Developing an area-based socioeconomic measure from American Community Survey data

Yang J, Schupp CW, Harrati A, Clarke C, Keegan THM, Gomez SL.

Objectives of the Study

The addition of area-based socioeconomic status (SES) measures to analyses of cancer registry data has led to profound advancements in public health knowledge about the joint effects of SES and race/ethnicity on cancer population patterns. Area-level SES measures have previously come from the long form of the decennial Census. After the 2000 Census, detailed demographic, social, economic, and housing data used previously for area-based SES measures are now collected through the American Community Survey (ACS). The primary objective of this study was to evaluate the use of the ACS data for area-based socioeconomic measures to enable the continued population-based surveillance analyses of cancer incidence, survival, and other outcomes using these measures.

We requested and received 2006-2010 and 2007-2011 aggregated data from the California Department of Finance. First, we identified the following individual component ACS variables relevant for measurement of area-level SES at both the census block group and tract levels:

1) Percent persons with less than a high school degree
2) Percent persons with a high school degree
3) Percent persons with some college education
4) Percent persons with a bachelor's degree or higher
5) Education index (a weighted average of variables 1-4 above)
6) Percent persons with a ratio of household income to poverty line less than 0.5
7) Percent persons with a ratio of household income to poverty line in 0.5-0.99
8) Percent persons with a ratio of household income to poverty line in 1.0-1.24
9) Percent persons with a ratio of household income to poverty line in 1.25-1.49
10) Percent persons with a ratio of household income to poverty line in 1.50-1.84
11) Percent persons with a ratio of household income to poverty line in 1.85-1.99
12) Percent persons with a ratio of household income to poverty line 2 or higher
13) Percent persons with a ratio of household income to poverty line 1 or less
14) Percent persons with a blue collar job
15) Percent persons employed
16) Percent persons unemployed
17) Percent occupied housing unit
18) Percent owner-occupied housing unit
19) Percent renter-occupied housing unit
20) Percent households with Supplemental Security Income (SSI)
21) Percent households with public assistance income
22) Percent households with cash public assistance or Food Stamps / SNAP
23) Percent persons under 18 years living in households with SSI, cash public assistance income, or Food Stamps / SNAP
24) Percent households with no vehicle available
25) Percent housing units with more than 1 occupant per room
26) Percent non-single (1-unit, detached or attached) housing unit
27) Percent housing units with 10 or more units in structure
28) Median rental
29) Median value of owner-occupied housing unit
30) Median household income
31) Median family household income
32) Median non-family household income
33) Average individual income
34) Median individual income

We then compared the distributions of each five-year aggregate individual component SES measure during the two time periods (2006-2010 versus 2007-2011) (see Appendix Tables 1a and 1b). The distributions were quite similar across the time periods for all of the individual SES component variables indicating that the five-year aggregate measures are relatively stable across time. Therefore, we chose to use the most recent 2007-2011 ACS data for the remaining analyses.

Next, we computed the Yost SES index (Yost et al., Cancer Causes and Control 2001) using the 2007-2011 ACS data; we chose the original 1990 Census long form variables used to create this index: education index, percent below 200% poverty line, median household income, median rent, percent blue collar, percent unemployed.

Each census block group and tract has both an estimate and an associated margin of error (MOE) for every ACS SES component variable. The coefficient of variation (CV) was calculated using the following formula: $CV = MOE / (1.645*Estimate)$. In terms of reliability, CVs of < 12% were considered highly reliable, CVs of 12% to < 40% were considered marginally reliable and CVs ≥ 40% were considered unreliable.

For each SES component variable, the number of census block groups and tracts that fell into each reliability category was summed up to determine the relative reliability of that variable for all of California (see Appendix Tables 2a and 2b). We chose to focus on SES variables that did not have a substantial number of census block groups and tracts with unreliable estimates. Education index (from Liu) was highly reliable and is a weighted average of the other education variables. The most reliable variable relating household income to poverty line was percent persons with a ratio of household income to poverty line 2 or higher, which can be interpreted as percent persons above 200% poverty line, and contained within it the other poverty line variables. Notably, percent employed was found to be much more reliable than percent unemployed. All of the social assistance and housing unit size and structure variables proved to have high levels of unreliability and were no longer considered; percent renter occupied and median family/non-family income also had high levels of unreliability and were not considered further. The final list of variables selected to explore in a new multi-component SES variable were:

1) Education Index
2) Percent persons with a ratio of household income to poverty line 2 or higher (percent persons above 200% poverty line)
3) Percent persons with a blue collar job
4) Percent persons employed
5) Median rental
6) Median value of owner-occupied housing unit
7) Median household income
8) Percent occupied housing unit
9) Percent owner-occupied housing unit

We created the new multi-component SES variable by applying principal components analysis (PCA) to the above identified ACS component variables. We used a backward selection type method to choose a final index. We started by examining the first principal component in the analysis of all identified variables, then removed the variable with the smallest weight that was also less than 0.30 (a standard threshold level in PCA) indicating that the variable did not contribute significantly to the index. We continued this process of removing variables while also maximizing the overall variability explained by the first principal component until we obtained our final index (see Appendix Table 3). The final index contained the following variables:

1) Education Index
2) Percent persons with a ratio of household income to poverty line 2 or higher (percent persons above 200% poverty line)
3) Percent persons with a blue collar job
4) Percent persons employed
5) Median rental
6) Median value of owner-occupied housing unit
7) Median household income

The final SES index contained the same type and number of variables as the original Yost index that used census long form data. The main difference between our final SES index and the original Yost SES index is that our final SES index used the inverse complement of two variables in the Yost SES index: percent unemployed and percent less than 200% of poverty line. Percent unemployed and percent less than 200% of poverty line were unreliable in ACS data; however, percent employed and percent persons above 200% poverty line (percent persons with a ratio of household income to poverty line 2 or higher) were considered highly reliable. Therefore, the Yost SES index and our final SES index include the same components, but our final SES index is preferable to the Yost SES measure for ACS data.

Given the much smaller sample size of ACS compared to the census long form samples, there are much higher percent of missing values in ACS data. The final SES index could not be calculated if any of the seven component variables were missing, and the percent of missing SES index was 2.8% at census tract level (227 out of 8,057), and 9.8% at block group level (2,266 out of 23,212). Among the census tracts/block groups where it is valid to compute a SES index (i.e. the total population > 0 and median household income >0), the following four variables had missing values: education index, median value of owned household, median rental, and percent blue collar. We imputed those missing values using multiple imputation and developed a SES index based on the imputed data. We examined the distributions of our final SES index based on data with and without imputation, and found that they are comparable with each other (see Appendix Table 4a and 4b) especially at the census tract level.

The result of Aim 1 was a composite SES index estimate with MOE for every census tract and block group where an SES measure is valid. Providing the MOE will allow researchers to decide if specific tracts/block groups have a preferred level of reliability. The quintiles of the estimates have been calculated for analytic use.

Because of the higher margins of error and higher percentage of missing values in ACS data than the census long-form data, the ACS data-based SES index needed to account for the variable data reliability. We initially calculated an MOE for each composite SES index value; however, MOE or CV is not useful to test the reliability for the SES index given that the composite SES index is a weighted linear combination of seven Z-scaled scores with mean 0. Therefore, we created an associated reliability index to measure the degree of data uncertainty based on the reliability category and missing status of the seven component variables. The possible range of index value is 0 to 6, with 0 indicating that it is not valid to compute a SES index (i.e. the total population = 0 or median household income = 0). For values 1 to 6, a high index indicates a low reliability and a low index indicates a high reliability. Below is a list of labels of each of the possible values for the reliability index:

1) 0 = block group/census tract where population = 0 or median household income=0
2) 1 = block group/census tract where all 7 component variables have high or medium reliability (CV<40%)

3) 2 = block group/census tract where 6 component variables have high or medium reliability (CV<40%) and 1 component variable is missing (which could be imputed based on the 6 reliable component variables)
4) 3 = block group/census tract where 6 component variables have high or medium reliability (CV<40%) and 1 component variable has low reliability (CV≥40%)
5) 4 = block group/census tract where 5 component variables have high or medium reliability (CV<40%) and 2 component variable are missing (which could be imputed based on the 5 reliable component variables)
6) 5 = block group/census tract where 5 component variables have high or medium reliability (CV<40%) and 2 component variables have low reliability (CV≥40%)
7) 6 = block group/census tract where 3 or more component variables are missing or have low reliability (CV≥40%)

According to the distribution of the reliability index, the developed composite SES measure is comparably reliable, particularly at the census tract level. In California, 81.8% of the census tracts and 49.9% of the block groups are assigned with reliable composite SES index derived from ACS data with high or medium reliability. There are 0.7% (57 out of 8,057) of the census tracts and 5.8% (1,351 out of 23,212) of the block groups with composite SES index whose reliability are relatively low due to the data quality issue of 3 or more component variables. (see Appendix Table 5). There is no decisive cut off boundary for the reliability index, but we suggest that the composite SES index associated with lower reliability should be used with caution and sensitivity analysis might be necessary to detect the impact of data uncertainty.

Appendix

Table 1a. Distribution of American Community Survey (ACS) socioeconomic status (SES) variables, census tract level.

Table 1b. Distribution of American Community Survey (ACS) socioeconomic status (SES) variables, census block group level.

Table 2a. Reliability of American Community Survey (ACS) socioeconomic status (SES) variables, census tract level.

Table 2b. Reliability of American Community Survey (ACS) socioeconomic status (SES) variables, census block group level.

Table 3. Loadings of principal components analyses using different combinations of American Community Survey socioeconomic status (SES) variables, 2007-2011.

Table 4a. Comparing the socioeconomic status (SES) composite measure with and without imputation, American Community Survey, 2007-2011, census tract level.

Table 4b. Comparing the socioeconomic status (SES) composite measure with and without imputation, American Community Survey, 2007-2011, census block group level.

Table 5. Distribution of the reliability index associating with the socioeconomic status (SES) composite measure, American Community Survey, 2007-2011, census tract and block group level.

Table 1a. Distribution of American Community Survey (ACS) socioeconomic status (SES) variables, census tract level.

SES variables	2006-2010					2007-2011				
	Missing N	Mean	Median	Minimum	Maximum	Missing N	Mean	Median	Minimum	Maximum
% persons with less than a high school degree	54	0.2028	0.1508	0	0.9362	50	0.2014	0.1497	0	0.8086
% persons with a high school degree	54	0.2161	0.2212	0	0.5206	50	0.2126	0.2168	0	1
% persons with some college education or higher	54	0.5811	0.599	0.0351	1	50	0.586	0.6062	0	1
% persons with a bachelor's degree or higher	54	0.3678	0.3418	0	1	50	0.3692	0.3421	0	1
Education Index	54	13.7161	13.9472	9.4468	16	50	13.7398	13.9791	9.8482	16
% persons with a ratio of household income to poverty line less than 0.5	75	0.0588	0.0431	0	0.9393	70	0.0626	0.0463	0	1
% persons with a ratio of household income to poverty line as 0.5 to 0.99	75	0.0803	0.0588	0	1	70	0.0838	0.0624	0	0.6452
% persons with a ratio of household income to poverty line as 1 to 1.24	75	0.0497	0.0369	0	0.8474	70	0.0508	0.0385	0	0.7678
% persons with a ratio of household income to poverty line as 1.25 to 1.49	75	0.0491	0.0384	0	0.463	70	0.0503	0.0399	0	0.3909
% persons with a ratio of household income to poverty line as 1.50 to 1.84	75	0.0652	0.0559	0	0.3591	70	0.0665	0.0585	0	0.3545
% persons with a ratio of household income to poverty line as 1.85 to 1.99	75	0.0265	0.0191	0	0.4521	70	0.0263	0.019	0	0.2721
% persons with a ratio of household income to poverty line as 2 or higher	75	0.6705	0.7051	0	1	70	0.6596	0.6924	0	1
% persons with a ratio of household income to poverty lineless than 2	75	0.3295	0.2949	0	1	70	0.3404	0.3076	0	1

% persons with a ratio of household income to poverty lineless than 1	75	0.1391	0.1078	0	1	70	0.1464	0.1142	0	1
% persons with a blue collar job	71	0.5917	0.5985	0	1	67	0.5871	0.5942	0	1
% persons employed	71	0.9084	0.9163	0.4082	1	65	0.8965	0.9054	0	1
% persons unemployed	71	0.0916	0.0837	0	0.5918	65	0.1035	0.0946	0	1
% occupied housing unit	78	0.9201	0.9385	0	1	78	0.9181	0.9368	0	1
% owner-occupied housing unit	79	0.5727	0.606	0	1	79	0.5656	0.597	0	1
% renter-occupied housing unit	79	0.4273	0.394	0	1	79	0.4344	0.403	0	1
% households with Supplemental Security Income (SSI)	79	0.0521	0.0417	0	0.5	79	0.0549	0.045	0	0.4644
% households with public assistance income	79	0.0363	0.0238	0	0.3519	79	0.0385	0.0257	0	0.3741
% households with cash public assistance or Food Stamps/SNAP	79	0.0714	0.0487	0	0.661	79	0.0809	0.0561	0	1
% persons under 18 years living in households with Supplemental Security Income (SSI), cash public assistance income, or Food Stamps/SNAP	115	0.1671	0.1292	0	1	113	0.1837	0.1463	0	1
% households with no vehicle available	79	0.0778	0.051	0	0.9246	79	0.0789	0.0514	0	0.9619
% housing units with more than 1 occupant per room	79	0.0904	0.0507	0	0.7289	79	0.0916	0.052	0	0.7401
% non-single (1-unit, detached or attached) housing unit	78	0.3349	0.2796	0	1	78	0.3349	0.2805	0	1
% housing units with 10 or more units in structure	78	0.1545	0.0784	0	1	78	0.1556	0.0787	0	1
Median rental	133	1255.13	1193.5	99	2001	130	1292.8	1234	247	2001
Median value of owner-occupied housing unit	187	479123	435200	13300	1000001	184	445606	393400	16200	1000001
Median household income	84	65553.1	59706	2499	250001	83	66444.1	60213.5	2499	250001
Median family household income	96	74414.2	67500	2499	250001	93	75479.6	67932.5	7273	250001
Median non-family household income	113	42945.8	39411.5	2499	250001	115	43320.1	39547	2499	250001

Average individual income	56	30041.8	26071	334	152715	48	30466.1	26430	528	172951
Median individual income	56	30889.1	27538	2499	125179	47	31109.8	27688.5	2499	130982

Table 1b. Distribution of American Community Survey (ACS) socioeconomic status (SES) variables, census block group level.

SES variables	2006-2010					2007-2011				
	Missing N	Mean	Median	Minimum	Maximum	Missing N	Mean	Median	Minimum	Maximum
% persons with less than a high school degree	93	0.1975	0.1372	0	1	81	0.1962	0.1368	0	1
% persons with a high school degree	93	0.2154	0.2133	0	0.8182	81	0.212	0.2092	0	1
% persons with some college education or higher	93	0.5871	0.6092	0	1	81	0.5918	0.6147	0	1
% persons with a bachelor's degree or higher	93	0.3719	0.3443	0	1	81	0.3735	0.3448	0	1
Education Index	93	13.7558	14.0189	9	16	81	13.7785	14.0377	9	16
% persons with a ratio of household income to poverty line less than 0.5	122	0.0572	0.0334	0	0.9393	114	0.0609	0.0369	0	1
% persons with a ratio of household income to poverty line as 0.5 to 0.99	122	0.0782	0.0453	0	1	114	0.0818	0.0493	0	1
% persons with a ratio of household income to poverty line as 1 to 1.24	122	0.0485	0.0246	0	1	114	0.0496	0.0262	0	1
% persons with a ratio of household income to poverty line as 1.25 to 1.49	122	0.0481	0.0263	0	0.6105	114	0.0493	0.028	0	0.5662
% persons with a ratio of household income to poverty line as 1.50 to 1.84	122	0.0641	0.0429	0	0.6634	114	0.0654	0.0448	0	0.7137
% persons with a ratio of household income to poverty line as 1.85 to 1.99	122	0.0261	0.0088	0	0.4613	114	0.026	0.0085	0	0.7196
% persons with a ratio of household income to poverty line as 2 or higher	122	0.6779	0.7203	0	1	114	0.667	0.7089	0	1
% persons with a ratio of household income to poverty lineless than 2	122	0.3221	0.2797	0	1	114	0.333	0.2911	0	1
% persons with a ratio of household income to poverty lineless than 1	122	0.1354	0.0941	0	1	114	0.1427	0.1022	0	1

% persons with a blue collar job	119	0.5866	0.5928	0	1	108	0.5819	0.5897	0	1
% persons employed	118	0.9088	0.9216	0	1	105	0.8971	0.9105	0	1
% persons unemployed	118	0.0912	0.0784	0	1	105	0.1029	0.0895	0	1
% occupied housing unit	124	0.9227	0.9444	0	1	120	0.9204	0.9428	0	1
% owner-occupied housing unit	129	0.5861	0.6332	0	1	128	0.5789	0.6216	0	1
% renter-occupied housing unit	129	0.4139	0.3668	0	1	128	0.4211	0.3784	0	1
% households with Supplemental Security Income (SSI)	129	0.0516	0.0347	0	0.6153	128	0.0543	0.0373	0	0.6978
% households with public assistance income	129	0.0364	0.0154	0	1	128	0.0386	0.0181	0	1
% households with cash public assistance or Food Stamps/SNAP	23205	0.0949	0.076	0.0232	0.2234	23212	0	0	0	0
% persons under 18 years living in households with Supplemental Security Income (SSI), cash public assistance income, or Food Stamps/SNAP	23205	0.2367	0.202	0	0.5521	23212	0	0	0	0
% households with no vehicle available	23205	0.0265	0.0094	0	0.0783	23212	0	0	0	0
% housing units with more than 1 occupant per room	129	0.087	0.0405	0	0.9331	128	0.088	0.0423	0	1
% non-single (1-unit, detached or attached) housing unit	124	0.3124	0.2324	0	1	120	0.3125	0.2313	0	1
% housing units with 10 or more units in structure	124	0.1354	0.0299	0	1	120	0.1361	0.0304	0	1
Median rental	1736	1270.84	1198	99	2001	1522	1307	1240	139	2001
Median value of owner-occupied housing unit	918	481949	438450	9999	1000001	895	449976	397200	9999	1000001
Median household income	143	67313.4	60436	2499	250001	144	68301.4	61182.5	2499	250001
Median family household income	183	76250.1	67917	2499	250001	182	77352.4	68839	2499	250001
Median non-family household income	1131	46605.9	40426	2499	250001	1115	46873.5	40556	2499	250001
Average individual income	94	30783.9	26353.5	334	316856	84	31262.4	26641	528	496964
Median individual income	23205	26738.4	27294	17234	36708	23212	0	0	0	0

Table 2a. Reliability of American Community Survey (ACS) socioeconomic status (SES) variables, census tract level.

SES variables	2007-20011							
	Reliability estimate not available		High reliability (CV: <12%)		Marginal reliability (CV: 12-40%)		Unreliabile (CV: >= 40%)	
	N	%	N	%	N	%	N	%
% persons with less than a high school degree	99	1%	1181	15%	4508	56%	2269	28%
% persons with a high school degree	62	1%	1250	16%	6597	82%	148	2%
% persons with some college education or higher	51	1%	5930	74%	1998	25%	78	1%
% persons with a bachelor's degree or higher	56	1%	3664	45%	3780	47%	557	7%
Education Index	50	1%	7713	96%	257	3%	37	0%
% persons with a ratio of household income to poverty line less than 0.5	178	2%	15	0%	3013	37%	4851	60%
% persons with a ratio of household income to poverty line as 0.5 to 0.99	226	3%	3	0%	3469	43%	4359	54%
% persons with a ratio of household income to poverty line as 1 to 1.24	440	5%	1	0%	1815	23%	5801	72%
% persons with a ratio of household income to poverty line as 1.25 to 1.49	398	5%	1	0%	1775	22%	5883	73%
% persons with a ratio of household income to poverty line as 1.50 to 1.84	247	3%	2	0%	2743	34%	5065	63%
% persons with a ratio of household income to poverty line as 1.85 to 1.99	983	12%	0	0%	267	3%	6807	84%
% persons with a ratio of household income to poverty line as 2 or higher	73	1%	6286	78%	1670	21%	28	0%
% persons with a ratio of household income to poverty lineless than 2	85	1%	383	5%	7037	87%	552	7%
% persons with a ratio of household income to poverty lineless than 1	103	1%	40	0%	5802	72%	2112	26%
% persons with a blue collar job	73	1%	4640	58%	3251	40%	93	1%
% persons employed	67	1%	7344	91%	634	8%	12	0%
% persons unemployed	104	1%	6	0%	6655	83%	1292	16%
% occupied housing unit	79	1%	7918	98%	57	1%	3	0%
% owner-occupied housing unit	150	2%	6013	75%	1745	22%	149	2%
% renter-occupied housing unit	88	1%	3887	48%	3757	47%	325	4%
% households with Supplemental Security Income (SSI)	428	5%	1	0%	2860	35%	4768	59%

% households with public assistance income	1054	13%	0	0%	1280	16%	5723	71%
% households with cash public assistance or Food Stamps/SNAP	510	6%	19	0%	3428	43%	4100	51%
% persons under 18 years living in households with Supplemental Security Income (SSI), cash public assistance income, or Food Stamps/SNAP	910	11%	45	1%	2693	33%	4409	55%
% households with no vehicle available	507	6%	82	1%	3328	41%	4140	51%
% housing units with more than 1 occupant per room	906	11%	2	0%	1711	21%	5438	67%
% non-single (1-unit, detached or attached) housing unit	376	5%	1136	14%	4537	56%	2008	25%
% housing units with 10 or more units in structure	1486	18%	588	7%	3294	41%	2689	33%
Median rental	841	10%	5732	71%	1341	17%	143	2%
Median value of owner-occupied housing unit	549	7%	5943	74%	1395	17%	170	2%
Median household income	88	1%	4970	62%	2940	36%	59	1%
Median family household income	105	1%	4084	51%	3717	46%	151	2%
Median non-family household income	123	2%	1221	15%	4982	62%	1731	21%
Average individual income	48	1%	6876	85%	1115	14%	18	0%
Median individual income	60	1%	5330	66%	2630	33%	37	0%

CV: Coefficient of variance=Standard Deviation/Mean.

■ Reliability Estimate Not Available: Estimate is not available or estimate is 0.

■ High Reliability: Small CVs (less than or equal to 12 percent) are flagged green to indicate that the sampling error is small relative to the estimate, and the estimate is reasonably reliable.

■ Medium Reliability: Estimates with CVs between 12 and 40 are flagged yellow—use with caution.

■ Low Reliability: Large CVs (over 40 percent) are flagged red to indicate that the sampling error is large relative to the estimate. The estimate is considered very unreliable.

Table 2b. Reliability of American Community Survey (ACS) socioeconomic status (SES) variables, census block group level.

SES variables	2007-2011							
	Reliability estimate not available		High reliability (CV: <12%)		Marginal reliability (CV: 12-40%)		Unreliabile (CV: >= 40%)	
	N	%	N	%	N	%	N	%
% persons with less than a high school degree	1358	6%	716	3%	7463	32%	13675	59%
% persons with a high school degree	258	1%	545	2%	18158	78%	4251	18%
% persons with some college education or higher	93	0%	7916	34%	13107	56%	2096	9%
% persons with a bachelor's degree or higher	208	1%	3334	14%	12734	55%	6936	30%
Education Index	81	0%	10563	46%	12334	53%	234	1%
% persons with a ratio of household income to poverty line less than 0.5	3558	15%	15	0%	1729	7%	17910	77%
% persons with a ratio of household income to poverty line as 0.5 to 0.99	3710	16%	4	0%	2687	12%	16811	72%
% persons with a ratio of household income to poverty line as 1 to 1.24	5771	25%	1	0%	841	4%	16599	72%
% persons with a ratio of household income to poverty line as 1.25 to 1.49	5807	25%	3	0%	737	3%	16665	72%
% persons with a ratio of household income to poverty line as 1.50 to 1.84	4009	17%	1	0%	1189	5%	18013	78%
% persons with a ratio of household income to poverty line as 1.85 to 1.99	9915	43%	0	0%	80	0%	13217	57%
% persons with a ratio of household income to poverty line as 2 or higher	132	1%	11208	48%	11076	48%	796	3%
% persons with a ratio of household income to poverty lineless than 2	319	1%	242	1%	12806	55%	9845	42%
% persons with a ratio of household income to poverty lineless than 1	1329	6%	40	0%	6631	29%	15212	66%
% persons with a blue collar job	127	1%	3276	14%	15976	69%	3833	17%
% persons employed	108	0%	16335	70%	6278	27%	491	2%

% persons unemployed	1252	5%	11	0%	6579	28%	15370	66%
% occupied housing unit	128	1%	20797	90%	2263	10%	24	0%
% owner-occupied housing unit	562	2%	10910	47%	10136	44%	1604	7%
% renter-occupied housing unit	550	2%	4582	20%	12136	52%	5944	26%
% households with Supplemental Security Income (SSI)	6015	26%	1	0%	1582	7%	15614	67%
% households with public assistance income	9529	41%	2	0%	573	2%	13108	56%
% households with cash public assistance or Food Stamps/SNAP	23212	100%	0	0%	0	0%	0	0%
% persons under 18 years living in households with Supplemental Security Income (SSI), cash public assistance income, or Food Stamps/SNAP	23212	100%	0	0%	0	0%	0	0%
% households with no vehicle available	23212	100%	0	0%	0	0%	0	0%
% housing units with more than 1 occupant per room	7334	32%	1	0%	706	3%	15171	65%
% non-single (1-unit, detached or attached) housing unit	4319	19%	594	3%	7883	34%	10416	45%
% housing units with 10 or more units in structure	10058	43%	626	3%	4556	20%	7972	34%
Median rental	4553	20%	10699	46%	6300	27%	1660	7%
Median value of owner-occupied housing unit	2183	9%	12226	53%	7154	31%	1649	7%
Median household income	191	1%	5489	24%	15206	66%	2326	10%
Median family household income	301	1%	4756	20%	14421	62%	3734	16%
Median non-family household income	1300	6%	1923	8%	9491	41%	10498	45%
Average individual income	84	0%	7605	33%	15341	66%	182	1%
Median individual income	23212	100%	0	0%	0	0%	0	0%

CV: Coefficient of variance=Standard Deviation/Mean.

■ Reliability Estimate Not Available: Estimate is not available or estimate is 0.

■ High Reliability: Small CVs (less than or equal to 12 percent) are flagged green to indicate that the sampling error is small relative to the estimate, and the estimate is reasonably reliable.

■ Medium Reliability: Estimates with CVs between 12 and 40 are flagged yellow—use with caution.

■ Low Reliability: Large CVs (over 40 percent) are flagged red to indicate that the sampling error is large relative to the estimate. The estimate is considered very unreliable.

Table 3. Loadings of principal components analyses using different combinations of American Community Survey socioeconomic status (SES) variables, 2007-2011.

Variable	Model 1	Model 2	Model 3	Model 4
Census tract (CT)-level (N CT=8,057)				
% variance explained	**56.4%**	**63.3%**	**69.0%**	**73.9%**
N missing	**227**	**227**	**227**	**227**
% above 200% poverty line	0.40395	0.404258	0.412488	0.420725
Education Index	0.393365	0.394959	0.399607	0.428713
Median Household Income	0.392557	0.393991	0.408495	0.43037
Median value of owned household	0.349047	0.349047	0.362064	0.386868
Median Rental	0.344576	0.343475	0.361115	0.363154
% Blue collar	-0.37732	-0.37832	-0.383864	-0.415246
% Employed	0.294938	0.294779	0.307333	.
% Owner occupied	0.235413	0.235637	.	.
% Occupied household	0.051411	.	.	.
Census block group (BG)-Level (N BG=23,212)				
% variance explained	**50.5%**	**56.7%**	**61.6%**	**67.9%**
N missing	**2266**	**2266**	**2266**	**2266**
% above 200% poverty line	0.411218	0.4115	0.421069	0.42244
Education Index	0.404943	0.40658	0.411521	0.436117
Median Household Income	0.404451	0.406098	0.419931	0.437511
Median value of owned household	0.35905	0.359358	0.374432	0.394629
Median Rental	0.335669	0.334517	0.354493	0.347625
% Blue collar	-0.369899	-0.371003	-0.37625	-0.404172
% Employed	0.251769	0.251705	0.263781	.
% Owner occupied	0.241994	0.241673	.	.
% Occupied household	0.054549	.	.	.

The eigenvectors show the loadings on each of the principal components axes. These loadings represent the degree to which the original variables are correlated with the principal components and whether the correlation is direct or inverse. Eigenvectors of greater than 0.3 are considered as important variables.

Table 4a. Comparing the socioeconomic status (SES) composite measure with and without imputation, American Community Survey, 2007-2011, census tract level.

SES quintiles based on data without imputation	SES quintiles based on data with imputation						
	.	1	2	3	4	5	Total
.	83	41	21	23	21	38	227
1	0	1550	16	0	0	0	1566
2	0	3	1555	8	0	0	1566
3	0	0	3	1555	8	0	1566
4	0	0	0	9	1556	1	1566
5	0	0	0	0	10	1556	1566
Total	83	1594	1595	1595	1595	1595	8057

Table 4b. Comparing the socioeconomic status (SES) composite measure with and without imputation, American Community Survey, 2007-2011, census block group level.

SES quintiles based on data without imputation	SES quintiles based on data with imputation						
	.	1	2	3	4	5	Total
.	144	406	302	364	451	599	2266
1	0	4184	5	0	0	0	4189
2	0	23	4166	0	0	0	4189
3	0	0	141	4049	0	0	4190
4	0	0	0	201	3988	0	4189
5	0	0	0	0	175	4014	4189
Total	144	4613	4614	4614	4614	4613	23212

Table 5. Distribution of the reliability index associating with the socioeconomic status (SES) composite measure, American Community Survey, 2007-2011, census tract and block group level.

Reliability Index	Census Tract		Block Group	
	N	%	N	%
0: block group/census tract where population = 0 or median household income=0	83	1.0%	144	0.6%
1: block group/census tract where all 7 component variables have high or medium reliability (CV<40%)	6591	81.8%	11583	49.9%
2: block group/census tract where 6 component variables have high or medium reliability (CV<40%) and 1 component variable is missing (which could be imputed based on the 6 reliable component variables)	87	1.1%	1047	4.5%
3: block group/census tract where 6 component variables have high or medium reliability (CV<40%) and 1 component variable has low reliability (CV≥40%)	1040	12.9%	6320	27.2%
4: block group/census tract where 5 component variables have high or medium reliability (CV<40%) and 2 component variable are missing (which could be imputed based on the 5 reliable component variables)	20	0.3%	630	2.7%
5: block group/census tract where 5 component variables have high or medium reliability (CV<40%) and 2 component variables have low reliability (CV≥40%)	179	2.2%	2137	9.2%
6: block group/census tract where 3 or more component variables are missing or have low reliability (CV≥40%)	57	0.7%	1351	5.8%
Total	8057	100.0%	23212	100.0%