaded by urban/rural classification

Supplemental Fig. 2. County-level agreement (Spearman's ρ) between educational attainment and tract-level neighborhood advantage

Supplemental Fig. 3. County-level agreement (Spearman's ρ) between relative income and ZCTA-level neighborhood advantage

Supplemental Table 1. Census data variables and factor score coefficients used to calculate 2013 Area Deprivation Index (ADI)^a

Domain	Variable	Coefficient
Education	% Population aged 25 years or older with less than 9 years of education	0.0849
	% Population aged 25 years or older with at least a high school diploma	-0.0970
Income/ employment	Median family income in US dollars	-0.0977
	Income disparity ^b	0.0936
	% Families below federal poverty level	0.0977
	% Population below 150% of federal poverty level	0.1037
	% Civilian labor force population aged 16 years or older who are unemployed	0.0806
	% Employed population aged 16 years or older in white-collar occupations	-0.0874
Housing	Median home value in US dollars	-0.0688
	Median gross rent in US dollars	-0.0781
	Median monthly mortgage in US dollars	-0.0770
	% Owner-occupied housing units	-0.0615
	% Occupied housing units without complete plumbing (log)	0.0510
Household characteristics	% Single-parent households with children younger than 18	0.0719
	% Households without a motor vehicle	0.0694
	% Households without a telephone	0.0877
	% Households with more than one person per room	0.0556

^a2013 ADI was calculated using data from the American Community Survey 5-year estimates from 2009-2013 by summing variables weighted by their respective factor score coefficients; ^bIncome disparity defined as the log of 100*ratio of households with <\$10,000 income to number of households with ≥\$50,000 income

Supplemental Table 2. Characteristics of respondents missing household income by county, SEPA-HHS 2010, 2012 and BLS-HHS 2011 (N = 4,764)

Survey cycle(s)	SEPA-HHS 2010 & 2012					BLS-HHS 2011		
	Philadelphia (n = 1,694)	Bucks (n = 523)	Chester (n = 605)	Delaware (n = 621)	Montgomery (n = 830)	Berks (n = 175)	Lancaster (n = 172)	Schuylkill (n = 144)
County								
Age, median (IQR), y	58 (48-71)	58 (49-71)	57 (49-69)	58 (49-72)	58 (48-71)	61 (48-73)	60 (49-72)	62 (49-75)
Female, No. (%)	1,167 (68.9)	362 (69.2)	398 (65.8)	425 (68.4)	568 (68.4)	108 (61.7)	98 (57)	93 (64.6)
Race ^a , No. (%)								
White	701 (41.4)	455 (87)	512 (84.6)	489 (78.7)	706 (85.1)	156 (89.1)	153 (89.0)	134 (93.1)
Black	637 (37.6)	6 (1.1)	31 (5.1)	72 (11.6)	36 (4.3)	2 (1.1)	3 (1.7)	1 (0.7)
Hispanic	148 (8.7)	14 (2.7)	14 (2.3)	5 (0.8)	15 (1.8)	7 (4.0)	3 (1.7)	3 (2.1)
Other	87 (5.1)	16 (3.1)	18 (3.0)	17 (2.7)	26 (3.1)	2 (1.1)	2 (1.2)	1 (0.7)
Missing	121 (7.1)	32 (6.1)	30 (5.0)	38 (6.1)	47 (5.7)	8 (4.6)	11 (6.4)	5 (3.5)
Education ^b , No. (%)								
College +	375 (22.1)	219 (41.9)	316 (52.2)	264 (42.5)	428 (51.6)	39 (22.3)	42 (24.4)	19 (13.2)
Some college	341 (20.1)	110 (21.0)	109 (18.0)	127 (20.5)	154 (18.6)	35 (20.0)	30 (17.4)	31 (21.5)
High school	669 (39.5)	153 (29.3)	140 (23.1)	193 (31.1)	195 (23.5)	73 (41.7)	75 (43.6)	75 (52.1)
< High school	270 (15.9)	35 (6.7)	35 (5.8)	25 (4.0)	37 (4.5)	25 (14.3)	23 (13.4)	17 (11.8)

^a *White* refers to Non-Hispanic white race/ethnicity and *black* refers to Non-Hispanic black race/ethnicity; ^b *Education* refers to respondent's educational attainment

Supplemental Table 3. Characteristics of respondents missing address or geocode information by county, SEPA-HHS 2010, 2012 and BLS-HHS 2011 (N = 1,673)

Survey cycle(s)	SEPA-HHS 2010 & 2012					BLS-HHS 2011		
	Philadelphia (n = 633)	Bucks (n = 158)	Chester (n = 175)	Delaware (n = 239)	Montgomery (n = 213)	Berks (n = 82)	Lancaster (n = 82)	Schuylkill (n = 91)
Age, median (IQR), y	50 (40-59)	50 (42-61)	52 (45-62)	52 (41-60)	50 (41-59)	52 (42-62)	50 (41-61)	56 (48-67)
Female, No. (%)	442 (69.8)	84 (53.2)	102 (58.3)	152 (63.6)	134 (62.9)	43 (52.4)	39 (47.6)	37 (40.7)
<i>Race</i> ^a , No. (%)								
White	218 (34.4)	133 (84.2)	139 (79.4)	160 (66.9)	168 (78.9)	65 (79.3)	69 (84.1)	86 (94.5)
Black	316 (49.9)	11 (7.9)	16 (9.1)	58 (24.3)	23 (10.8)	2 (2.4)	2 (2.4)	0
Hispanic	54 (8.5)	7 (4.4)	12 (6.9)	10 (4.2)	10 (4.7)	10 (12.2)	8 (9.8)	1 (1.1)
Other	45 (7.1)	7 (4.4)	8 (4.6)	11 (4.6)	12 (5.6)	5 (6.1)	3 (3.7)	4 (4.4)
<i>Rel. income</i> ^b , No. (%)								
High (>5)	117 (18.5)	64 (40.5)	83 (47.4)	89 (37.2)	92 (43.2)	17 (20.7)	20 (24.4)	12 (13.2)
Middle (2-5)	236 (37.3)	57 (36.1)	58 (33.1)	87 (36.4)	94 (44.1)	43 (52.4)	36 (43.9)	52 (57.1)
Low (<2)	280 (44.2)	37 (23.4)	34 (19.4)	63 (26.4)	27 (12.7)	22 (26.8)	26 (31.7)	27 (29.7)
<i>Education</i> ^c , No. (%)								
College +	194 (30.6)	63 (39.9)	100 (57.1)	105 (43.9)	117 (54.9)	27 (32.9)	27 (32.9)	10 (11.0)
Some college	137 (21.6)	41 (25.9)	27 (15.4)	54 (22.6)	49 (23.0)	10 (12.2)	17 (20.7)	18 (19.8)
High school	221 (34.9)	47 (29.7)	39 (22.3)	67 (28.0)	41 (19.2)	27 (32.9)	25 (30.5)	53 (58.2)
< High school	81 (12.8)	7 (4.4)	9 (5.1)	13 (5.4)	6 (2.8)	18 (22.0)	13 (15.9)	10 (11.0)

^a *White* refers to Non-Hispanic white race/ethnicity and *black* refers to Non-Hispanic black race/ethnicity; ^b*Rel. income* (relative income) refers to the factor by which reported household income is above or below the federal poverty line determined for that household; ^c*Education* refers to respondent's educational attainment

Supplemental Table 4. Adjusted^a relative risk (RR) of fair/poor health associated with individual-level SES measures. Significant results ($p < 0.05$) are bolded.

Individual-level SES indicator	Philadelphia β (95% CI) ^b	Bucks β (95% CI)	Chester β (95% CI)	Delaware β (95% CI)	Montgomery β (95% CI)	Berks β (95% CI)	Lancaster β (95% CI)	Schuylkill β (95% CI)
Relative income								
Q1 (lowest)	Reference	Reference	Reference	Reference	Reference	Reference	Reference	Reference
Q2	0.75 (0.67, 0.83)	0.42 (0.31, 0.58)	0.48 (0.34, 0.67)	0.51 (0.39, 0.67)	0.67 (0.52, 0.86)	0.54 (0.37, 0.78)	0.48 (0.31, 0.76)	0.49 (0.35, 0.69)
Q3	0.50 (0.44, 0.58)	0.41 (0.29, 0.59)	0.30 (0.19, 0.47)	0.44 (0.32, 0.61)	0.32 (0.22, 0.46)	0.43 (0.28, 0.67)	0.46 (0.28, 0.75)	0.31 (0.20, 0.47)
Q4 (highest)	0.35 (0.28, 0.43)	0.35 (0.23, 0.54)	0.28 (0.16, 0.48)	0.28 (0.18, 0.45)	0.24 (0.15, 0.38)	0.16 (0.07, 0.33)	0.30 (0.15, 0.59)	0.28 (0.17, 0.47)
Education								
College +	Reference	Reference	Reference	Reference	Reference	Reference	Reference	Reference
Some college	1.37 (1.15, 1.64)	1.63 (1.16, 2.28)	1.36 (0.95, 1.94)	2.03 (1.43, 2.89)	1.24 (0.90, 1.69)	1.09 (0.61, 1.94)	1.59 (0.82, 3.1)	0.91 (0.53, 1.57)
High school	1.48 (1.25, 1.75)	1.65 (1.17, 2.32)	1.34 (0.95, 1.87)	2.15 (1.52, 3.03)	1.34 (1.01, 1.77)	1.54 (0.96, 2.47)	1.73 (0.98, 3.06)	1.06 (0.66, 1.70)
< High school	2.07 (1.72, 2.49)	1.75 (0.99, 3.1)	1.40 (0.85, 2.32)	3.03 (1.96, 4.68)	1.59 (1.04, 2.42)	1.91 (1.14, 3.19)	1.88 (0.95, 3.72)	1.42 (0.83, 2.43)

^aAll models adjusted for age, sex, race/ethnicity, neighborhood advantage, relative income, and education; ^bCI denotes confidence interval

Supplemental Table 5. Adjusted^a relative risk (RR) of obesity associated with individual-level SES measures. Significant results ($p < 0.05$) are bolded.

Individual-level SES indicator	Philadelphia β (95% CI) ^b	Bucks β (95% CI)	Chester β (95% CI)	Delaware β (95% CI)	Montgomery β (95% CI)	Berks β (95% CI)	Lancaster β (95% CI)	Schuylkill β (95% CI)
Relative income								
Q1 (lowest)	Reference	Reference	Reference	Reference	Reference	Reference	Reference	Reference
Q2	1.00 (0.91, 1.09)	0.77 (0.61, 0.98)	0.81 (0.65, 1.02)	0.95 (0.80, 1.14)	0.81 (0.67, 0.97)	0.68 (0.50, 0.93)	0.90 (0.67, 1.22)	0.93 (0.70, 1.24)
Q3	0.97 (0.87, 1.07)	0.96 (0.76, 1.20)	0.73 (0.58, 0.93)	0.83 (0.67, 1.02)	0.78 (0.64, 0.95)	0.87 (0.65, 1.16)	0.82 (0.60, 1.13)	0.97 (0.73, 1.29)
Q4 (highest)	0.84 (0.74, 0.95)	0.89 (0.69, 1.14)	0.77 (0.58, 1.02)	0.78 (0.61, 0.98)	0.72 (0.58, 0.90)	0.63 (0.44, 0.91)	0.84 (0.59, 1.20)	0.79 (0.57, 1.10)
Education								
College +	Reference	Reference	Reference	Reference	Reference	Reference	Reference	Reference
Some college	1.28 (1.15, 1.43)	1.18 (0.96, 1.46)	1.08 (0.86, 1.36)	1.15 (0.96, 1.39)	1.16 (0.96, 1.39)	1.09 (0.77, 1.55)	1.26 (0.87, 1.80)	0.88 (0.63, 1.23)
High school	1.16 (1.04, 1.29)	1.03 (0.83, 1.27)	1.06 (0.85, 1.33)	1.20 (1.00, 1.44)	1.24 (1.04, 1.48)	1.26 (0.94, 1.71)	1.26 (0.92, 1.74)	0.94 (0.70, 1.26)
< High school	1.12 (0.97, 1.30)	1.93 (1.38, 2.70)	1.02 (0.68, 1.55)	1.13 (0.79, 1.63)	1.44 (1.04, 1.99)	1.68 (1.16, 2.43)	1.56 (1.04, 2.35)	0.74 (0.46, 1.21)

^aAll models adjusted for age, sex, race/ethnicity, neighborhood advantage, relative income, and education; ^bCI denotes confidence interval

Supplemental Table 6. Relative risk (RR) of fair/poor health associated with obesity and the magnitude of confounding by individual-level SES.

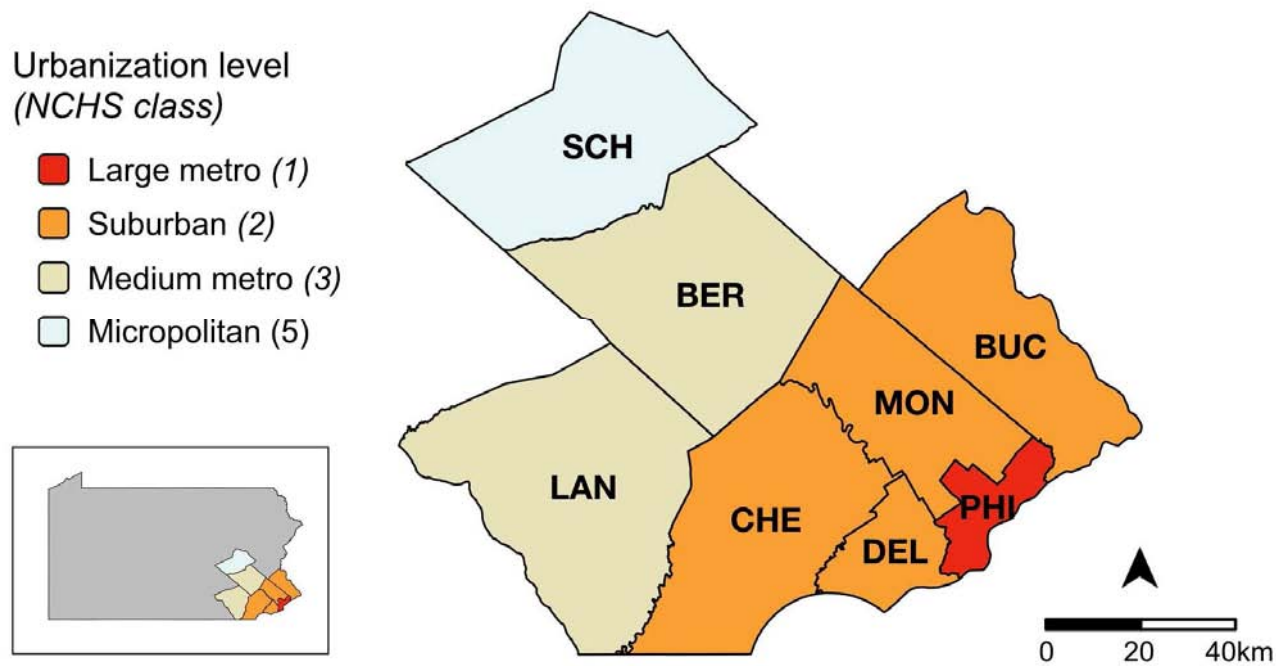
County	Urbanicity (NCHS class)	RR of fair/poor health associated with obesity		Magnitude of confounding (%) ^c
		Model 1 ^a , RR ₁ (95% CI) ^b	Model 2, RR ₂ (95% CI)	
Philadelphia	Urban (1)	1.60 (1.45, 1.76)	1.55 (1.41, 1.70)	3.2
Bucks	Suburban (2)	2.07 (1.64, 2.62)	1.96 (1.55, 2.48)	5.6
Chester	Suburban (2)	2.40 (1.85, 3.10)	2.19 (1.7, 2.83)	9.6
Delaware	Suburban (2)	1.74 (1.40, 2.16)	1.60 (1.30, 1.97)	8.8
Montgomery	Suburban (2)	1.95 (1.57, 2.44)	1.73 (1.39, 2.15)	12.7
Berks	Medium metro (3)	2.05 (1.52, 2.76)	1.68 (1.25, 2.25)	22.0
Lancaster	Medium metro (3)	1.85 (1.32, 2.61)	1.61 (1.14, 2.27)	14.9

^aModel 1 was a Poisson regression model with robust variance estimates with covariate adjustments for respondent sex, age, race/ethnicity, and neighborhood advantage categorized into quartiles. Model 2 included all covariates included in Model 1 with additional adjustment for relative income quartiles and respondent education. ^bCI indicates confidence interval. ^cMagnitude of confounding by individual-level SES when only neighborhood-level measures were accounted for, estimated as a percentage: $100 * (RR_1 - RR_2) / RR_2$, where RR_1 and RR_2 were estimated from models 1 and 2, respectively.

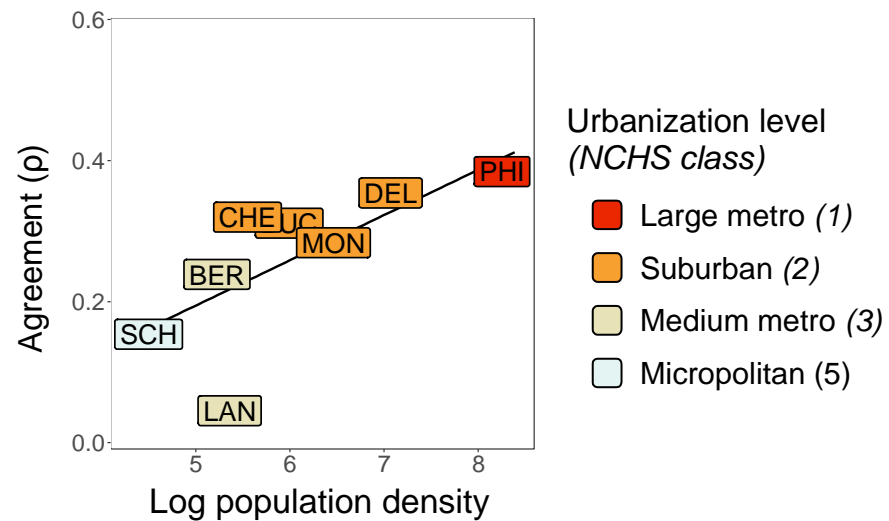
Supplemental Table 7. Comparison of the agreement (Spearman's ρ) between relative income and census tract-level vs. ZIP Code Tabulation Area (ZCTA)-level neighborhood advantage^a

County	Census tracts	ZCTAs
Philadelphia	0.472	0.414
Bucks	0.332	0.313
Chester	0.390	0.303
Delaware	0.447	0.453
Montgomery	0.356	0.277
Berks	0.308	0.266
Lancaster	0.156	0.058
Schuylkill	0.255	0.232

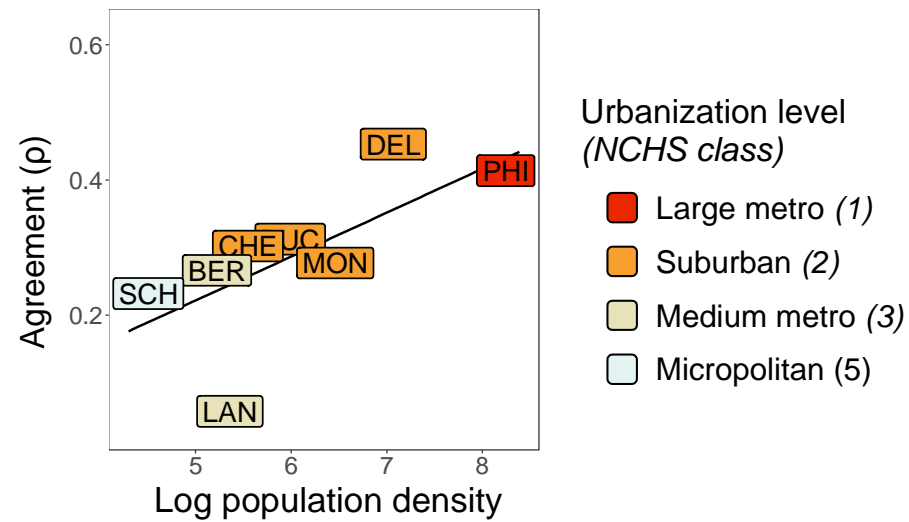
^aZCTA-level neighborhood advantage was calculated as follows: (1) variables listed in Supplemental Table 1 were extracted at the ZCTA level from the American Community Survey 5-year estimates for 2009-2013; (2) ZCTA-level ADI were derived as the linear combination of variables using factor coefficients given in Supplemental Table 1 and transformed to a percentile ranking (taking values 0-99); (3) ZCTA-level neighborhood advantage was calculated by subtracting the ADI percentile from 100



Supplemental Fig. 1. Counties surveyed by SEPA-HHS and BLS-HHS shaded by urban/rural classification. Counties are abbreviated as follows: PHI = Philadelphia, BUC = Bucks, CHE = Chester, DEL = Delaware, MON = Montgomery, BER = Berks, LAN = Lancaster, and SCH = Schuylkill. The inset map in the bottom left-hand corner shows the state of Pennsylvania with the study area shaded in color.



Supplemental Fig. 2. County-level agreement (Spearman's ρ) between educational attainment and tract-level neighborhood advantage. PHI = Philadelphia, BUC = Bucks, CHE = Chester, DEL = Delaware, MON = Montgomery, BER = Berks, LAN = Lancaster, and SCH = Schuylkill.



Supplemental Fig. 3. County-level agreement (Spearman's ρ) between relative income and ZCTA-level neighborhood advantage. PHI = Philadelphia, BUC = Bucks, CHE = Chester, DEL = Delaware, MON = Montgomery, BER = Berks, LAN = Lancaster, and SCH = Schuylkill.