Supplementary Table S1: Spatial features

Feature	Source	Description
Latitude & longitude	USA shape files	Geograpical coordinates of counties
Female obesity prevalence	http://ghdx.healthdata.org/us-data	Female obesity prevalence 2011 (%)
Male obesity prevalence	http://ghdx.healthdata.org/us-data	Male obesity prevalence 2011 (%)
Female anyPA prevalence	http://ghdx.healthdata.org/us-data	Prevalence 2011 (%)
Male anyPA prevalence	http://ghdx.healthdata.org/us-data	Prevalence 2011 (%)
Female sufficientPA prevalence	http://ghdx.healthdata.org/us-data	Female sufficientPA Prevalence 2011 (%)
Male sufficientPA prevalence	http://ghdx.healthdata.org/us-data	Male sufficientPA Prevalence 2011 (%)
Cardiovascular disease mortality	http://ghdx.healthdata.org/us-data	Mortality rate 2014
Cancer mortality	http://ghdx.healthdata.org/us-data	Mortality rate 2014
Respiratory disease mortality	http://ghdx.healthdata.org/us-data	Mortality rate 2014
Life expectancy	http://ghdx.healthdata.org/us-data	2014
Male hypertension prevalence (%)	http://ghdx.healthdata.org/us-data	total hypertension prevalence (among all respondents, percentage of those who reported systolic BP of at least 140mm HG and/or self-reported taking medication)
Female hypertension prevalence (%)	http://ghdx.healthdata.org/us-data	total hypertension prevalence (among all respondents, percentage of those who reported systolic BP of at least 140mm HG and/or self-reported taking medication)
Male hypertension prevalence self-reported (%)	http://ghdx.healthdata.org/us-data	percentage of respondents who reported being told by a doctor or other healthcare professional that they had hypertension
Female hypertension prevalence self-reported (%)	http://ghdx.healthdata.org/us-data	percentage of respondents who reported being told by a doctor or other healthcare professional that they had hypertension
Male hypertension prevalence treatment (%)	http://ghdx.healthdata.org/us-data	among prevalent cases, those who report taking prescribed medication
Female hypertension prevalence treatment (%)	http://ghdx.healthdata.org/us-data	among prevalent cases, those who report taking prescribed medication
Male hypertension prevalence control (%)	http://ghdx.healthdata.org/us-data	among prevalent cases, the percentage of respondents who reported taking prescribed medication and SBP <140 mm Hg
Female hypertension prevalence control (%)	http://ghdx.healthdata.org/us-data	among prevalent cases, the percentage of respondents who reported taking prescribed medication and SBP <140 mm Hg

Male hypertension prevalence uncontrolled (%)	http://ghdx.healthdata.org/us-data	percentage of respondents who reported being told by a doctor or other healthcare professional that they had hypertension and SBP of 140 mm Hg or higher
Female hypertension prevalence uncontrolled (%)	http://ghdx.healthdata.org/us-data	percentage of respondents who reported being told by a doctor or other healthcare professional that they had hypertension and SBP of 140 mm Hg or higher
Male hypertension prevalence awareness (%)	http://ghdx.healthdata.org/us-data	among prevalent cases, the percentage of people who have hypertension and know it
Female hypertension prevalence awareness (%)	http://ghdx.healthdata.org/us-data	among prevalent cases, the percentage of people who have hypertension and know it
Direct purchase only - Pop 19-34	https://covid19.census.gov/datasets/	Number of Population
Direct purchase only - Pop 35-64	https://covid19.census.gov/datasets/	Number of Population
Direct purchase only - Pop 65+	https://covid19.census.gov/datasets/	Number of Population
Medicare only - Pop < 19	https://covid19.census.gov/datasets/	Number of Population
Medicare only - Pop 19-34	https://covid19.census.gov/datasets/	Number of Population
Medicare only - Pop 35-64	https://covid19.census.gov/datasets/	Number of Population
Medicare only - Pop 65+	https://covid19.census.gov/datasets/	Number of Population
Medicaid only - Pop < 19	https://covid19.census.gov/datasets/	Number of Population
Medicaid only - Pop 19-34	https://covid19.census.gov/datasets/	Number of Population
Medicaid only - Pop 35-64	https://covid19.census.gov/datasets/	Number of Population
TRICARE/Military only: - Pop < 19	https://covid19.census.gov/datasets/	Number of Population
TRICARE/Military only: - Pop 19-34	https://covid19.census.gov/datasets/	Number of Population
TRICARE/Military only: - Pop 35-64	https://covid19.census.gov/datasets/	Number of Population
TRICARE/Military only: - Pop 65+	https://covid19.census.gov/datasets/	Number of Population
VA health care only - Pop < 19	https://covid19.census.gov/datasets/	Number of Population
VA health care only - Pop 19-34	https://covid19.census.gov/datasets/	Number of Population
VA health care only - Pop 35-64	https://covid19.census.gov/datasets/	Number of Population
VA health care only - Pop 65+	https://covid19.census.gov/datasets/	Number of Population
2 or more insurance - Pop < 19	https://covid19.census.gov/datasets/	Number of Population
2 or more insurance - Pop 19-34	https://covid19.census.gov/datasets/	Number of Population
2 or more insurance - Pop 35-64	https://covid19.census.gov/datasets/	Number of Population
2 or more insurance - Pop 65+	https://covid19.census.gov/datasets/	Number of Population
Population with no health insurance - 0-18	https://covid19.census.gov/datasets/	Number of Population

Population with no health insurance - 19-34	https://covid19.census.gov/datasets/	Number of Population
Population with no health insurance - 35-64	https://covid19.census.gov/datasets/	Number of Population
Population with no health insurance - Age 65+	https://covid19.census.gov/datasets/	Number of Population
Civilian noninstitutionalized pop - With health coverage	https://covid19.census.gov/datasets/	Number of Population
Total civilian noninstitutionalized pop - With health insurance coverage	https://covid19.census.gov/datasets/	Number of Population
Total civilian noninstitutionalized pop - With private health insurance	https://covid19.census.gov/datasets/	Number of Population
Total civilian noninstitutionalized pop - With public coverage	https://covid19.census.gov/datasets/	Number of Population
Total civilian noninstitutionalized pop - No health insurance coverage	https://covid19.census.gov/datasets/	Number of Population
Civilian noninstitutionalized pop under 19 yrs	https://covid19.census.gov/datasets/	Number of Population
Total civilian noninstitutionalized pop under 19 yrs - No health insurance coverage	https://covid19.census.gov/datasets/	Number of Population
Total civilian noninstitutionalized pop - with a disability	https://covid19.census.gov/datasets/	Number of Population
Total civilian noninstitutionalized pop - with a disability 65 and over	https://covid19.census.gov/datasets/	Number of Population
Total households with a computer	https://covid19.census.gov/datasets/	Number of total households
Total households with a broadband Internet subscription	https://covid19.census.gov/datasets/	Number of total households
Less than a high school diploma	https://www.ers.usda.gov/data-products/county-level-data-sets/download-data/	Percent of adults, 2014-18
High school diploma only	https://www.ers.usda.gov/data-products/county-level-data-sets/download-data/	Percent of adults, 2014-19
Some college or associate's degree	https://www.ers.usda.gov/data-products/county-level-data-sets/download-data/	Percent of adults, 2014-20
Bachelor's degree or higher	https://www.ers.usda.gov/data-products/county-level-data-sets/download-data/	Percent of adults, 2014-21

Population estimate	https://www.ers.usda.gov/data-products/county-level-data-sets/download-data/	Population estimate 2019
Population change	https://www.ers.usda.gov/data-products/county-level-data-sets/download-data/	Number of population change 2019
Births	https://www.ers.usda.gov/data-products/county-level-data-sets/download-data/	Birth rate 2019
Deaths	https://www.ers.usda.gov/data-products/county-level-data-sets/download-data/	Death rate 2019
Natural increase	https://www.ers.usda.gov/data-products/county-level-data-sets/download-data/	Natural increase rate 2019
International migration	https://www.ers.usda.gov/data-products/county-level-data-sets/download-data/	International migration rate 2019
Domestic migration	https://www.ers.usda.gov/data-products/county-level-data-sets/download-data/	Domestic migration rate 2019
Net migration	https://www.ers.usda.gov/data-products/county-level-data-sets/download-data/	Net migration rate 2019
Residual	https://www.ers.usda.gov/data-products/county-level-data-sets/download-data/	Residual 2019
Rural-urban continuum code	https://www.ers.usda.gov/data-products/county-level-data-sets/download-data/	The 2013 Rural-Urban Continuum Codes form a classification scheme that distinguishes metropolitan counties by the population size of their metro area, and nonmetropolitan counties by degree of urbanization and adjacency to a metro area.
Urban influence code	https://www.ers.usda.gov/data-products/county-level-data-sets/download-data/	The 2013 Urban Influence Codes form a classification scheme that distinguishes metropolitan counties by population size of their metro area, and nonmetropolitan counties by size of

		the largest city or town and proximity to metro and micropolitan areas.
White alone	https://covid19.census.gov/datasets/	Number of Total Population
Black or African American alone	https://covid19.census.gov/datasets/	Number of Total Population
American Indian and Alaska Native alone	https://covid19.census.gov/datasets/	Number of Total Population
Asian alone	https://covid19.census.gov/datasets/	Number of Total Population
Native Hawaiian and other Pacific Islander alone	https://covid19.census.gov/datasets/	Number of Total Population
Some other race alone	https://covid19.census.gov/datasets/	Number of Total Population
Two or more races	https://covid19.census.gov/datasets/	Number of Total Population
Not Hispanic or Latino	https://covid19.census.gov/datasets/	Number of Total Population
Hispanic or Latino (of any race)	https://covid19.census.gov/datasets/	Number of Total Population
Nursery, preschool	https://covid19.census.gov/datasets/	Number of Population Enrollment in
Kindergarten	https://covid19.census.gov/datasets/	Number of Population Enrollment in
Grade 1-4	https://covid19.census.gov/datasets/	Number of Population Enrollment in
Grade 5-8	https://covid19.census.gov/datasets/	Number of Population Enrollment in
Grade 9-12	https://covid19.census.gov/datasets/	Number of Population Enrollment in
College	https://covid19.census.gov/datasets/	Number of Population Enrollment in
Grad/Prof	https://covid19.census.gov/datasets/	Number of Population Enrollment in
Elementary school (grades 1-8)	https://covid19.census.gov/datasets/	Number of Population Enrollment in
High school (grades 9-12)	https://covid19.census.gov/datasets/	Number of Population Enrollment in
College or graduate school	https://covid19.census.gov/datasets/	Number of Population Enrollment in
Total households	https://covid19.census.gov/datasets/	Number of Total Households
Civilian labor force	https://www.ers.usda.gov/data-products/county-level-data-sets/download-data/	Number, 2019
Employed	https://www.ers.usda.gov/data-products/county-level-data-sets/download-data/	Rate 2019
Unemployed	https://www.ers.usda.gov/data-products/county-level-data-sets/download-data/	Rate 2019
Median household income	https://www.ers.usda.gov/data-products/county-level-data-sets/download-data/	Number, 2019

Median household income percent of state total	https://www.ers.usda.gov/data-products/county-level-data-sets/download-data/	Number, 2020
Votes difference	https://github.com/tonmcg/US_County_Level_Election_Results_08-20	Absolute difference between Republican votes - Democrat votes
Estimated percent of people in poverty	https://www.ers.usda.gov/data-products/county-level-data-sets/download-data/	Estimated percent of people of all ages in poverty 2018

Supplementary Figure S1 Color-coded comparison of top five most frequently selected features of the four prediction scenarios covered for spatial analysis of case and death counts during initial and nationwide COVID- 19 pandemics.

Supplementary Figure S1 Color-coded comparison of top five most frequently selected features of the four prediction scenarios covered for spatial analysis of case and death counts during initial and nationwide COVID- 19 pandemics.

Supplementary Figure S2 (a-b) Topic distributions versus cases and deaths during initial phase, respectively (c-d) Topic distributions versus cases and deaths during nationide phase, respectively.

Topic_1
Topic_6
Topic_2
Topic_7
Topic_3
Topic_8
Topic_4
Topic_9
Topic_5
Topic_10
[-0.2, 0.6)
[0.6, 1.5)
[1.5, 2.5)
[2.5, 5.1)
[5.1,229.6]
[0.0, 0.2)
[0.3, 0.5)
[0.5, 1.1)
[1.1,21.5]
0.2

(a) (b)

Supplementary Figure S2 (a-b) Topic distributions versus cases and deaths during initial phase, respectively (c-d) Topic distributions versus cases and deaths during nationwide phase, respectively.