# Supplementary Online Content

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

**eMethods.** *Data Sources*

Population characteristics and sociodemographic data were measured using 5-year estimates for 2011-2015 from the American Community Survey (ACS)[12], which administers surveys to approximately 295,000 households per month and aggregates results to the block group-, tract-, county-, and state-levels over 1 and 5 years.[13] We included measures of counties' racial and ethnic composition, gender distribution, proportion of the population over the age of 55, income, education and violent crime rates. Economic distress, measured by housing vacancy rate, proportion of adults not in work, proportion of population in a distressed zip code and aggregate distress score, was reported based on data collected from the Distressed Communities Index (DCI) using data from ACS 5-year estimates and Census Bureau Business Patterns datasets.[14] The DCI additionally compiles an aggregate score, termed the distress score, for each county accounting for performance across seven individual metrics (< high-school education, housing vacancy rate, adults not in work, poverty rate, median income ratio, and change in employment and establishment proportions from 2014-2018). Scores range from 0-100, reflecting how prosperous (low score) or distressed (high score) a county is. Counties are then grouped by score into quintiles that reflect whether a community is prosperous, comfortable, mid-tier, at-risk, or distressed. Population distribution was determined from the United States Department of Agriculture (USDA) Economic Research Service (ERS) Rural-Urban Continuum Codes (RUCC) codes, which classifies U.S. counties as metropolitan versus non-metropolitan based on total population adjacent to a metropolitan area, percentage of labor force commuting to metropolitan counties, and population density.[12,15] The health status of

the population was measured using data reported in the 2014 County Health Rankings dataset[16] which captures county-level data on prevalence of health outcomes, risk factors and physical environment including prevalence of obesity, diabetes, smoking, and self-reported metrics of fair or poor health. A summary measure of the food environment in each county and the percent of tracts within a county classified as a food desert in 2010 was downloaded from the USDA's Food Environment Atlas.[17] The USDA classifies tracts as being in a food desert if at least 500 people or one-third of the population lives greater than a threshold distance (1 mile in an urban area; 10 in a rural area) from a large grocery store. A list of included covariates and data sources is provided in **eTable 1**.

**eTable 1.** Data Sources for Relevant County-Level Exposure Variables

| **Population characteristics** *(2011-2014 ACS 5-year estimates)* | **Population Distribution** *(USDA Economic Research Service (ERS) Rural-Urban Continuum Codes dataset)* | **Distressed Communities Index** *(2014-2018 ACS 5-year estimates and Census Bureau Business Patterns datasets)* | **Population Health Status** *(2014 CHR dataset)* | **County Food Environment** *(USDA Food Environmental Atlas)* |
|---|---|---|---|---|
| Non-white (%) | RUCA Code | Distress Score | BMI > 30 | Proportion of tracts within a county that qualify as a food dessert |
| Hispanic (%) | | Housing Vacancy Rate | Diabetes (%) | |
| Male (%) | | Change in employment (%) | Currently smoking (%) | |
| Age >= 55 (%) | | Change in establishments (%) | Fair/poor health (%) | |
| Median household income | | Population in distressed zip codes (%) | Mentally unhealthy days/month | |
| < HS education (%) | | Adults not in work (%) | No leisure-time physical activity | |
| Violent crime rate | | Housing Vacancy Rate | Access to exercise (%) | |
| | | Change in employment (%) | Frequent mental distress (%) | |
| | | Change in establishments (%) | Frequent physical distress (%) | |
| | | | Uninsured (%) | |

**eTable 2.** Annual Rate of Decline by Generalized Linear Mixed-Effects Modeling of CV Mortality for All US Counties and by Trajectory Cluster, 1980-2014

| ***Time Period*** | ***Rate of change in CV mortality in county-level clusters*** | | |
|---|---|---|---|
| | ***Low-mortality cluster*** | ***Intermediate-mortality cluster*** | ***High-mortality cluster*** |
| *(1980-1990)* | *-0.73 (-0.73, -0.72)* | *-0.77 (-0.77, -0.78)* | *-0.70 (-0.70, -0.69)* |
| *(1990-1999)* | *-0.69 (-0.70, -0.69)* | *-0.74 (-0.75, -0.74)* | *-0.67 (-0.67, -0.66)* |
| *(2000-2009)* | *-0.85 (-0.85, -0.84)* | *-1.00 (-1.00, -0.99)* | *-1.07 (-1.07, -1.06)* |
| *(2010-2014)* | *-0.06 (-0.07, -0.05)* | *-0.04 (-0.05, -0.04)* | *0.013 (0.001, 0.03)* |

**eTable 3.** Characteristics of Outlier Counties Comparing Low-Distress Counties Belonging to the High Mortality Trajectory vs Those With Low or Intermediate Mortality

Outlier counties with low distress and high mortality differed from other low-distress counties due to an excess burden of social, community, and health-related risk factors as well as demographic differences including a higher proportion of non-White residents.

| | | Low Distress | | |
|---|---|---|---|---|
| **Characteristic** | | **High-mortality (n = 133)** | **Intermediate- or low-mortality (n = 1691)** | **P-value** |
| **Demographics** | Population density | 68.1 [37.9, 130.3] | 51.9 [14.5, 167.5] | 0.012 |
| | Male (%) | 49.1 [48.6, 50.1] | 49.7 [49.0, 50.4] | <0.001 |
| | Age > 55 (%) | 0.3 [0.3, 0.3] | 0.3 [0.3, 0.4] | 0.004 |
| | Non-White (%) | 11.6 [4.8, 25.8] | 7.4 [3.9, 14.7] | <0.001 |
| | Hispanic (%) | 2.6 [1.6, 4.9] | 4.1 [2.1, 9.2] | <0.001 |
| | Foreign-born population (%) | 1.9 [1.2, 3.3] | 3.2 [1.7, 6.8] | <0.001 |
| **Socioeconomic metrics** | Distress Score (0-100) | 48.0 [36.9, 59.4] | 28.5 [13.9, 45.6] | <0.001 |
| | Population in Distressed Zip Code (%) | 2.0 [0.0, 8.0] | 0.0 [0.0, 2.0] | <0.001 |
| | Median household income ($) | 43K [40K, 47K] | 51K [45K, 58K] | <0.001 |
| | Poverty Rate (%) | 15.5 [13.1, 18.0] | 11.7 [9.2, 14.4] | <0.001 |
| | < HS education (%) | 15.8 [12.5, 19.0] | 10.3 [8.0, 13.0] | <0.001 |
| | Adults not in work (%) | 25.7 [23.3, 29.2] | 19.7 [16.3, 23.5] | <0.001 |
| | Uninsured (%) | 21.3 [18.9, 24.2] | 17.7 [13.9, 22.3] | <0.001 |
| **Physical environment** | RUCA Code | 4.3 [2.0, 6.6] | 4.9 [2.0, 8.3] | 0.047 |
| | Violent crime rate (per 100,000 population) | 262.8 [156.3, 393.3] | 165.8 [96.1, 262.4] | <0.001 |
| | Housing Vacancy Rate (%) | 10.5 [8.5, 12.7] | 8.2 [6.1, 11.0] | <0.001 |
| | Establishments in 2014 (n) | 511.0 [265.0, 967.0] | 775.0 [295.0, 2269.5] | 0.001 |
| | Food desert (%) | 17.6 [0.0, 30.0] | 7.7 [0.0, 20.0] | <0.001 |
| | Access to exercise (%) | 58.5 [41.4, 69.3] | 68.2 [52.9, 82.5] | <0.001 |
| **Health status & behaviors** | BMI > 30 (%) | 32.8 [30.9, 34.7] | 29.9 [27.1, 32.2] | <0.001 |
| | T2DM (%) | 11.6 [10.5, 12.5] | 9.9 [8.9, 10.9] | <0.001 |
| | Current smoking (%) | 20.7 [17.9, 22.7] | 16.4 [15.0, 18.4] | <0.001 |
| | No leisure physical activity (%) | 31.0 [28.0, 33.8] | 25.3 [21.9, 28.4] | <0.001 |
| | Frequent mental distress (%) | 12.2 [11.4, 13.5] | 10.1 [8.9, 11.3] | <0.001 |
| | Frequent physical distress (%) | 12.5 [11.2, 13.9] | 10.0 [8.9, 11.2] | <0.001 |

| | | | | |
|---|---|---|---|---|
| | Adults with fair/poor health (%) | 18.6 [16.3, 21.2] | 13.5 [11.9, 15.6] | <0.001 |

**eTable 4.** Characteristics of Outlier Counties Comparing High-Distress Counties Belonging to the Low-Mortality Trajectory vs Those With High or Intermediate Mortality

Outlier counties with high distress but low mortality exhibited a high burden of health risk factors, but were demographically distinct from other high-distress counties with a significantly lower proportion of non-White residents, and significantly lower levels of socioeconomic and community risk factors.

| | | High Distress | | |
|---|---|---|---|---|
| **Characteristic** | | **Low mortality (n = 184)** | **Intermediate or High-mortality (n = 350)** | **P-value** |
| **Demographics** | Population density | 27.0 [11.7, 47.1] | 30.8 [15.7, 46.5] | 0.44 |
| | Male (%) | 49.5 [48.8, 51.6] | 49.4 [48.6, 51.2] | 0.141 |
| | Age > 55 (%) | 0.3 [0.3, 0.3] | 0.3 [0.3, 0.3] | 0.001 |
| | Non-White (%) | 11.8 [5.9, 25.8] | 26.4 [7.6, 44.5] | <0.001 |
| | Hispanic (%) | 3.1 [1.6, 14.6] | 2.7 [1.4, 7.6] | 0.072 |
| | Foreign-born population (%) | 2.2 [0.9, 4.6] | 1.6 [0.9, 3.7] | 0.096 |
| **Socioeconomic metrics** | Distress Score (0-100) | 86.8 [78.2, 93.5] | 90.1 [82.8, 96.2] | <0.001 |
| | Population in Distressed Zip Code (%) | 100.0 [89.0, 100.0] | 100.0 [91.0, 100.0] | 0.174 |
| | Median household income ($) | 38K [34K, 41K] | 34K [31K, 37K] | <0.001 |
| | Poverty Rate (%) | 19.9 [16.6, 23.6] | 23.6 [20.2, 27.8] | <0.001 |
| | < HS education (%) | 20.3 [17.0, 23.5] | 22.5 [19.2, 25.7] | <0.001 |
| | Adults not in work (%) | 32.7 [27.4, 39.2] | 35.4 [31.1, 43.9] | <0.001 |
| | Uninsured (%) | 24.9 [22.1, 29.4] | 25.5 [22.5, 28.2] | 0.771 |
| **Physical environment** | RUCA Code | 7.0 [4.4, 9.0] | 6.7 [4.9, 8.0] | 0.377 |
| | Violent crime rate (per 100,000 population) | 217.5 [116.3, 329.1] | 274.1 [149.1, 451.0] | 0.001 |
| | Housing Vacancy Rate (%) | 15.0 [12.4, 17.6] | 15.2 [13.2, 17.6] | 0.254 |
| | Establishments in 2014 (n) | 235.0 [121.0, 483.5] | 248.5 [142.0, 438.5] | 0.522 |
| | Food desert (%) | 25.0 [0.0, 46.6] | 27.0 [0.0, 50.0] | 0.486 |
| | Access to exercise (%) | 50.6 [30.7, 66.8] | 43.3 [29.0, 57.5] | 0.004 |
| **Health status & behaviors** | BMI > 30 (%) | 32.2 [30.1, 34.4] | 34.3 [31.1, 37.7] | <0.001 |
| | T2DM (%) | 12.7 [11.6, 13.9] | 13.8 [12.5, 15.3] | <0.001 |
| | Current smoking (%) | 20.1 [16.9, 22.4] | 22.5 [19.2, 25.0] | <0.001 |
| | No leisure physical activity (%) | 29.8 [28.0, 32.9] | 32.0 [29.2, 35.2] | <0.001 |
| | Frequent mental distress (%) | 12.4 [10.8, 13.4] | 13.7 [12.5, 14.7] | <0.001 |
| | Frequent physical distress (%) | 13.1 [11.7, 14.7] | 14.7 [13.2, 16.4] | <0.001 |

| | | | | |
|---|---|---|---|---|
| | Adults with fair/poor health (%) | 19.9 [17.9, 22.9] | 23.4 [20.2, 26.5] | <0.001 |

**eTable 5.** Pairwise Pearson Correlation Coefficients Among County-Level Exposure Levels

Where two variables demonstrated a correlation of 0.6 or greater, the variable believed to be more upstream in the causal pathway was retained and the downstream variable excluded.

| | County-level Chracterstics | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **1** | **Population density** | **1** | | | | | | | | | | | | | | | | | | | | | | | | | |
| **2** | **Non-white (%)** | 0.3 | **1** | | | | | | | | | | | | | | | | | | | | | | | | |
| **3** | **Hispanic (%)** | 0.1 | 0.4 | **1** | | | | | | | | | | | | | | | | | | | | | | | |
| **4** | **Male (%)** | 0.4 | 0.2 | 0.1 | **1** | | | | | | | | | | | | | | | | | | | | | | |
| **5** | **> 55 years (%)** | 0.5 | 0.5 | 0.4 | 0 | **1** | | | | | | | | | | | | | | | | | | | | | |
| **6** | **Median Income** | 0.3 | 0.1 | 0.2 | 0.1 | 0.2 | **1** | | | | | | | | | | | | | | | | | | | | |
| **7** | **< HS education (%)** | 0.1 | 0.3 | 0.1 | 0 | 0.1 | 0.7 | **1** | | | | | | | | | | | | | | | | | | | |
| **8** | **Uninsured (%)** | 0.2 | 0.4 | 0.3 | 0 | 0.1 | 0.5 | 0.7 | **1** | | | | | | | | | | | | | | | | | | |
| **9** | **Violent crime rates** | 0.3 | 0.5 | 0.3 | 0.2 | 0.3 | 0.2 | 0.3 | 0.3 | **1** | | | | | | | | | | | | | | | | | |
| **10** | **Access to exercise opportunities (%)** | 0.6 | 0.1 | 0.3 | 0.2 | 0.3 | 0.4 | 0.3 | 0.2 | 0.2 | **1** | | | | | | | | | | | | | | | | |
| **11** | **Food desert (%)** | 0 | 0.3 | 0.1 | 0.1 | 0.1 | 0.4 | 0.3 | 0.3 | 0.3 | 0.1 | **1** | | | | | | | | | | | | | | | |
| **12** | **Mean RUCA*** | 0.7 | 0.3 | 0.2 | 0.3 | 0.5 | 0.3 | 0.1 | 0.1 | 0.4 | 0.5 | 0.1 | **1** | | | | | | | | | | | | | | |
| **13** | **BMI>30** | 0.1 | 0.1 | 0.3 | 0.1 | 0 | 0.5 | 0.4 | 0.2 | 0.1 | 0.4 | 0.2 | 0.1 | **1** | | | | | | | | | | | | | |
| **14** | **DM (%) *** | 0.2 | 0.3 | 0.2 | 0.2 | 0.3 | 0.8 | 0.7 | 0.6 | 0.2 | 0.4 | 0.3 | 0.2 | 0.5 | **1** | | | | | | | | | | | | |
| **15** | **Smoking (%)** | 0.1 | 0.2 | 0.4 | 0.1 | 0.1 | 0.6 | 0.5 | 0.3 | 0.2 | 0.3 | 0.3 | 0 | 0.6 | 0.6 | **1** | | | | | | | | | | | |
| **16** | **Poor/fair health (%)** | 0.0 | 0.4 | 0 | 0.2 | 0.2 | 0.7 | 0.8 | 0.7 | 0.4 | 0.3 | 0.4 | 0.1 | 0.5 | 0.8 | 0.7 | **1** | | | | | | | | | | |
| **17** | **No leisure time activity (%)** | 0.2 | 0 | 0.3 | 0.1 | 0.1 | 0.6 | 0.5 | 0.3 | 0 | 0.5 | 0.1 | 0.2 | 0.7 | 0.6 | 0.6 | 0.6 | **1** | | | | | | | | | |
| **18** | **Average # mentally unhealthy days** | 0.2 | 0.3 | 0.2 | 0.3 | 0.1 | 0.7 | 0.6 | 0.4 | 0.3 | 0.2 | 0.3 | 0.1 | 0.5 | 0.6 | 0.8 | 0.8 | 0.4 | **1** | | | | | | | | |
| **19** | **Frequent mental distress** | 0.2 | 0.3 | 0.2 | 0.3 | 0.1 | 0.7 | 0.6 | 0.5 | 0.3 | 0.2 | 0.4 | 0.1 | 0.5 | 0.7 | 0.8 | 0.9 | 0.5 | 1 | **1** | | | | | | | |
| **20** | **Frequent physical distress*** | 0 | 0.4 | 0.1 | 0.2 | 0.1 | 0.8 | 0.7 | 0.6 | 0.4 | 0.3 | 0.4 | 0 | 0.5 | 0.8 | 0.8 | 1 | 0.5 | 0.9 | 1 | **1** | | | | | | |

| | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **21** | **Foreign-born (%)** | 0.3 | 0.4 | 0.8 | 0 | 0.4 | 0.4 | 0 | 0.2 | 0.3 | 0.5 | 0 | 0.4 | 0.4 | 0.3 | 0.4 | 0.1 | 0.5 | 0.2 | 0.2 | 0.2 | **1** | | | | | |
| **22** | **Population in distressed zip code (%)** | 0.1 | 0.3 | 0 | 0.1 | 0 | 0.6 | 0.6 | 0.5 | 0.3 | 0.3 | 0.3 | 0.1 | 0.4 | 0.6 | 0.5 | 0.7 | 0.5 | 0.5 | 0.6 | 0.6 | 0.2 | **1** | | | | |
| **23** | **Poverty rate (%)** | 0 | 0.4 | 0.1 | 0.1 | 0.1 | 0.8 | 0.7 | 0.6 | 0.3 | 0.2 | 0.4 | 0 | 0.4 | 0.7 | 0.6 | 0.8 | 0.4 | 0.7 | 0.8 | 0.8 | 0.2 | 0.7 | **1** | | | |
| **24** | **Adults not in work (%)** | 0.1 | 0.3 | 0 | 0.1 | 0 | 0.7 | 0.7 | 0.5 | 0.3 | 0.3 | 0.3 | 0.1 | 0.4 | 0.6 | 0.6 | 0.7 | 0.4 | 0.7 | 0.7 | 0.8 | 0.2 | 0.7 | 0.7 | **1** | | |
| **25** | **Housing vacancy rate (%)** | 0.5 | 0.1 | 0.1 | 0 | 0.2 | 0.6 | 0.5 | 0.5 | 0.1 | 0.5 | 0.2 | 0.4 | 0.4 | 0.6 | 0.4 | 0.5 | 0.6 | 0.3 | 0.3 | 0.5 | 0.3 | 0.6 | 0.5 | 0.5 | **1** | |
| **26** | **Establishments in 2014 (n)** | 0.8 | 0.3 | 0.3 | 0.3 | 0.4 | 0.4 | 0.3 | 0.3 | 0.4 | 0.7 | 0.1 | 0.7 | 0.3 | 0.4 | 0.1 | 0.2 | 0.4 | 0 | 0 | 0.1 | 0.5 | 0.2 | 0.2 | 0.2 | 0.6 | **1** |