Table S1 Primary Standard Industrial Classification (SIC) codes from Dun & Bradstreet (D&B) used in the analysis in years 1993, 2001 and 2011, 8-digit codes shown below

| Food Resource Type | Description | D&B primary SIC code |
| --- | --- | --- |
| Sit-down Restaurants | Ethnic food restaurant  American restaurant  Cajun restaurant  Chinese restaurant  French restaurant  German restaurant  Greek restaurant  India/Pakistan restaurant  Italian restaurant  Japanese restaurant  Korean restaurant  Lebanese restaurant  Spanish restaurant  Thai restaurant  Vietnamese restaurant  Pakistani restaurant  Seafood restaurants: include sushi restaurants, oyster bars & seafood shacks  Steak house & BBQ restaurants  Chicken restaurants  Family-owned restaurant  Family-owned restaurants, chain  Family-owned restaurant, independent | 58120100  58120101  58120102  58120103  58120104  58120105  58120106  58120107  58120108  58120109  58120110  58120111  58120113  58120115  58120116  58120117  58120114  58120700  58120701  58120702  58120800  58120801  58120802  58129904  58120500  58120501  58120502 |
| Fast food Restaurants | Fast food restaurants and stands  Box lunch stand  Carry-out only (except pizza) restaurant  Chili stand  Coffee shop  Delicatessen (eating places)  Drive-in restaurant  Fast-food restaurant, chain  Fast-food restaurant, independent  Food bars  Pizzeria, Chain  Grills (eating places)  Hamburger stand  Hot dog stand  Sandwiches and submarines shop  Snack bar  Snack shop  Pizza restaurants  Pizzeria, chain  Pizzeria, independent | 58120300  58120301  58120302  58120303  58120304  58120305  58120306  58120307  58120308  58120309  58120601  58120310  58120311  58120312  58120313  58120314  58120315  58120600  58120601  58120602 |
| Supermarkets | Supermarkets  Supermarkets, chain  Supermarkets, independent  Supermarkets, greater than 100,000 square feet (hypermarket)  Supermarkets, 55,000-65,000 square feet (superstore)  Supermarket, 66,000-99,000 square feet | 54110100  54110101  54110102  54110103  54110104  54110105 |
| Grocery stores | Grocery store  Grocery store, nec  Frozen food and freezer plans, except meat  Country general stores  Grocery stores, chain  Grocery stores, independent | 54110000  54119900  54119903  53999903  54119904  54119905 |
| Convenience stores | Variety stores  Convenience stores  Convenience stores, chain  Convenience stores, independent  Gasoline service stations  Gasoline service stations, nec  Filling stations, gasoline | 53310000  54110200  54110201  54110202  55410000  55419900  55419901 |

Table S2. Specific neighborhood characteristics a by neighborhood type classified in 1993

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | Urban core  (n=63) | Inner city  (n=103) | Urban  (n=335) | Aging suburb (n=579) | High-income suburb (n=331) | Suburban edge (n=672) |
| **Built environment** |  |  |  |  |  |  |
| Residential population density, 1,000 person/km2 | **5.26±1.79 (2.79)** | 3.68±1.24 (1.62) | 2.45±1.03 (0.70) | 1.66±0.80 (0.11) | 0.87±0.48 (-0.48) | **0.54±0.46 (-0.72)** |
| Employment population density, 1,000 person/km2 | **3.32±1.37 (3.34)** | 1.37±0.62 (0.74) | 1.41±0.57 (0.81) | 0.84±0.39 (0.05) | 0.49±0.28 (-0.42) | **0.31±0.27 (-0.66)** |
| Mix of land use, % b | 55.19±22.15 (0.39) | 48.41±23.91 (0.15) | **55.61±24.84 (0.41)** | 55.54±25.39 (0.41) | 38.13±28.62 (-0.22) | **30.08±24.78 (-0.51)** |
| % single-family housing c | **20.98± 21.61 (-1.19)** | 40.29±24.53 (-0.62) | 33.46±28.08 (-0.82) | 50.63±30.98 (-0.31) | 75.71±28.08 (0.43) | **84.18±21.62 (0.68)** |
| **Sociodemographic** |  |  |  |  |  |  |
| % population aged under 14 d | **7.49±3.85 (-2.29) a** | 28.09±7.51 (0.91) | 17.16±4.51 (-0.79) | 20.08±4.18 (-0.34) | 20.27±3.42 (-0.31) | **28.13±2.98 (0.91)** |
| % population aged between 15 and 29 d | **50.76±14.21 (3.69)** | 25.11±4.82 (0.19) | 26.84±7.02 (0.42) | 22.64±3.88 (-0.15) | **19.32±4.03 (-0.60)** | 22.56±3.61 (-0.16) |
| % population aged between 30 and 44 d | **22.41±7.10 (-1.00)** | 23.63±3.31 (-0.75) | 29.28±4.22 (0.45) | 23.69±2.75 (-0.73) | 25.63±3.11 (-0.32) | **30.83±3.40 (0.78)** |
| % population aged between 45 and 64 d | **10.13±4.85 (-1.36)** | 12.44±2.83 (-0.90) | 15.01±3.18 (-0.38) | 17.93±3.42 (0.20) | **24.48±3.49 (1.51)** | 14.60±3.08 (-0.46) |
| % population aged 65 or above d | 9.25±6.30(-0.10) | 10.71±4.46 (0.12) | 11.66±4.61 (0.27) | **15.61±6.18 (0.87)** | 10.30±4.96 (0.06) | **3.87±2.31 (-0.92)** |
| Median household income, 1,000 $ e | 20.01±6.11 (-1.48) | **17.6±5.59 (-1.68)** | 33.83±8.06 (-0.38) | 31.04±5.93 (-0.60) | **52.13±11.98 (1.08)** | 45.79±6.54 (0.57) |
| % white race d | 83.29±9.50 (-0.64) | **44.21±16.98 (-3.65)** | 89.90±7.91 (-0.13) | 92.95±6.60 (0.10) | 96.75±1.85 (0.39) | **96.89±2.13 (0.40)** |
| % black race d | 8.87±7.25 (0.53) | **35.05±20.11 (3.39)** | 5.47±5.51 (0.16) | 2.53±3.19 (-0.16) | **0.89±1.08 (-0.34)** | 0.90±1.18 (-0.34) |
| % population with a college education or above d | **70.81±10.80 (0.87)** | **38.55±9.19 (-1.25)** | 66.80±12.24 (0.60) | 45.06±10.29 (-0.82) | 70.18±10.42 (0.83) | 59.28±12.12(-0.11) |

Note.Bold font indicates the highest/lowest value of z score in the six types of neighborhoods.

a Mean ± standard error (mean z-score) of neighborhood characteristics measured at the census block group level.

b The mix of land use was measured by 3-tier land use entropy (denominator set to the static 3 land use types in the census block group), which used three land use categories (residential, employment and retail) to calculate mix of land use in the census block group.

c Percent of single-family housing relative to total single-family and multi-family housings.

d The denominators of percent of population aged under 14, aged between 15 and 29, aged between 30 and 44, aged between 45 and 64, aged 65 or above, population with a college education or above, white race and black race were total population in the census block group.

e The median household income in 1993 and 2001 were adjusted for inflation to compare with that in 2011.

Table S3. P values for the changes of difference in estimated average a percent of sit-down restaurants/supermarkets for each neighborhood type pair between two observational years

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | P value b | | | | | |
|  | Sit-down restaurant | | | Supermarket | | |
|  | 1993 vs. 2001 | 2001 vs. 2011 | 1993 vs. 2011 | 1993 vs. 2001 | 2001 vs. 2011 | 1993 vs. 2011 |
| Urban core vs. inner city | **0.00 c** | **0.00** | **0.00** | 0.91 | 0.91 | 0.91 |
| Urban core vs. urban | 0.06 | 0.06 | 0.06 | 0.53 | 0.53 | 0.53 |
| Urban core vs. aging suburb | 0.07 | 0.07 | 0.07 | 0.90 | 0.90 | 0.90 |
| Urban core vs. high-income suburb | **0.01** | **0.01** | **0.01** | 0.22 | 0.22 | 0.22 |
| Urban core vs. suburban edge | **0.01** | **0.01** | **0.01** | 0.88 | 0.88 | 0.88 |
| Inner city vs. urban | **0.03** | **0.03** | **0.03** | 0.55 | 0.55 | 0.55 |
| Inner city vs. aging suburb | **0.01** | **0.01** | **0.01** | 0.99 | 0.99 | 0.99 |
| Inner city vs. high-income suburb | 0.14 | 0.14 | 0.14 | 0.18 | 0.18 | 0.18 |
| Inner city vs. suburban edge | 0.08 | 0.08 | 0.08 | 0.99 | 0.99 | 0.99 |
| Urban vs. aging suburb | 0.74 | 0.74 | 0.74 | 0.31 | 0.31 | 0.31 |
| Urban vs. high-income suburb | 0.29 | 0.29 | 0.29 | 0.30 | 0.30 | 0.30 |
| Urban vs. suburban edge | 0.33 | 0.33 | 0.33 | 0.33 | 0.33 | 0.33 |
| Aging suburb vs. high-income suburb | 0.13 | 0.13 | 0.13 | **0.03** | **0.03** | **0.03** |
| Aging suburb vs. suburban edge | 0.13 | 0.13 | 0.13 | 0.96 | 0.96 | 0.96 |
| High-income suburb vs. suburban edge | 0.80 | 0.80 | 0.80 | **0.03** | **0.03** | **0.03** |

**Bold** font indicates significant association (P <.05).

Notes a Multivariable mixed effects regression modeling percent of sit-down restaurants relative to total sit-down restaurants and fast food restaurants/percent of supermarkets relative to total supermarkets, grocery stores and convenience stores in each neighborhood as a function of neighborhood type in 1993, time elapsed since 1993, interaction between neighborhood type in 1993 and time elapsed, changes in residential population density, median household income, percent of white and percent of single-family housing since 1993, total sit-down and fast food restaurants/total supermarkets, grocery stores, and convenience stores, and a random intercept for each neighborhood.

b P value for two-tailed Student’s t-test of difference in difference of estimated mean of percent of sit-down restaurants relative to total sit-down restaurants and fast food restaurants/percent of supermarkets relative to total supermarkets, grocery stores and convenience stores

c The p value of 0.00 indicates that the difference of estimated mean of percent of sit-down restaurants relative to total sit-down restaurants and fast food restaurants between urban core and inner city in 1993 is significantly different from that in 2001.

Table S4. Predicted multivariable-adjusted model coefficients of associations among the percent of sit-down restaurants relative to the total of sit-down restaurants and fast food restaurants, neighborhood type in 1993, interaction of the latter with time elapsed, and time elapsed from years 1993, 2001 and 2011: Twin Cities Region of Minnesota

|  |  |  |
| --- | --- | --- |
| Predictors | b (95% CI) | P value |
| Neighborhood type in 1993 a |  |  |
| Urban core | 23.02 (13.18, 32.85) | **0.000** |
| Inner city (Ref) | … | … |
| Urban | 0.23 (-6.80, 7.27) | 0.948 |
| Aging suburb | -0.73 (-7.66, 6.19) | 0.835 |
| High-income suburb | -1.91 (-9.48, 5.65) | 0.620 |
| Suburban edge | -4.94 (-12.28, 2.41) | 0.188 |
|  |  |  |
| Neighborhood type in 1993: time elapsed b |  |  |
| Urban core | -1.13 (-1.83, -0.44) | **0.001** |
| Inner city (Ref) | … | … |
| Urban | -0.55 (-1.04, -0.07) | **0.026** |
| Aging suburb | -0.60 (-1.07, -0.14) | **0.010** |
| High-income suburb | -0.37 (-0.86, 0.12) | 0.137 |
| Suburban edge | -0.41 (-0.86, 0.05) | 0.081 |
|  |  |  |
| Time elapsed c | 0.82 (0.39, 1.25) | **0.000** |
|  |  |  |
| Covariates |  |  |
| Change in residential population density, 1,000 person/km2 | 0.96 (-0.11, 2.02) | 0.078 |
| Change in income, 1,000 US dollar | 0.07 (-0.03, 0.17) | 0.164 |
| Change in percent of white | 0.05 (-0.04, 0.14) | 0.282 |
| Change in percent of single family housing | 0.02 (-0.03, 0.07) | 0.480 |
| Total of sit-down restaurants and fast food restaurants, count | 2.99 (2.70, 3.28) | **0.000** |
|  |  |  |
| Constant | 14.50 (7.21, 21.78) | **0.000** |

Abbreviations: b: model effect; CI: confidential interval. **Bold** font indicates significant association (P <.05). N=6,249.

a The coefficient of neighborhood type in 1993 shows if other types of neighborhoods had a greater percent of sit-down restaurants than the reference neighborhood type (inner city) in 1993.

b Time elapsed in 1993, 2001, and 2011 is defined as 0, 8, and 18, respectively. The coefficient of the interaction term between neighborhood type in 1993 and the time elapsed shows if other types of neighborhoods experienced a greater increase in the percent of sit-down restaurants than the reference neighborhood type (inner city).

c The coefficient of time elapsed refers to the effect of time on the reference neighborhood type (inner city). The coefficient of time elapsed shows if the reference neighborhood type experienced a significant change in the percent of sit-down restaurants between 1993 and 2011.

Table S5. Predicted multivariable-adjusted model coefficients of associations among the percent of supermarkets relative to the total of supermarkets, grocery stores and convenience stores, neighborhood type in 1993, interaction of the latter with time elapsed, and time elapsed from years 1993, 2001 and 2011: Twin Cities Region of Minnesota

|  |  |  |
| --- | --- | --- |
| Predictors | b (95% CI) | P value |
| Neighborhood type in 1993 a |  |  |
| Urban core | 1.87 (-2.50, 6.24) | 0.401 |
| Inner city (Ref) | … | … |
| Urban | 0.46 (-2.67, 3.59) | 0.773 |
| Aging suburb | 1.69 (-1.39, 4.77) | 0.282 |
| High-income suburb | 1.30 (-2.07, 4.66) | 0.450 |
| Suburban edge | 0.19 (-3.08, 3.46) | 0.909 |
|  |  |  |
| Neighborhood type in 1993: time elapsed b |  |  |
| Urban core | 0.02 (-0.29, 0.33) | 0.910 |
| Inner city (Ref) | … | … |
| Urban | -0.07 (-0.29, 0.15) | 0.546 |
| Aging suburb | 0.00 (-0.21, 0.21) | 0.990 |
| High-income suburb | -0.15 (-0.37, 0.07) | 0.182 |
| Suburban edge | -0.00 (-0.21, 0.20) | 0.988 |
|  |  |  |
| Time elapsed c | **0.24 (0.05, 0.43)** | **0.014** |
|  |  |  |
| Covariates |  |  |
| Change in residential population density, 1,000 person/km2 | 0.04 (-0.43, 0.51) | 0.869 |
| Change in income, 1,000 US dollar | -0.04 (-0.08, 0.01) | 0.101 |
| Change in percent of white | 0.02 (-0.02, 0.06) | 0.356 |
| Change in percent of single-family housing | **-0.03 (-0.05, -0.01)** | **0.016** |
| Total of supermarkets, grocery stores and convenience stores, count | **1.83 (1.51, 2.16)** | **0.000** |
|  |  |  |
| Constant | -0.83 (-4.08, 2.42) | 0.616 |

Abbreviations: b: model effect; CI: confidential interval. **Bold** font indicates significant association (P <.05). N=6,249.

a The coefficient of neighborhood type in 1993 shows if other types of neighborhoods had a greater percent of supermarkets than the reference neighborhood type (inner city) in 1993.

b Time elapsed in 1993, 2001, and 2011 is defined as 0, 8, and 18, respectively. The coefficient of the interaction term between neighborhood type in 1993 and the time elapsed shows if other types of neighborhoods experienced a greater increase in the percent of supermarkets than the reference neighborhood type (inner city).

c The coefficient of time elapsed refers to the effect of time on the reference neighborhood type (inner city). The coefficient of time elapsed shows if the reference neighborhood type experienced a significant change in the percent of supermarkets between 1993 and 2011.