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Neighborhood Poverty and Cigarette Smoking Across U.S. Census Tracts: Evidence Consistent with Minorities' Diminished Returns by Racial and Ethnic Composition

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Abstract

Background.

Cigarette smoking is more common among adults facing economic hardship. Similarly, living in a community where more residents are above the poverty threshold is associated with lower smoking prevalence, however, this may differ across neighborhoods.

Objective.

To examine whether the association between the percentage of residents living above the federal poverty threshold and estimated adult cigarette smoking prevalence varies with the racial and ethnic composition of U.S. census tracts.

Methods.

We linked 2014–2018 American Community Survey estimates to 2023 adult smoking estimates from CDC PLACES for 56,112 census tracts in 2,891 counties. We fitted increasingly adjusted linear models with state fixed effects and county-clustered standard errors. We tested continuous socioeconomic interactions and estimated poverty slopes within quartiles of each population share.

Results.

In the main-effects model, a 10-percentage-point higher share of residents above the poverty threshold was associated with 1.68 percentage points lower estimated smoking prevalence (95% CI, 1.61 to 1.75 lower). In the interaction model, this inverse association weakened by 0.044 percentage points per 10-point higher non-Hispanic Black share (95% CI, 0.015 to 0.072, p for interaction = .0029) and by 0.086 points per 10-point higher Hispanic share (95% CI, 0.054 to 0.118, p for interaction < .001). Comparing the highest with the lowest quartile, the inverse slope was weaker by 0.52 percentage points for Black share (95% CI, 0.30 to 0.74) and 0.65 for Hispanic share (95% CI, 0.45 to 0.84).

Conclusions.

The poverty findings are consistent with a neighborhood-level expression of Minorities' Diminished Returns. While living above poverty line is protective against smoking, this pattern is most observable in predominantly White communities.

Introduction

Cigarette smoking follows a socioeconomic gradient [1–2]. Adults experiencing economic hardship are more likely to smoke, and financial strain can make it harder to sustain a quit attempt [3–4]. Living above the poverty threshold may therefore mark an important advantage for tobacco-related health. At the community level, a higher percentage of residents above that threshold may also signal more stable economic conditions. Two tracts with the same median income can differ substantially in the percentage of families making ends meet. Historical studies suggest that the distribution of smoking across educational and income groups changes as tobacco use and cessation spread through the population [5–7]. This makes the geographic distribution of economic resources relevant even when national smoking prevalence declines. A community measure of poverty may capture both the resources available to households and the economic circumstances shared by neighbors. Neighborhood research links smoking to concentrated poverty, distress, and features of the physical and social environment [8–11]. One U.S. study directly examined racial and ethnic differences in the associations among neighborhood socioeconomic status, distress, and smoking [8]. Residential segregation offers one reason to expect variation across places: it can shape which services and commercial environments residents encounter at a given income level [12].

Minorities' Diminished Returns (MDRs) theory proposes that a socioeconomic resource can be associated with a smaller health advantage for groups facing social and economic exclusion. Applied to a neighborhood, the question is whether a given difference in economic security corresponds to a smaller difference in health across communities with different racial and ethnic compositions. This contextual question is distinct from asking whether the association differs between individuals within the same neighborhood. Tobacco studies have found diminished returns of education for adult smoking among Black Americans and of parental education for youth smoking among Black and Hispanic families [13–14]. Related studies have examined smoking among American Indian and Alaska Native adults, tobacco use in Baltimore, tobacco harm knowledge, and employment in relation to smoking among Hispanic adults in Los Angeles [15–18]. These studies point to a question that individual-level comparisons cannot answer: does the smoking advantage associated with lower neighborhood poverty vary across tracts?

We examined whether the association between earlier tract poverty status and later estimated adult cigarette smoking prevalence varied with the shares of non-Hispanic Black and Hispanic or Latino residents. We interpreted a weaker inverse association at higher population shares as a pattern consistent with tract-level MDRs. The poverty-focused interpretation emerged from an exploratory analysis of several socioeconomic interactions.

Methods

Design and sample. This ecological study linked the 2014–2018 American Community Survey (ACS) five-year estimates [19] to the 2025 PLACES census tract file [20]. We matched the 11-digit tract identifier. Of 83,522 tracts in PLACES, 60,168 had an exact historical identifier match. Complete data on the variables used in both models were available for 56,112 tracts (67.2% of the PLACES file). Each tract

contributed one observation. The study compared places across two measurement periods and did not track individual residents or changes in their smoking.

Outcome. The outcome was the PLACES estimate of crude adult current cigarette smoking prevalence, expressed as a percentage. Current smoking refers to adults who have smoked at least 100 cigarettes in their lifetime and currently smoke every day or on some days. The 2025 release used 2023 Behavioral Risk Factor Surveillance System data for smoking. CDC produces local estimates through multilevel modeling and poststratification [20–21].

Exposures and covariates. Using ACS table B17001, we calculated the percentage above the poverty threshold among residents for whom poverty status was determined. The ACS category includes residents whose income equals the threshold. Using B03002, we calculated the percentages of all residents who were non-Hispanic Black alone and Hispanic or Latino of any race. We included median household income in 2018 dollars (B19013), the percentage of adults aged 25 or older with at least a bachelor's degree (B15003), and the percentages of adults aged 45–64 and 65 or older (B01001). Adults aged 18–44 formed the age reference group. A higher share of either racial or ethnic group, holding the other fixed, implies a lower combined share of the remaining groups. The estimates therefore do not identify a specific comparison with White residents.

Analysis. We estimated four linear models on the same complete-case sample. All included state fixed effects. Model A included only the percentage of residents above poverty. Model B added non-Hispanic Black and Hispanic population shares and the adult age distribution. Model C added median household income and educational attainment. Model D retained those main effects and added six interactions between the three socioeconomic measures and the two population shares. We centered continuous predictors at their tract means. Each tract received equal weight. We report percentage-point differences in smoking prevalence per 10-percentage-point higher share of residents above poverty, with county-clustered 95% confidence intervals. Model D evaluates this slope at the mean of each composition measure. We used two-sided tests with 2,890 degrees of freedom and report nominal intervals for these exploratory comparisons.

Quartile analysis. We ranked tracts separately by non-Hispanic Black and Hispanic population share and divided each ranking into four equal groups. In two additional models, we replaced the relevant continuous share and its three socioeconomic interactions with quartile indicators and corresponding interactions. The other population share remained continuous, with its three interactions retained. We estimated a poverty slope for each quartile at the mean of the other share and tested the difference between the highest and lowest quartiles using the covariance matrix of the fitted model. This allows the slopes to depart from a straight-line pattern. Quartiles rank tracts within this sample and do not imply majority-Black or majority-Hispanic populations. For the adjusted prevalence estimates in Table 6, we fitted a separate joint-quartile model for each population share. We used all combinations of poverty and composition quartiles and standardized predictions to the full sample, including adult sex composition derived from ACS table B01001. The earlier slope models used the adjustment sets specified in

Tables 1–4. For the supplementary White series, we obtained non-Hispanic White alone from ACS B03002 and replaced the Black share with the White share, retaining Hispanic share. These companion estimates use a different composition contrast and do not provide a direct test of differences between the plotted group slopes.

Results

Across the analytic tracts, the mean percentage of residents above the poverty threshold was 84.7%. Mean non-Hispanic Black and Hispanic shares were 13.8% and 17.0%, respectively. In Model C, both the percentage above poverty and educational attainment were inversely associated with smoking after mutual adjustment. The median-income coefficient was close to zero (Table 2). The estimated smoking difference per 10 points above poverty was − 2.61 points with state adjustment alone and − 2.71 with age and composition added. Adding median income and education reduced its magnitude to − 1.68 points. The latter estimate compares areas with similar socioeconomic characteristics on those two dimensions.

Table 1
Association between living above the poverty threshold and estimated adult smoking across successive models

Model	Adjustment in addition to state fixed effects	Difference (95% CI)
A	Poverty measure alone	−2.61 (− 2.71, − 2.51)
B	A plus age and racial/ethnic composition	−2.71 (− 2.83, − 2.60)
C	B plus median income and education	−1.68 (− 1.75, − 1.61)
D	C plus six socioeconomic interactions	−1.49 (− 1.57, − 1.41)

Note: *Each estimate is the percentage-point difference in smoking prevalence per 10-point higher share above poverty. All models used the same 56,112 tracts and included state fixed effects. The adjustment column lists additional covariates. Model D gives the poverty slope at average Black and Hispanic population shares. The 95% confidence intervals account for clustering by county. Tract characteristics are from the 2014–2018 American Community Survey. The outcome is estimated 2023 adult current cigarette smoking prevalence from CDC PLACES (2025 release).*

Adding median income and education reduced the estimated smoking difference per 10-point higher share of residents above poverty from 2.71 to 1.68 percentage points. Table 2 shows how each socioeconomic and demographic characteristic was associated with smoking after mutual adjustment.

Table 2
Adjusted differences in estimated adult smoking prevalence, in percentage points (95% CI) (Models C and D)

Tract characteristic	Main effects only	With interactions
Above poverty threshold	−1.682 (− 1.753, − 1.611)	−1.491 (− 1.572, − 1.411)
Median household income	−0.014 (− 0.043, 0.015)	−0.124 (− 0.158, − 0.089)
Bachelor's degree or higher	−1.511 (− 1.558, − 1.465)	−1.565 (− 1.611, − 1.519)
Non-Hispanic Black share	0.054 (0.009, 0.099)	−0.131 (− 0.160, − 0.101)
Hispanic or Latino share	−0.451 (− 0.487, − 0.414)	−0.445 (− 0.486, − 0.405)
Adults aged 45–64	0.650 (0.552, 0.749)	0.594 (0.502, 0.686)
Adults aged 65 or older	−0.308 (− 0.351, − 0.264)	−0.362 (− 0.403, − 0.321)

Note: *Income coefficients are per $10,000. All other coefficients are per 10 percentage points. Adults aged 18–44 are the age reference. Both models included state fixed effects. In Model D, socioeconomic coefficients apply at average racial and ethnic composition, and composition coefficients apply at average socioeconomic conditions. The 95% confidence intervals account for clustering by county. Tract characteristics are from the 2014–2018 American Community Survey. The outcome is estimated 2023 adult current cigarette smoking prevalence from CDC PLACES (2025 release).*

The poverty coefficient in Model D describes tracts with average Black and Hispanic population shares. Table 3 shows how that association changes as each population share increases, alongside the corresponding estimates for household income and education.

Table 3
Change in each socioeconomic slope per 10-point higher population share, Model D (95% CI)

Socioeconomic measure	Non-Hispanic Black share	Hispanic or Latino share
Above poverty threshold	0.044 (0.015, 0.072)	0.086 (0.054, 0.118)
Median household income	−0.041 (− 0.059, − 0.023)	−0.056 (− 0.074, − 0.039)
Bachelor's degree or higher	−0.119 (− 0.143, − 0.094)	0.014 (− 0.004, 0.032)

Note: *Each coefficient is the change in an SES slope per 10-point higher population share, holding the other share fixed. The SES contrasts are 10 percentage points for poverty and education and $10,000 for income. Models included median household income, educational attainment, the share above poverty, non-Hispanic Black and Hispanic population shares, adult age composition, and state fixed effects. All six interactions were estimated together. The 95% confidence intervals account for clustering by county. Tract characteristics are from the 2014–2018 American Community Survey. The outcome is estimated 2023 adult current cigarette smoking prevalence from CDC PLACES (2025 release).*

At average racial and ethnic composition, a 10-point higher share of residents above poverty corresponded to 1.491 points lower estimated smoking prevalence. At a 10-point higher Black share, with Hispanic share held at its mean, the corresponding difference was 1.447 points lower. At a 10-point

higher Hispanic share, with Black share held at its mean, it was 1.405 points lower. Thus, the inverse association persisted in each example, with modest attenuation. The six interactions were jointly associated with smoking prevalence (Wald test, $p < .001$). Income interactions were negative for both population shares. The education interaction was negative for Black share, and its confidence interval included zero for Hispanic share.

Note

Each line shows the estimated difference in adult smoking prevalence per 10-point higher share of residents above poverty. Each line spans the 5th through 95th percentiles of the displayed population share, with the other share held at its mean. Shading gives pointwise 95% confidence intervals. Values closer to zero indicate a weaker inverse association. Models included median household income, educational attainment, the share above poverty, non-Hispanic Black and Hispanic population shares, adult age composition, and state fixed effects. All six socioeconomic interactions were included. Intervals account for clustering by county. Tract characteristics are from the 2014–2018 American Community Survey. The outcome is estimated 2023 adult current cigarette smoking prevalence from CDC PLACES (2025 release). White denotes non-Hispanic White alone. Its estimates come from a companion model pairing White and Hispanic shares in place of Black and Hispanic shares. Each slope is evaluated with the companion share at its mean where applicable.

The poverty slope shifted by + 0.036 percentage points per 10-point higher White population share in the companion model. Figure 2 places this estimate alongside the education and income interactions.

Note

Points give the change in each socioeconomic slope per 10-percentage-point higher Black or Hispanic share. Bars show county-clustered 95% confidence intervals. The socioeconomic contrasts are 10 percentage points for poverty status and education and $10,000 for income. Positive estimates indicate a shift toward a more positive slope. Models included median household income, educational attainment, the share above poverty, non-Hispanic Black and Hispanic population shares, adult age composition, and state fixed effects. All six socioeconomic interactions were included. Tract characteristics are from the 2014–2018 American Community Survey. The outcome is estimated 2023 adult current cigarette smoking prevalence from CDC PLACES (2025 release). White denotes non-Hispanic White alone. Its estimates come from a companion model pairing White and Hispanic shares in place of Black and Hispanic shares. Each slope is evaluated with the companion share at its mean where applicable.

The continuous-share interactions summarize average changes across the composition range. The quartile estimates below show that the Black-share association was weakest in the third quartile, whereas the Hispanic-share association weakened through the fourth quartile.

Table 4
Fully adjusted smoking prevalence difference per 10-point higher share above poverty, by quartile of tract composition

Quartile	Black share (%)	Difference (95% CI)	Hispanic share (%)	Difference (95% CI)
Q1	0.00–0.86	−1.94 (− 2.13, − 1.75)	0.00–2.82	−1.69 (− 1.83, − 1.55)
Q2	0.86–3.94	−1.53 (− 1.63, − 1.42)	2.82–7.86	−1.58 (− 1.70, − 1.46)
Q3	3.94–15.05	−1.35 (− 1.45, − 1.26)	7.86–21.53	−1.46 (− 1.56, − 1.36)
Q4	15.05–100.00	−1.42 (− 1.54, − 1.31)	21.53–100.00	−1.04 (− 1.17, − 0.91)

Note: *Each estimate is the smoking prevalence difference in percentage points per 10-point higher share above poverty. Separate models grouped tracts by non-Hispanic Black or Hispanic population share. Each model included adult age composition and state fixed effects and allowed the associations of poverty, education, and median income with smoking to vary by quartile and by the other population share. Slopes are evaluated at the mean of the other share. The 95% confidence intervals account for clustering by county. Tract characteristics are from the 2014–2018 American Community Survey. The outcome is estimated 2023 adult current cigarette smoking prevalence from CDC PLACES (2025 release).*

Each quartile included 14,028 tracts. Upper bounds are inclusive, and cut points are rounded for display. The Q4 minus Q1 contrast was + 0.52 (95% CI, 0.30 to 0.74, $p < .001$) for Black share and + 0.65 (95% CI, 0.45 to 0.84, $p < .001$) for Hispanic share. These positive differences indicate weaker inverse associations in Q4. The Hispanic-share estimates attenuated across all four quartiles. For Black share, the weakest estimate was in Q3, followed by a slightly more inverse estimate in Q4. Thus the endpoint contrast did not imply a uniform gradient.

In the companion White-share analysis, a 10-point higher share living above poverty corresponded to 1.67 points lower estimated smoking prevalence in Q1 and 1.72 points lower prevalence in Q4. Figure 3 displays these slopes alongside the Black and Hispanic estimates.

Note

Points are differences in percentage points of smoking prevalence per 10-point higher share out of poverty. Bars are 95% confidence intervals. The three series use separate quartile rankings. Separate models grouped tracts by non-Hispanic Black or Hispanic population share. Each model included adult age composition and state fixed effects and allowed the associations of poverty, education, and median income with smoking to vary by quartile and by the other population share. Slopes are evaluated at the mean of the other share. Intervals account for clustering by county. Tract characteristics are from the 2014–2018 American Community Survey. The outcome is estimated 2023 adult current cigarette smoking prevalence from CDC PLACES (2025 release). White denotes non-Hispanic White alone. Its estimates come from a

companion model pairing White and Hispanic shares in place of Black and Hispanic shares. Each slope is evaluated with the companion share at its mean where applicable.

Across the 56,112 tracts, estimated smoking prevalence varied jointly with neighborhood poverty and racial or ethnic composition. Within each composition quartile, the mean was lower in the highest quartile of residents living above poverty than in the lowest. These descriptive comparisons complement the adjusted slopes in Table 4.

Table 5
Mean estimated adult cigarette smoking prevalence by quartile of residents living above poverty and quartile of tract racial or ethnic composition

Non-Hispanic Black residents (% of tract residents)				
Residents above poverty	**Q1: 0.00–0.86%**	**Q2: 0.86–3.94%**	**Q3: 3.94–15.05%**	**Q4: 15.05–100.00%**
Q1: 0.49–79.11%	17.9% (1,782)	16.5% (1,934)	17.0% (3,094)	19.9% (7,218)
Q2: 79.11–87.79%	15.5% (3,410)	14.5% (3,267)	14.2% (3,771)	15.2% (3,580)
Q3: 87.79–93.38%	13.4% (4,274)	12.0% (3,987)	11.8% (3,726)	12.6% (2,041)
Q4: 93.38–100.00%	10.2% (4,562)	9.4% (4,840)	9.9% (3,437)	10.9% (1,189)
Hispanic or Latino residents (% of tract residents)				
Residents above poverty	**Q1: 0.00–2.82%**	**Q2: 2.82–7.86%**	**Q3: 7.86–21.53%**	**Q4: 21.53–100.00%**
Q1: 0.49–79.11%	21.4% (3,193)	19.3% (2,547)	18.2% (2,809)	16.7% (5,479)
Q2: 79.11–87.79%	17.1% (3,353)	15.3% (3,117)	14.0% (3,325)	13.4% (4,233)
Q3: 87.79–93.38%	14.2% (3,659)	12.5% (3,659)	11.4% (3,864)	11.5% (2,846)
Q4: 93.38–100.00%	10.8% (3,823)	9.5% (4,705)	9.3% (4,030)	10.2% (1,470)
Non-Hispanic White population share				
Residents above poverty	**Q1: 0.00–37.21%**	**Q2: 37.21–68.94%**	**Q3: 68.94–86.93%**	**Q4: 86.93–100.00%**
Q1: 0.49–79.11%	18.9% (7,690)	17.8% (3,534)	17.5% (1,720)	20.0% (1,084)
Q2: 79.11–87.79%	13.7% (3,433)	14.1% (3,924)	14.7% (3,364)	16.9% (3,307)
Q3: 87.79–93.38%	11.5% (1,876)	11.3% (3,452)	11.9% (4,056)	14.1% (4,644)
Q4: 93.38–100.00%	9.5% (1,029)	9.3% (3,118)	9.3% (4,888)	10.9% (4,993)

Note: *Cells show the unadjusted mean of tract smoking prevalence estimates, with the number of tracts in parentheses. Each tract has equal weight. Rows and columns use quartiles defined separately across the same 56,112 complete-case tracts. Each panel contains the full sample. Cutoffs are rounded, with boundary values assigned to the lower quartile. The ACS poverty measure includes residents whose income equals the threshold. Composition and poverty are from the 2014–2018 American Community Survey. Smoking is estimated 2023 adult current cigarette smoking prevalence from CDC PLACES (2025 release). Each value describes all adults in the contributing tracts. Darker blue indicates higher smoking prevalence.* Tables 5 and 6 *use the same color scale, based on the prevalence estimate in each cell. The third ranking uses the percentage of residents who are non-Hispanic White alone.*

After adjustment, estimated smoking prevalence in the highest White-share quartile was 15.7% in the lowest above-poverty quartile and 12.1% in the highest. Table 6 presents the corresponding standardized comparisons for all three population shares.

Table 6

Adjusted adult cigarette smoking prevalence (%) by quartile of residents living above poverty and quartile of racial or ethnic composition

Non-Hispanic Black population share				
Residents above poverty	**Q1: 0.00–0.86%**	**Q2: 0.86–3.94%**	**Q3: 3.94–15.05%**	**Q4: 15.05–100.00%**
Q1: 0.49–79.11%	16.4 (16.1–16.8)	15.7 (15.5–15.9)	15.9 (15.6–16.1)	17.0 (16.7–17.2)
Q2: 79.11–87.79%	13.9 (13.8–14.0)	13.8 (13.7–13.9)	13.8 (13.7–13.9)	13.9 (13.7–14.1)
Q3: 87.79–93.38%	12.8 (12.7–12.9)	12.8 (12.8–12.9)	12.8 (12.7–12.8)	12.7 (12.6–12.9)
Q4: 93.38–100.00%	12.6 (12.5–12.7)	12.7 (12.6–12.8)	12.5 (12.4–12.6)	12.3 (12.1–12.5)
Hispanic or Latino population share				
Residents above poverty	**Q1: 0.00–2.82%**	**Q2: 2.82–7.86%**	**Q3: 7.86–21.53%**	**Q4: 21.53–100.00%**
Q1: 0.49–79.11%	17.5 (17.3–17.8)	16.8 (16.6–17.0)	16.4 (16.1–16.6)	14.6 (14.3–14.9)
Q2: 79.11–87.79%	14.6 (14.5–14.8)	14.2 (14.1–14.4)	13.9 (13.8–14.0)	12.7 (12.6–12.9)
Q3: 87.79–93.38%	13.3 (13.2–13.4)	13.2 (13.1–13.3)	13.1 (13.0–13.2)	12.2 (12.0–12.3)
Q4: 93.38–100.00%	12.8 (12.7–13.0)	13.1 (13.0–13.3)	13.0 (12.8–13.1)	12.0 (11.8–12.2)
Non-Hispanic White population share				
Residents above poverty	**Q1: 0.00–37.21%**	**Q2: 37.21–68.94%**	**Q3: 68.94–86.93%**	**Q4: 86.93–100.00%**
Q1: 0.49–79.11%	17.3 (17.0–17.6)	16.0 (15.8–16.2)	15.5 (15.3–15.7)	15.7 (15.5–15.9)

Note: *Cells show standardized mean tract prevalence (%) and county-clustered 95% confidence intervals. Each panel uses the same 56,112 tracts, with equal tract weights and the quartile boundaries and counts in* Table 5. *Separate linear models include 16 joint-category indicators and adjust for adult age composition (45–64 and 65 + years, reference 18–44), sex composition (percentage of adults recorded as male), median household income, percentage of adults aged 25 + with a bachelor's degree or higher, the other continuous racial or ethnic population share, and state fixed effects. Predictions are averaged over the covariate distribution of the full analytic sample. The outcome is modeled 2023 adult current smoking prevalence from CDC PLACES (2025 release). Covariates are from the 2014–2018 ACS. Intervals describe regression uncertainty and do not incorporate first-stage uncertainty in the PLACES or ACS estimates. Darker blue indicates higher smoking prevalence.* Tables 5 and 6 *use the same color scale, based on the prevalence estimate in each cell. The White panel adjusts for Hispanic share as the other population share.*

Non-Hispanic Black population share				
Residents above poverty	**Q1: 0.00–0.86%**	**Q2: 0.86–3.94%**	**Q3: 3.94–15.05%**	**Q4: 15.05–100.00%**
Q2: 79.11–87.79%	14.2 (14.0–14.5)	13.9 (13.8–14.1)	13.6 (13.5–13.7)	13.6 (13.5–13.8)
Q3: 87.79–93.38%	13.1 (13.0–13.3)	13.0 (12.9–13.1)	12.7 (12.6–12.8)	12.4 (12.2–12.5)
Q4: 93.38–100.00%	12.5 (12.3–12.8)	12.9 (12.7–13.0)	12.7 (12.6–12.8)	12.1 (11.9–12.2)

Note: *Cells show standardized mean tract prevalence (%) and county-clustered 95% confidence intervals. Each panel uses the same 56,112 tracts, with equal tract weights and the quartile boundaries and counts in* Table 5. *Separate linear models include 16 joint-category indicators and adjust for adult age composition (45–64 and 65 + years, reference 18–44), sex composition (percentage of adults recorded as male), median household income, percentage of adults aged 25 + with a bachelor's degree or higher, the other continuous racial or ethnic population share, and state fixed effects. Predictions are averaged over the covariate distribution of the full analytic sample. The outcome is modeled 2023 adult current smoking prevalence from CDC PLACES (2025 release). Covariates are from the 2014–2018 ACS. Intervals describe regression uncertainty and do not incorporate first-stage uncertainty in the PLACES or ACS estimates. Darker blue indicates higher smoking prevalence.* Tables 5 and 6 *use the same color scale, based on the prevalence estimate in each cell. The White panel adjusts for Hispanic share as the other population share.*

Discussion

Tracts where more residents lived above the poverty threshold tended to have lower estimated adult cigarette smoking prevalence. Even after accounting for median income and education, this association was weaker as the shares of non-Hispanic Black and Hispanic residents increased. The direction fits an area-level extension of MDRs. The size of the difference also deserves attention: a 10-point shift in composition changed the estimated poverty slope by less than one tenth of a percentage point of smoking prevalence.

Neighborhood socioeconomic conditions are a well-established correlate of cigarette smoking. In a multilevel study, daily smoking was more common in disadvantaged neighborhoods even after adjustment for individual socioeconomic status [22]. Halonen and colleagues found that moving to a more disadvantaged neighborhood was associated with increased odds of smoking in a within-person analysis [23]. Other studies have examined neighborhood context in relation to cessation, the outcomes of a cessation intervention, and the joint distribution of poverty, tobacco retail outlets, and tobacco use [24–26]. Our study adds a question to this literature: whose community experiences the smoking advantage associated with lower poverty? Across the lowest and highest quartiles of Hispanic population share, the estimated difference in smoking per 10-point higher share of residents above poverty narrowed from 1.69 to 1.04 percentage points. For Black population share it narrowed from 1.94 to 1.42 points, although the pattern across the middle quartiles was uneven. These comparisons identify

communities where the slope differs. Determining which residents hold the resources or receive the associated health advantage would require individual data linked to neighborhood conditions.

Research on residential racial and ethnic composition provides a second context for these findings. Reviews of ethnic density report considerable variation across populations and outcomes. Bécares and colleagues found that most associations were null and that protective associations were more frequent than adverse ones, particularly for health behaviors and among Hispanic populations [27–28]. U.S. studies have examined neighborhood composition in relation to self-rated health among Black and Hispanic residents, maternal smoking and birth outcomes, and later depressive symptoms among Hispanic patients [29–31]. Studies at neighborhood and county levels have also examined cardiovascular mortality, changes in health in older age, and all-cause mortality [32–34]. Work on birth outcomes and on physical and mental health in California further illustrates how strongly interpretation depends on the population, outcome, and geographic unit [35–36]. Living near members of one's own ethnic group can provide social support, even where disinvestment limits local opportunities. Our results suggest an additional possible pathway to poor health: economic differences across communities may translate into smaller differences in smoking when tobacco exposure or barriers to quitting persist across income levels. The interaction identifies a pattern that such a mechanism might explain. It does not show that racial composition causes poor health or establish that diminished protection mediates disease risk.

Independent research teams have repeatedly tested whether socioeconomic resources yield comparable health advantages across racial and ethnic groups. Farmer and Ferraro examined whether Black–White differences in health varied across levels of socioeconomic status [37]. Other investigators have compared education–health gradients across racial and ethnic groups and assessed how far differential returns depend on the outcome, the resource measured, or the period of life during which it was available [38–41]. Studies of body mass index and educational differences in mortality extend this work to other outcomes [42–43]. Boen found that increases in socioeconomic position were associated with different health returns for Black and White adults [40]. Vable and colleagues also found settings in which Black women had larger health gains with education [39]. These independent studies complement analyses by Assari and colleagues on allostatic load and self-rated health [44–45]. Related work on college completion and upward mobility shows why results can differ even for the same group: Gaydosh and colleagues observed lower depression alongside higher metabolic risk among disadvantaged minority young adults who completed college [46]. Studies of mobility, allostatic load, and resilience likewise distinguish psychosocial gains from physical health returns [47–49]. Descriptive research on self-rated health and racial differences in socioeconomic gradients offers additional comparisons [50–51]. Taken together, these studies provide independent support for the possibility of diminished returns, with meaningful variation across settings. The main contribution here is the level of analysis: an area-level resource was associated with an area-level outcome, and the strength of that association varied by community composition. The findings extend the MDRs hypothesis to neighborhood poverty and smoking while leaving open whether other neighborhood resources follow the same pattern.

The poverty threshold describes income relative to an official cutoff. It provides little information about what families can purchase locally or which neighborhood resources they can access. One hypothesis is that differences in housing costs, exposure to tobacco marketing, or access to cessation support weaken the link between economic security and lower smoking prevalence in some neighborhoods. Residential segregation and unequal public investment are possible structural explanations to examine. We did not measure these conditions, and racial composition alone cannot identify which explanation, if any, accounts for the findings. Reviews of point-of-sale marketing and retailer availability, along with a national U.S. study of outlet density, document neighborhood differences in commercial tobacco exposure [52–54]. These studies suggest measurable features of place for follow-up analyses. Research on cessation interventions for economically disadvantaged populations also points to the value of measuring access to support directly [55]. The upper quartile began at about 15% Black residents or 22% Hispanic residents. These cutoffs illustrate why a comparison of quartiles cannot be described as a comparison between racial majorities. Demographic composition is a marker of social context, and the analyses do not establish which residents experienced any particular exposure.

Advertising and commercial targeting offer one plausible pathway. Industry documents describe efforts by R.J. Reynolds to reach African American consumers, and research on menthol marketing describes the audiences, messages, and channels used in these campaigns [56–57]. Store audits near California high schools examined how menthol advertising, promotions, and prices varied with the student population [58]. Research has also documented tobacco-industry sponsorship of Hispanic and Latino organizations and the use of direct marketing and ethnic target marketing [59–61]. These exposures can reach households across an entire retail or media market. A resident whose income exceeds the poverty line may still encounter the same displays, discounts, and promotions on a daily shopping route. This mechanism would predict variation in the poverty slope with measured marketing exposure, something that population composition alone cannot establish.

Retail availability and pricing are related but distinct mechanisms. Retailers differ across neighborhoods in number, store type, product mix, and discounts [62–64]. Work in Wisconsin has also examined how past redlining relates to the current geography of tobacco retail [65]. A nearby outlet can make cigarettes easier to purchase during a quit attempt, whereas price promotions can reduce the cost of continuing to smoke. Research on retailer proximity, cessation, and neighborhood poverty provides ways to distinguish these processes [66–68]. Studies of cigarette discounts also document variation in the use of promotions across brands and social groups [69–70]. A stronger design would link geocoded store audits and prices to cessation attempts over time, allowing for retailers to locate in response to local demand as well as influence it [71].

Stress and the social environment may affect the association through other routes. The poverty threshold captures annual income relative to household needs but does not measure wealth, debt, housing insecurity, or discrimination. Studies of Black and Latino adults have examined ethnic discrimination in relation to smoking, beliefs about abstinence, and cessation during treatment [72–75]. Work on Latino health also emphasizes variation in stress and resilience within a broad ethnic category

[76]. Neighborhood disorder, social capital, and the composition of a smoker's support network may influence the circumstances of a quit attempt [77–79]. Community ties might facilitate quitting in one context while frequent exposure to smoking cues makes quitting harder in another. The present outcome combines initiation, persistence, and cessation, so it cannot identify which process accounts for the observed differences.

Unequal access to cessation support could matter even where similar percentages of residents are above poverty. U.S. studies have examined differences in clinician-delivered cessation services, the use of pharmaceutical aids among Latino adults, and Hispanic–White differences in cessation behaviors [80–82]. Telephone and web-based programs offer additional routes to support [83], but local accessibility, language, and continuity of care would need to be measured to assess their role here. Housing policy is another potentially modifiable exposure. Studies in subsidized and multi-unit housing have assessed smoking restrictions, secondhand smoke, and support for compliance [84–87]. Together these mechanisms suggest testable questions about what communities are offered. The present analysis measured none of these pathways and cannot assign the observed interactions to targeting, treatment access, housing conditions, or any other single explanation.

The other socioeconomic results qualify the MDRs interpretation. At higher Black population shares, the inverse education–smoking association was stronger. Higher Black and Hispanic shares were also associated with a more inverse income slope. Combining poverty, income, and education into a single socioeconomic index could obscure these differences. At the same time, their mutual adjustment means that the poverty coefficient describes contrasts among tracts with similar median incomes and educational attainment. It cannot quantify the expected effect of a policy that changes several economic conditions together.

Limitations. PLACES estimates smoking prevalence using models that may incorporate age, sex, race or ethnicity, education, and county poverty [21]. Shared demographic inputs could contribute to the observed interactions. County-clustered intervals account for clustering of regression residuals but do not propagate uncertainty from the PLACES models or ACS estimates. Exact identifier matching across census vintages excluded many tracts, and a retained identifier does not guarantee stable boundaries. Selection and boundary changes may affect the findings. Residential mobility also limits interpretation of the time ordering. Finally, all outcomes describe tract populations overall. These data cannot determine whether individual Black or Hispanic residents experience smaller smoking-related benefits from living above poverty. Replication with harmonized boundaries and directly observed smoking outcomes would strengthen an assessment of the neighborhood hypothesis.

Conclusion

A higher percentage of residents living above the poverty threshold was associated with lower estimated cigarette smoking prevalence. This association was modestly weaker in tracts with larger non-Hispanic Black or Hispanic populations, a pattern consistent with neighborhood-level MDRs for poverty status.

Future work can test whether specific neighborhood conditions account for this difference. The contribution is to show that a measure of community economic resources and a measure of community smoking can exhibit a diminished-returns pattern even when both are measured at the tract level.

Abbreviations

ACS
American Community Survey
AI
artificial intelligence
CA
California
CDC
Centers for Disease Control and Prevention
CDU
Charles R. Drew University of Medicine and Science
CI
confidence interval
MDRs
Minorities' Diminished Returns
NIH
National Institutes of Health
PLACES
Population—Level Analysis and Community Estimates
Q1
Q4—first through fourth quartiles
SES
socioeconomic status
U.S.
United States
USA
United States of America

Declarations

Conflict of interest.

The authors declare no conflicts of interest.

Ethics, institutional review, and consent.

This secondary analysis used publicly available census tract estimates from the U.S. Census Bureau and CDC PLACES. All observations represented geographic areas. The research team had no contact with participants and used no identifiable individual records. Individual consent was inapplicable to this analysis.

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Figures

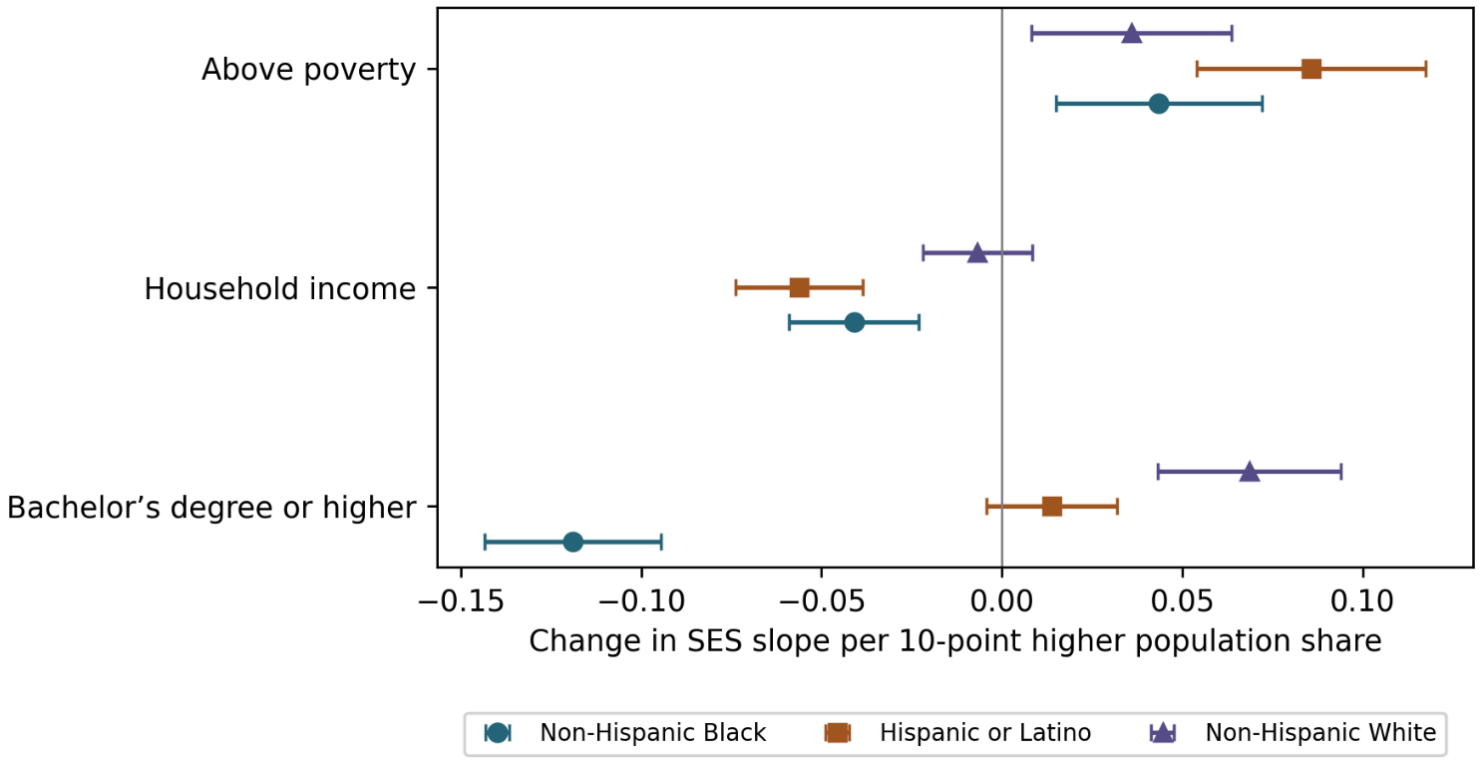


Figure 2

Socioeconomic interactions with Black, Hispanic, and White population shares.

Note: *Points give the change in each socioeconomic slope per 10-percentage-point higher Black or Hispanic share. Bars show county-clustered 95% confidence intervals. The socioeconomic contrasts are 10 percentage points for poverty status and education and $10,000 for income. Positive estimates indicate a shift toward a more positive slope. Models included median household income, educational attainment, the share above poverty, non-Hispanic Black and Hispanic population shares, adult age composition, and state fixed effects. All six socioeconomic interactions were included. Tract characteristics are from the 2014–*

2018 American Community Survey. The outcome is estimated 2023 adult current cigarette smoking prevalence from CDC PLACES (2025 release). White denotes non-Hispanic White alone. Its estimates come from a companion model pairing White and Hispanic shares in place of Black and Hispanic shares. Each slope is evaluated with the companion share at its mean where applicable.

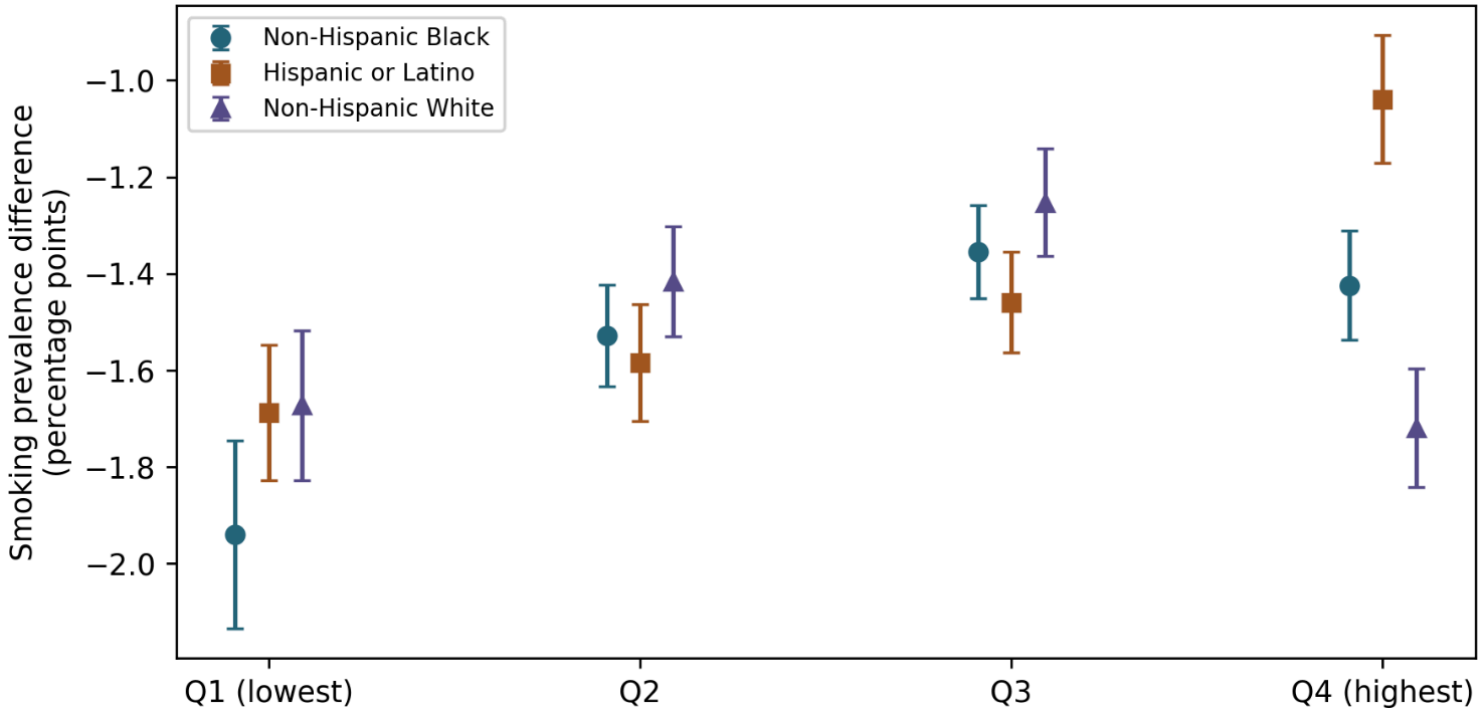


Figure 3

Adjusted poverty–smoking slopes within quartiles of tract population composition.

Note: *Points are differences in percentage points of smoking prevalence per 10-point higher share out of poverty. Bars are 95% confidence intervals. The three series use separate quartile rankings. Separate models grouped tracts by non-Hispanic Black or Hispanic population share. Each model included adult age composition and state fixed effects and allowed the associations of poverty, education, and median income with smoking to vary by quartile and by the other population share. Slopes are evaluated at the mean of the other share. Intervals account for clustering by county. Tract characteristics are from the 2014–2018 American Community Survey. The outcome is estimated 2023 adult current cigarette smoking prevalence from CDC PLACES (2025 release). White denotes non-Hispanic White alone. Its estimates come from a companion model pairing White and Hispanic shares in place of Black and Hispanic shares. Each slope is evaluated with the companion share at its mean where applicable.*