

*[GeoHelath]*

Supporting Information for

**[Spatial Heterogeneity of the Respiratory Health Impacts of Wildfire Smoke PM2.5  
in California]**

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\*Authors contributed equally to this manuscript.

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**Additional Supporting Information (Files uploaded separately)**

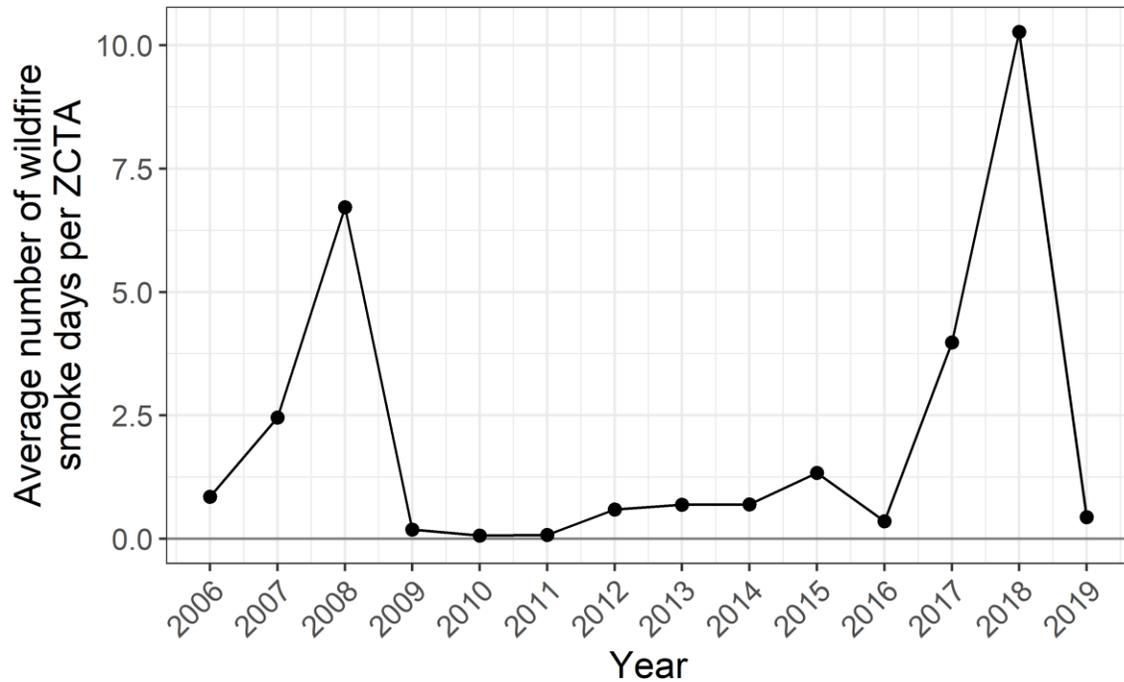
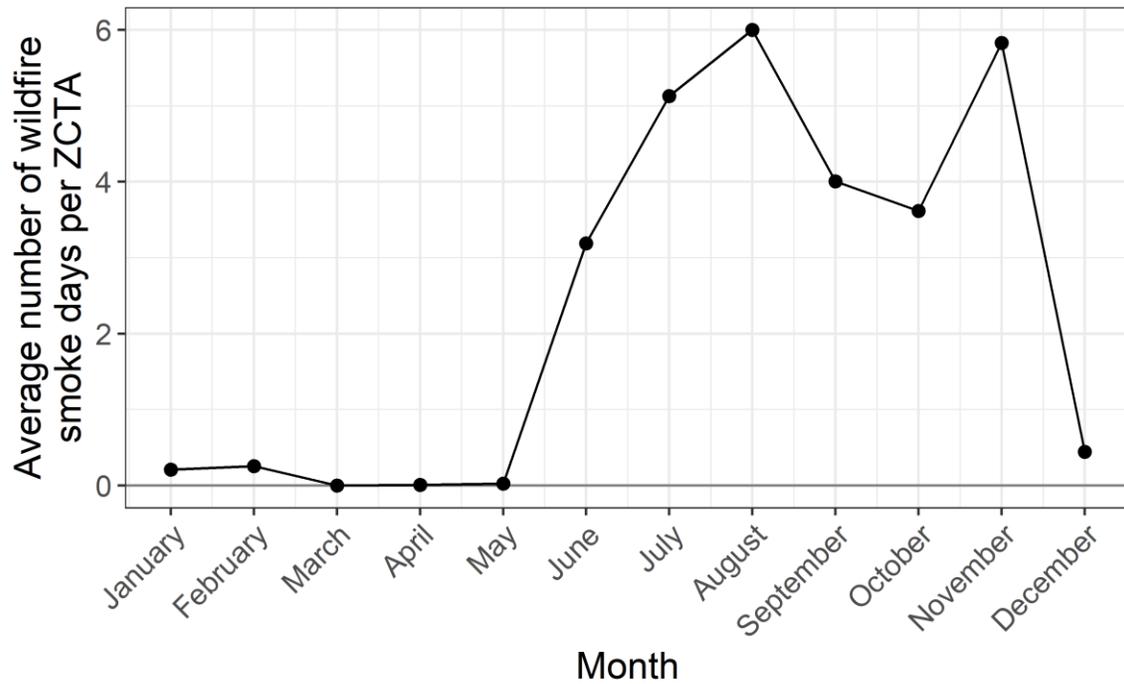
Table S1.csv for Tables S1

**Text S1. List of ICD codes for respiratory acute care utilizations (unscheduled hospitalizations and emergency department visits)**

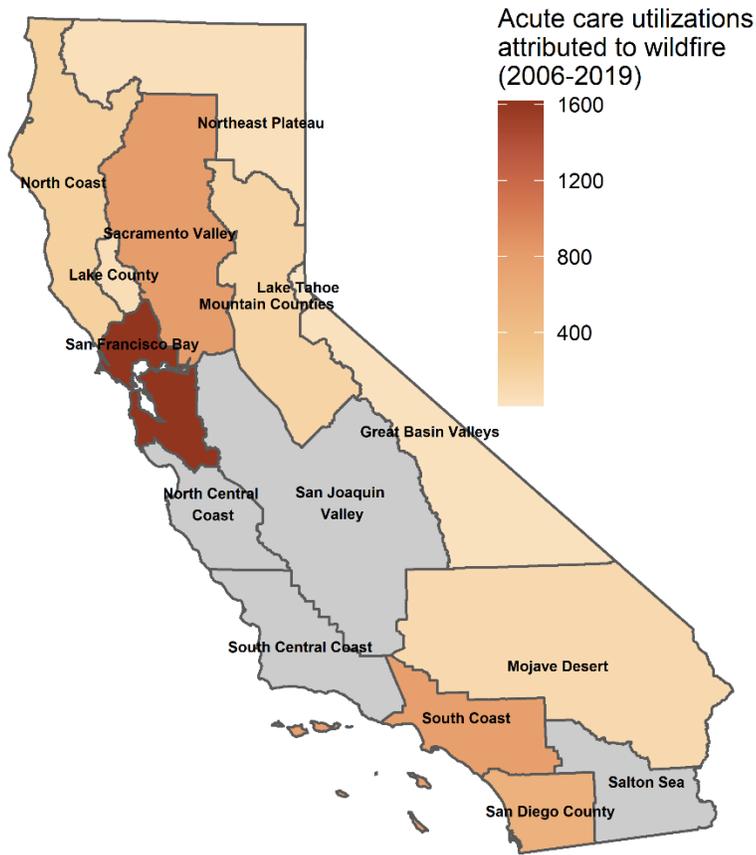
Below is a list of International Classification of Diseases (ICD) codes used to identify respiratory acute care utilizations.

ICD-9 codes: "460", "461", "462", "463", "464", "465", "466", "470", "471", "472", "473", "474", "475", "476", "477", "478", "480", "481", "482", "483", "484", "485", "486", "487", "490", "491", "492", "493", "494", "495", "496", "500", "501", "502", "503", "504", "505", "506", "507", "508", "510", "511", "512", "513", "514", "515", "516", "517", "518", "519".

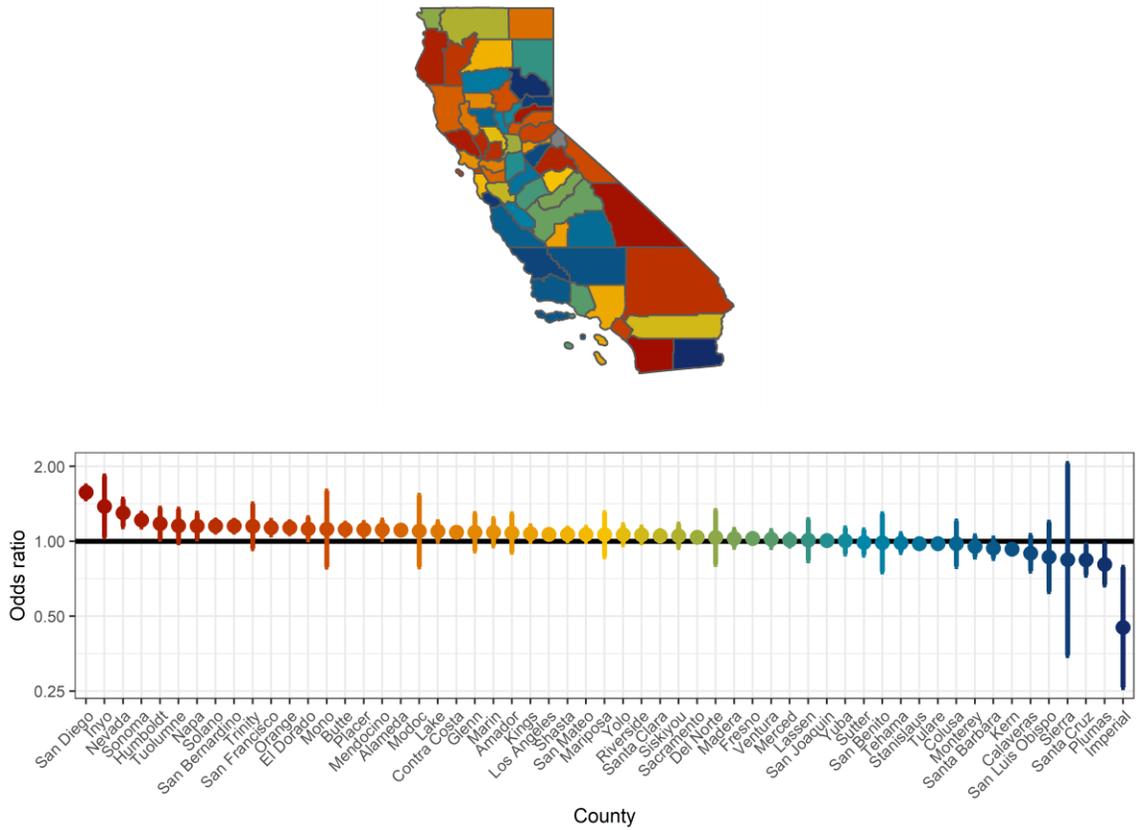
ICD-10 codes: "J00", "J01", "J02", "J03", "J04", "J05", "J06", "J09", "J10", "J11", "J12", "J13", "J14", "J15", "J16", "J17", "J18", "J20", "J21", "J22", "J30", "J31", "J32", "J33", "J34", "J35", "J36", "J37", "J38", "J39", "J40", "J41", "J42", "J43", "J44", "J45", "J46", "J47", "J60", "J61", "J62", "J63", "J64", "J65", "J66", "J67", "J68", "J69", "J70", "J80", "J81", "J82", "J83", "J84", "J85", "J86", "J90", "J91", "J92", "J93", "J94", "J95", "J96", "J97", "J98", "J99".



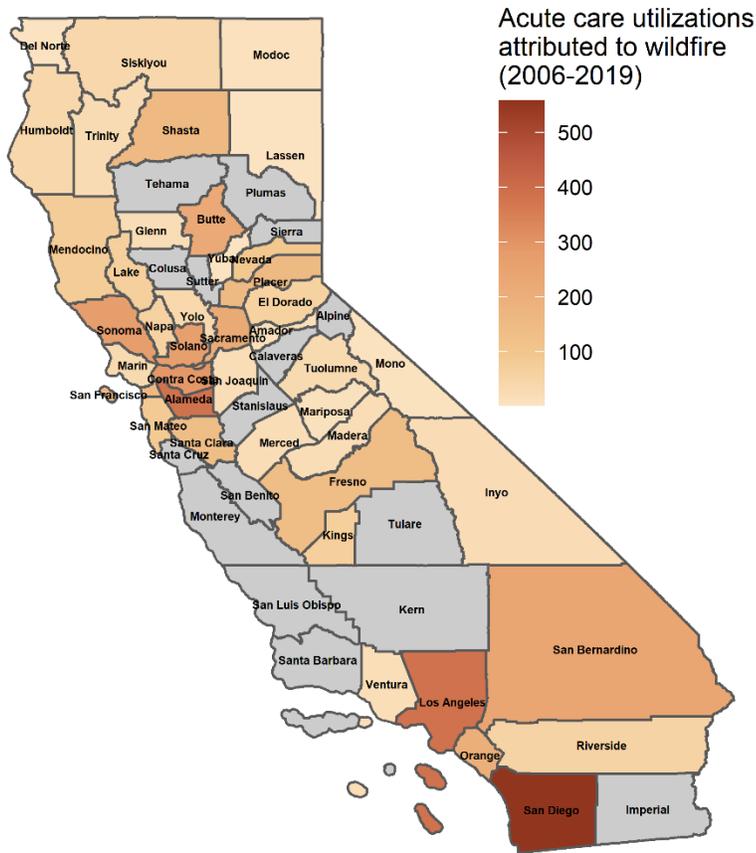
**Figure S1.** The temporal distribution of average wildfire smoke days per ZCTA. Top: distribution by month; Bottom: distribution by year.



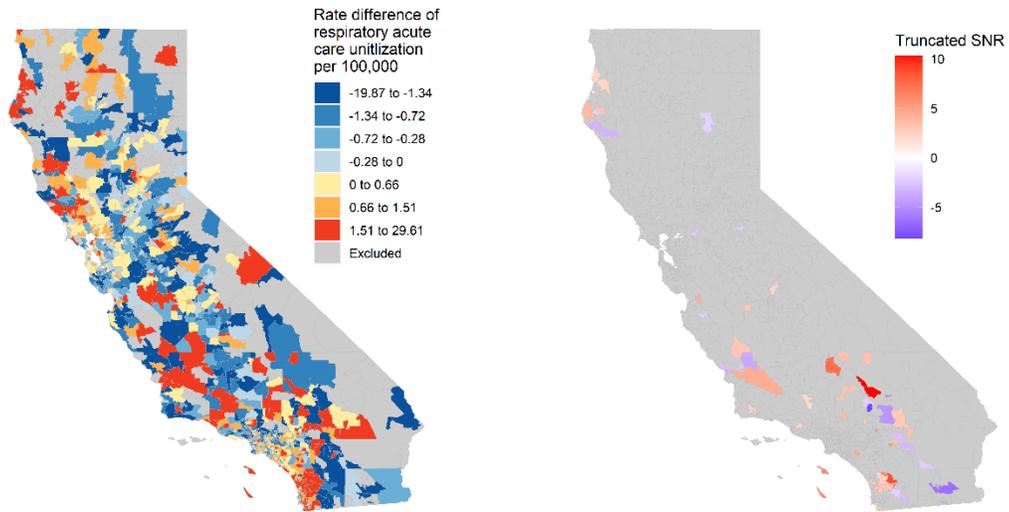
**Figure S2.** The air basin specific number of acute care utilizations attributable to wildfire smoke, 2006-2019. Grey areas represent air basins with negative odds ratios.



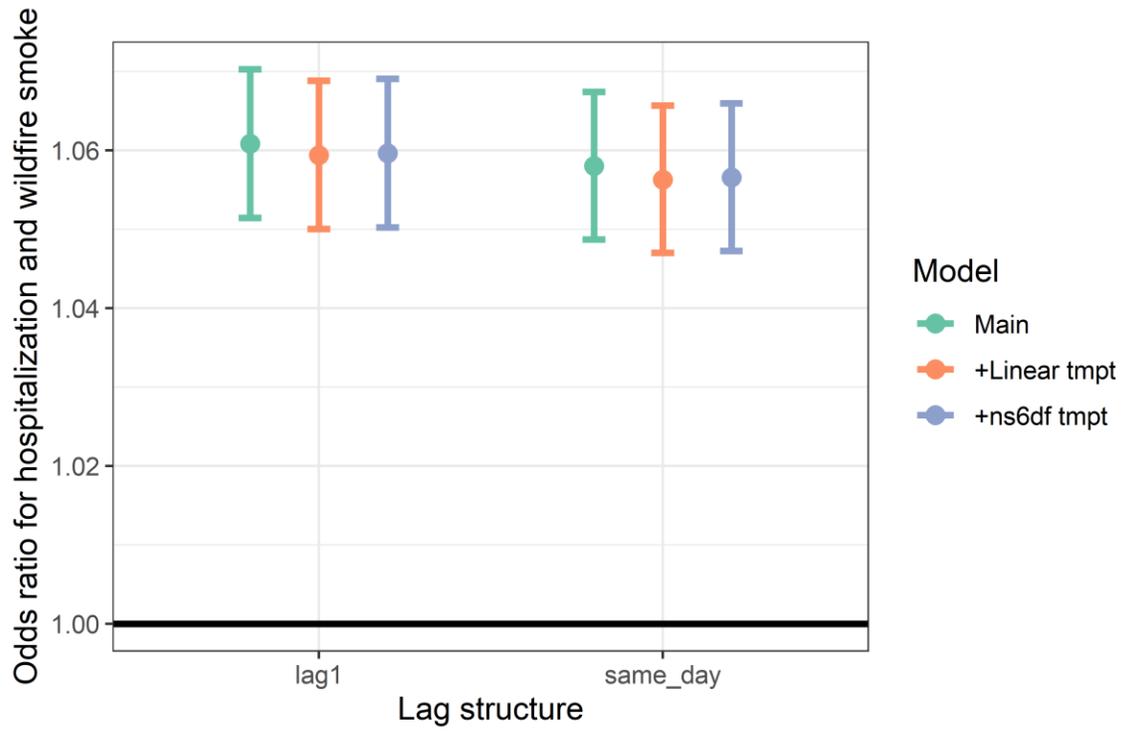
**Figure S3.** The county specific effect estimates (odds ratio) of wildfire smoke day on same-day respiratory acute care utilization. Top: spatial distribution of the effect estimates; Bottom: point estimates and 95% confidence intervals. We employed conditional logistic regressions in a time-stratified case-crossover design, matching on ZCTA, day of week, month and year. Note: the Alpine county (grey) was excluded from analysis because both ZCTAs in this county have a population smaller than 1000).



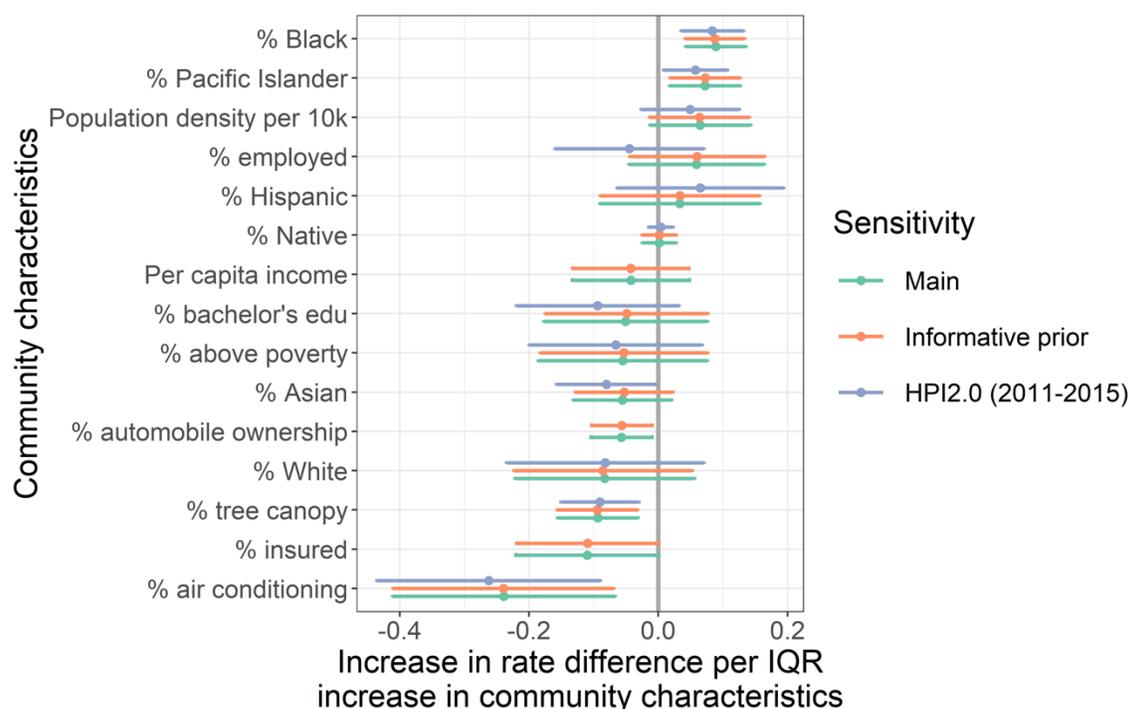
**Figure S4.** The county specific number of acute care utilizations attributable to wildfire smoke, 2006-2019. Grey areas represent counties with negative odds ratios. The Alpine County (grey) was excluded from analysis because both ZCTAs in this county have a population smaller than 1000).



**Figure S5.** The ZCTA specific effect estimates (rate difference) of wildfire smoke day on same-day respiratory acute care utilization: A) spatial distribution of the effect estimates and B) signal to noise ratio with absolute value larger than two.



**Figure S6.** The state-level effect estimates (odds ratio) of wildfire smoke day on the risk of acute care utilization by model specification and lag structure.



**Figure S7.** Effect modification of community characteristics on the effect of wildfire smoke (i.e., days with wildfire  $PM_{2.5} \geq 15 \mu g/m^3$ ) on same-day respiratory acute care utilization rate by different analytical decisions. Note: Informative prior analysis uses informative priors for the sill and nugget in the spatial Bayesian hierarchical model (1122 ZCTAs for air conditioning and 1296 ZCTAs for all other community characteristics); and HPI2.0 analysis used socioeconomic information obtained from the Healthy Place Index 2.0 dataset (2011-2015) instead of the Healthy Place Index 3.0 dataset (2015-2019) (1074 ZCTAs for air conditioning and 1296 ZCTAs for all other community characteristics; four community characteristics not available).

**Table S1.** Numeric results for state, air basin specific and county specific effect estimates (odds ratio and population attributable number) of wildfire smoke day on respiratory acute care utilization (included in a separate excel file with code book).

<b>Indicators</b>	<b>Description</b>	<b>Data source</b>	<b>ZCTAs used</b>	<b>Median (Q1, Q3)</b>	<b>IQR</b>	<b>Increase in rate difference per IQR increase (95% CI)</b>
% employed	Percentage of the population aged 25-64 who are employed	ACS, 2015-2019*	1296	72.7 (66.6, 76.6)	10.0	0.06 (-0.05, 0.16)
% Bachelor's education	Percentage of the population over age 25 with a Bachelor's education or higher	ACS, 2015-2019*	1296	29.8 (17.5, 47.5)	30.0	-0.05 (-0.18, 0.08)
% insured	Percentage of adults aged 18 to 64 years currently insured	ACS, 2015-2019*	1296	91.2 (86.7, 94.4)	7.7	-0.11 (-0.22, 0)
% above poverty	Percentage of the population with an income exceeding 200% of federal poverty level	ACS, 2015-2019*	1296	72.1 (58.9, 82.1)	23.2	-0.06 (-0.19, 0.08)
Per capita income (\$)	Per capita income in U.S. dollars	ACS, 2015-2019*	1296	33920 (24660.2, 48049.2)	23389	-0.04 (-0.13, 0.05)
% automobile ownership	Percentage of households with access to an automobile	ACS, 2015-2019*	1296	95.1 (92.5, 97)	4.5	-0.06 (-0.1, -0.01)
% tree canopy	Population-weighted percentage of the area with tree canopy	National Land Cover Database, 2011*	1296	6.1 (4, 11.8)	7.7	-0.09 (-0.16, -0.03)
Population density per 10k	Population density in 10,000 population per square meters	Census, 2010	1296	889.7 (101.4, 2412.1)	2310.8	0.06 (-0.01, 0.14)
% air conditioning	Percentage of households that have central air conditioning	California Residential Appliance	1122	62.5 (26.4, 86.4)	60	-0.24 (-0.41, -0.07)

		Saturation Study, 2009				
% white	Percentage of the population that is self-identified non-Hispanic white	Census, 2010	1296	64.7 (48.7, 79.8)	31.1	-0.08 (-0.22, 0.06)
% Black	Percentage of the population that is self-identified non-Hispanic Black	Census, 2010	1296	2.2 (1, 5.7)	4.7	0.09 (0.04, 0.14)
% Asian	Percentage of the population that is self-identified non-Hispanic Asian	Census, 2010	1296	6.3 (2.1, 14)	11.9	-0.06 (-0.13, 0.02)
% Hispanic	Percentage of the population that is self-identified Hispanic	Census, 2010	1296	25.3 (12.8, 46.1)	33.3	0.03 (-0.09, 0.16)
% Native American	Percentage of the population that is self-identified non-Hispanic American Indian or Alaska Native	Census, 2010	1296	0.9 (0.6, 1.3)	0.8	0 (-0.02, 0.03)
% Pacific Islander	Percentage of the population that is self-identified non-Hispanic Native Hawaiian or other Pacific Islander	Census, 2010	1296	0.2 (0.1, 0.4)	0.3	0.07 (0.02, 0.13)

ACS: American Community Survey; ZCTA: ZIP Code Tabulation Area.

\*Obtained from the Health Places Index

**Table S2.** Summary of meta-regression results in the main analysis and distribution of community characteristics explored among ZCTAs in the study.