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 restaurantAmerican restaurantCajun restaurantChinese restaurantFrench restaurantGerman restaurantGreek restaurantIndia/Pakistan restaurantItalian restaurantJapanese restaurantKorean restaurantLebanese restaurantSpanish restaurantThai restaurantVietnamese restaurantPakistani restaurantSeafood restaurants: include sushi restaurants, oyster bars & seafood shacksSteak house & BBQ restaurantsChicken restaurantsFamily-owned restaurantFamily-owned restaurants, chainFamily-owned restaurant, independent | 581201005812010158120102581201035812010458120105581201065812010758120108581201095812011058120111 581201135812011558120116581201175812011458120700581207015812070258120800581208015812080258129904581205005812050158120502 |
| Fast food Restaurants  | Fast food restaurants and standsBox lunch standCarry-out only (except pizza) restaurantChili standCoffee shopDelicatessen (eating places)Drive-in restaurantFast-food restaurant, chainFast-food restaurant, independentFood barsPizzeria, ChainGrills (eating places)Hamburger standHot dog standSandwiches and submarines shopSnack barSnack shopPizza restaurantsPizzeria, chainPizzeria, independent | 5812030058120301581203025812030358120304581203055812030658120307581203085812030958120601581203105812031158120312581203135812031458120315581206005812060158120602 |
| Supermarkets | SupermarketsSupermarkets, chainSupermarkets, independentSupermarkets, greater than 100,000 square feet (hypermarket)Supermarkets, 55,000-65,000 square feet (superstore)Supermarket, 66,000-99,000 square feet | 541101005411010154110102541101035411010454110105 |
| Grocery stores | Grocery storeGrocery store, necFrozen food and freezer plans, except meatCountry general storesGrocery stores, chainGrocery stores, independent | 541100005411990054119903539999035411990454119905 |
| Convenience stores | Variety storesConvenience storesConvenience stores, chainConvenience stores, independentGasoline service stationsGasoline service stations, necFilling stations, gasoline | 53310000541102005411020154110202554100005541990055419901 |

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.