Using Data from the American Community Survey to Better Understand Coverage Measurement Results in the 2010 Census

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Abstract

This research generates coverage estimates by socioeconomic characteristics from the American Community Survey (ACS). By using ACS results, we identify the areas that are poorer, less educated, more mobile, and less employed. The 2010 Census Coverage Measurement (CCM) program evaluated coverage of the 2010 Census and produced components of census coverage results that included estimates of correct enumerations, erroneous enumerations, and omissions of the national household population. We repeat the 2010 CCM estimation methodology to produce component estimates for these challenging areas. We could then use the results of this work to help focus research with the goal of improving coverage in these areas. Specifically, this paper integrates the five-year ACS estimates at the block group and tract level.

Key Words: American Community Survey, Census Coverage Measurement, Components of Census Coverage

1. Introduction

The 2010 Census Coverage Measurement (CCM) program evaluated coverage of the 2010 Census to aid in improving future censuses. The CCM measured the net coverage and components of census coverage of housing units and persons, excluding group quarters and persons residing in group quarters. The CCM sample design was a probability sample of 170,000 housing units. Remote areas of Alaska were out of scope for the CCM.

Keller and Fox (2012) provide the 2010 components of census coverage, including estimates of correct enumerations, erroneous enumerations, and omissions for the national household population. In that document, we provide coverage component estimates for persons by major demographic groups, census operational areas, states, large counties, and large places. For those results, we were limited to demographic, operational, and geographic data collected during the census. American Community Survey (ACS) data provides an opportunity for us to generate additional coverage estimates by socioeconomic and demographic characteristics collected from ACS. Since a goal of the CCM process was to aid in improving future censuses, we show coverage properties by socioeconomic and demographic characteristics to provide insight on how one might consider performing a census in those communities in the future.

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[1] The views expressed are those of the author and not necessarily those of the U.S. Census Bureau.

2. Census Coverage Measurement Methodology

The general estimation approach for components of census coverage for persons fell into four categories:

- estimates of correct enumerations
- estimates of erroneous enumerations
- tabulations of whole-person census imputations
- estimates of omissions

2.1 Estimates of Correct Enumerations

In the CCM, we evaluated a sample of data-defined[2] enumerations in the census to determine if they were correct enumerations. For a person to be a correct enumeration for our component estimation, the first requirement was that the census person record should have been enumerated in a housing unit in the census. If a person was determined to have been included in the census two or more times, the CCM had procedures to determine which enumeration was correct based on the Person Interview and Person Followup information. The other enumerations were classified as erroneous enumerations.

Another requirement was geographic correctness. For national-level estimates provided in this paper, the geographic requirement for the enumeration to be considered correct was that the record corresponded to a person that should have been included anywhere in the United States in the coverage universe (that is, in a housing unit outside of Remote Alaska areas). This criterion applied to the estimates of the total population and other domains, like demographic characteristics and census operational areas.

This definition of correct enumeration for components of census coverage was different from the definition of correct enumeration used for estimating net coverage. The definition for net error was stricter, as it applied additional criteria to minimize the bias in our dual system estimates (DSEs). For net estimation, the record must have (1) had sufficient identification information, that is, a valid name and two other characteristics, and (2) been enumerated in the specific geographic area referred to as the block cluster search area[3]. For component estimation, we used a different definition that was more suitable for national estimates.

In addition to generating estimates of levels of correct enumerations, the CCM produced percentages as well. For correct enumeration percentages, the denominator was the census count.

2.2 Estimates of Erroneous Enumerations

For component estimation, we also estimated the number of erroneous enumerations. When examining the reasons that a case was erroneous, we report the results for two categories:

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[2] A data-defined enumeration in the census had two reported characteristics, one of which can be name.

[3] The block cluster search area is the block cluster and the one ring of surrounding census blocks. A block cluster is one or more contiguous blocks, and averages 30 housing units.

- persons that should not have been enumerated at all ("Other Reasons")
- erroneous enumerations due to duplication

There were several types of erroneous enumerations combined into the first category of "Other Reasons." Some of these included persons who should have been enumerated in a group quarters, who were born after Census Day or who died before Census Day, and fictitious enumerations.

The second group was erroneous enumerations due to duplication. A person enumerated two or more times in the census for whom at least one of those enumerations was in a housing unit fell into this category. For the situation where the person was enumerated correctly in a group quarters and enumerated erroneously in a housing unit, the person enumeration in the housing unit was an erroneous enumeration due to duplication.

2.3 Tabulations of Whole-Person Census Imputations
We tallied the number of whole-person census imputations. All of the characteristics were imputed for these census person records. The CCM program was not in a position to assess whether an individual whole-person census imputation was correct or erroneous because, in large part, there was no practical way to follow up on records for which all information was imputed. Therefore, this report provides the count of whole-person imputations.

In addition to tallying the number of whole-person census imputations, the CCM produced percentages as well. For these percentages, the denominator was the census count.

2.4 Estimates of Omissions
We estimated the total number of omissions in the census as well. A direct estimation method for the number of omissions is not available. In the past, different definitions and estimators of omissions were used. The CCM estimated the number of omissions by subtracting the estimate of correct enumerations from the DSE.

$$Omissions = DSE - Correct\ Enumerations$$

As whole-person census imputations are a separate category from correct enumerations and erroneous enumerations, our definition of omissions effectively treats these imputations as omissions. In effect, omissions are people who *should have been* enumerated in the United States, but were not. Many of these people may have been accounted for in the whole-person census imputations. We believe that most of the imputed people may have been verified as correct if we could have collected a valid name and sufficient characteristics.

In addition to levels, the CCM reports omissions as a percentage of the estimated population.

$$Omission\ Percentage = \left(\frac{Omissions}{DSE}\right) \times 100$$

2.5 Net Coverage Estimates

In addition to reporting component estimates, we also show results of net coverage estimation, specifically percent net undercount. The percent net undercount is the net undercount estimate (DSE - Census Count) divided by the DSE expressed as a percentage. A positive percent indicates a net undercount and a negative percent indicates a net overcount.

$$Percent\ Net\ Undercount = \left(\frac{DSE - Census}{DSE} \right) \times 100$$

3. Creating ACS-Based Estimation Domains to Produce Coverage Estimates

The U.S. Census Bureau releases data from the ACS in the form of both single-year and multi-year estimates. For this research, we apply the five-year estimates from 2006-2010. The five-year ACS estimates have been synthesized into a database called the 2012 Planning Database (PDB) and is our ACS data source for this research. The PDB includes estimates concerning housing, demographic, socioeconomic, and census operational data. The 2012 PDB included estimates for tracts and block groups. For more information, see U.S. Census Bureau (2013).

For each geographic area (tract or block group), we have an estimate of the total population N_{POP} and the population for the statistic of interest N_{STAT}. We summarize the two area estimates into a proportion. That is, $PROP_{STAT} = \frac{N_{STAT}}{N_{POP}}$.

This research uses cut points of a distribution for a characteristic to form estimation domains. To do this, we first assign the area's $PROP_{STAT}$ value to all persons within the block group or tract. Each person in the area then has the same $PROP_{STAT}$ value. We then form categories with the ranges of $PROP_{STAT}$ values to provide estimates. For example, we estimate coverage for people in areas where $PROP_{STAT}$ is less than 10%, between 10% and 20%, between 20% and 30%, between 30% and 40%, between 40% and 50%, and 50% or greater.

4. Methodology and Limitations

4.1 Initial Approach to Categorize Persons into Estimation Domains

For the 2010 CCM, we assigned persons into estimation domains based on their characteristics (e.g. race, gender, Hispanic origin). Some of these characteristics were imputed or recorded incorrectly. This error was thought to be small compared to the sampling error. Consequently, a person was assigned to an estimation domain without any nonsampling error taken into account. For example, when we produced component estimates for tenure, each census person was placed in an owner or renter category, regardless of whether the characteristic was imputed.

Additional acknowledgements of limitations need to be made when combining the CCM and ACS data used in this research. First, the CCM generates point-in-time estimates of the 2010 Census while the ACS data used to form estimation domains comes from estimates between 2006-2010. Second, the ACS data consists of the group quarters and

household population while CCM only provides coverage of the household population. Third, the 2010 ACS uses control counts from the 2000 census.

When we compute estimates using the ACS data, we have to make a decision whether to include sampling error when forming the estimation categories. The initial approach is to ignore the sampling error and categorize all persons based solely on the point estimate for the area. For example, suppose a person lives in a block group with $PROP_{STAT} = 0.19$. This person gets categorized into the estimation domain between 10% and 20% and component estimation is completed as detailed in Fox, Keller, and Davis (2013). Section 4.2 outlines an alternative approach to account for the sampling error in the ACS in order to categorize each person.

4.2 Alternative Approach to Categorize Persons into Estimation Domains

An alternative approach is to account for the sampling error in the ACS in order to categorize block groups. We begin with the total population estimate, N_{POP} and its associated measure of error, MOE_{POP} for the block group or tract. We also have a measure of error for the population for the statistic of interest, MOE_{STAT}. To estimate the measure of error for the proportion, we use this approximation formula from the ACS handbook (U.S. Census Bureau, 2008):

$$MOE_{PROP} = \frac{\sqrt{MOE_{STAT}^2 - (PROP_{STAT}^2 * MOE_{POP}^2)}}{N_{POP}}$$

Once we calculate MOE_{PROP}, we derive the standard error from it. Since MOE_{PROP} describes the precision of each ACS estimate at the 90% confidence level, SE_{PROP} is derived by simply dividing the MOE_{PROP} by 1.645:

$$SE_{PROP} = \frac{MOE_{PROP}}{1.645}$$

New Estimate Accounting for ACS error

Finally, we generate a random number from a standard normal distribution, $Normal(\mu = 0, \sigma^2 = 1)$. To produce a new estimate that accounts for the sampling error in ACS estimates, this random number is multiplied by SE_{PROP} and added to the original derived estimate:

$$PROP_{NEWSTAT} = PROP_{STAT} + (Normal(\mu = 0, \sigma^2 = 1) * SE_{PROP})$$

The goal of this alternative approach is to incorporate some measure of error when forming the estimation domains. Back to an earlier example, suppose we have a block group with $PROP_{STAT} = 0.19$ and $SE_{PROP} = 0.02$. If the random number is $Normal(\mu = 0, \sigma^2 = 1) = 1$ for the block group, then all persons in the block group would now be treated with $PROP_{NEWSTAT} = 0.21$ and belong to the 'between 20% and 30%' estimation domain using the alternative approach. In the initial approach, all persons belong to the 'between 10% and 20%' estimation domain. In practice, when estimates were formed using the alternative approach, little changed in terms of results. That provided the authors confidence in their conclusions reached from the research.

5. Results

Section 5.1 summarizes the census coverage for people in block groups by socioeconomic characteristics such as poverty, education, and mobility. Section 5.2 summarizes the census coverage for people in block groups by demographic characteristics such as Hispanicity, Black alone classification, and whether another language is spoken in the household. Section 5.3 summarizes the census coverage for people in tracts by unemployment characteristics.

For all tables presented in this document:
1) The 2010 Census count excludes persons in group quarters and persons in Remote Alaska.
2) CCM standard errors are shown in parentheses below the estimate. See Imel et al. (2013) on how CCM standard errors were derived. Note that whole-person imputations have no associated standard error since they were tallied.
3) An asterisk (*) denotes a percent net undercount that is significantly different from 0 at the 90% confidence level.
4) For the percent net undercount column, a negative sign preceding the percentage indicates an overcount.

For the tables below, the row groupings are inclusive on the lower bound. For example, between 10% and 20% poverty means that we consider individuals in block groups with greater than or equal to 10% poverty and strictly less than 20% poverty. For each row grouping, two major column pieces are displayed. The first piece details the components of census count. The first column the census count. The census count is then broken into rates of correct enumeration (see section 2.1), erroneous enumeration by duplication (see section 2.2), erroneous enumeration for other reasons (see section 2.2), and whole-person imputation (see section 2.3). The second piece details the DSE. The first column, titled the 'Population Estimate', is the DSE. The DSE is then broken into rates of correct enumeration in the second column and omission (see section 2.4) in the fourth column. In addition, the percent undercount is shown in the third column (see section 2.5).

5.1 Socioeconomic Characteristics
This section summarizes the census coverage for people in block groups by socioeconomic characteristics. These include estimates of coverage by:

- Poverty
- College Graduation Rate
- High School Graduation Rate
- Mobility

5.1.1 Poverty
Table 1 shows the components of census coverage by poverty. Poverty statistics follow the standards specified by the Office of Management and Budget in Statistical Policy Directive 14[4]. To do this, the Census Bureau uses dollar value thresholds that vary by family size and household composition. Each person in a block group is assigned by whether they were counted in a block group with

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[4] http://www.census.gov/hhes/povmeas/methodology/ombdir14.html

- Less than 10% poverty
- Between 10% and 20% poverty
- Between 20% and 30% poverty
- Between 30% and 40% poverty
- Between 40% and 50% poverty
- 50% or more poverty

Table 1 shows that the undercounts of persons living in block groups with between 30% and 40% poverty, between 40% and 50% poverty, and more than 50% poverty are all significantly different than 0. In addition, the rate of whole-person imputations increases as the poverty rate of the block increases. The correct enumeration rate of persons living in block groups with between 10% and 20% poverty is significantly higher than those persons living in block groups with more than 50% poverty. The erroneous enumeration rate by duplication of persons living in block groups with between 0% and 10% poverty is significantly lower than those persons living in block groups with between 10% and 20% poverty.

Table 1: Components of Census Coverage by Percentage of Persons in Block Groups Who Are Below the Poverty Level

Percentage of Persons in Block Groups Who Are Below The Poverty Level	Census Count (Thousands)	Correct (%)	Erroneous (%)		Whole-Person Imputation (%)	Population Estimate (Thousands)	Correct (%)	Pct Undercount (%)	Omissions (%)
			Duplication	Other					
U.S. Total	300,703	94.7	2.8	0.5	2.0	300,667	94.7	-0.01	5.3
	(0)	(<0.1)	(<0.1)	(<0.1)	(0)	(429)	(0.1)	(0.14)	(0.1)
<10%	155,812	95.7	2.3	0.4	1.6	155,395	95.9	-0.27*	4.1
	(0)	(<0.1)	(<0.1)	(<0.1)	(0)	(181)	(0.1)	(0.12)	(0.1)
10% to 20%	73,718	94.3	3.0	0.5	2.1	73,640	94.4	-0.11	5.6
	(0)	(0.2)	(0.2)	(<0.1)	(0)	(114)	(0.2)	(0.16)	(0.2)
20% to 30%	36,203	93.4	3.6	0.6	2.4	36,290	93.2	0.24	6.8
	(0)	(0.2)	(0.2)	(<0.1)	(0)	(73)	(0.3)	(0.20)	(0.3)
30% to 40%	18,492	92.6	4.0	0.7	2.7	18,629	92.0	0.73*	8.0
	(0)	(0.3)	(0.3)	(<0.1)	(0)	(50)	(0.4)	(0.27)	(0.4)
40% to 50%	9,099	92.3	4.1	0.7	2.9	9,211	91.2	1.22*	8.8
	(0)	(0.6)	(0.6)	(<0.1)	(0)	(34)	(0.7)	(0.36)	(0.7)
≥ 50%	7,380	91.3	4.5	0.8	3.4	7,503	89.8	1.65*	10.2
	(0)	(0.9)	(0.9)	(<0.1)	(0)	(37)	(0.9)	(0.48)	(0.9)

Source: U.S. Census Bureau, 2010 Census Coverage Measurement, 2006-2010 American Community Survey
Standard Errors are shown in parentheses below the estimate.
The 2010 Census count excludes persons in group quarters and persons in Remote Alaska.
An asterisk (*) denotes a percent net undercount that is significantly different than zero.

The results above convey the relationship between the economic well-being of an area and census coverage. It can be seen that persons in less affluent areas have a tendency to be undercovered as compared to those in more prosperous areas.

5.1.2 College Graduation Rate
Table 2 shows the components of census coverage by college graduation rate. Each person in a block group is assigned by whether they were counted in a block group with

- Less than 10% college graduation rate
- Between 10% and 20% college graduation rate
- Between 20% and 30% college graduation rate
- Between 30% and 40% college graduation rate
- Between 40% and 50% college graduation rate
- 50% or more college graduation rate

The undercount of persons living in block groups where between 0% and 10% of people 25 or older earned a college degree is significant. No other education categories have an undercount different from 0. The correct enumeration rate of persons living in block groups where between 0% and 10% of people 25 or older earned a college degree is significantly lower than those persons living in block groups where between 10% and 20% of people 25 or older earned a college degree.

Table 2: Components of Census Coverage by Percentage of Persons in Block Groups 25 or Older With a College Degree or Higher

Percentage of Persons in Block Groups Who Are 25+ With a College Degree or Higher	Census Count (Thousands)	Correct (%)	Erroneous (%)		Whole-Person Imputation (%)	Population Estimate (Thousands)	Correct (%)	Pct Undercount (%)	Omissions (%)
			Duplication	Other					
U.S. Total	300,703	94.7	2.8	0.5	2.0	300,667	94.7	-0.01	5.3
	(0)	(<0.1)	(<0.1)	(<0.1)	(0)	(429)	(0.1)	(0.14)	(0.1)
<10%	54,826	93.1	3.9	0.6	2.3	55,062	92.7	0.43*	7.3
	(0)	(0.2)	(0.2)	(<0.1)	(0)	(125)	(0.3)	(0.23)	(0.3)
10% to 20%	76,826	94.5	3.0	0.5	2.1	76,767	94.6	-0.08	5.4
	(0)	(0.1)	(0.1)	(<0.1)	(0)	(121)	(0.2)	(0.16)	(0.2)
20% to 30%	57,349	94.8	2.7	0.5	2.0	57,269	94.9	-0.14	5.1
	(0)	(0.2)	(0.2)	(<0.1)	(0)	(78)	(0.2)	(0.14)	(0.2)
30% to 40%	39,999	95.3	2.3	0.5	1.9	39,953	95.4	-0.11	4.6
	(0)	(0.2)	(0.2)	(<0.1)	(0)	(53)	(0.3)	(0.13)	(0.3)
40% to 50%	27,388	95.5	2.2	0.5	1.9	27,355	95.6	-0.12	4.4
	(0)	(0.2)	(0.2)	(<0.1)	(0)	(37)	(0.2)	(0.14)	(0.2)
≥ 50%	44,316	95.6	2.2	0.5	1.7	44,262	95.7	-0.12	4.3
	(0)	(0.1)	(0.1)	(<0.1)	(0)	(68)	(0.2)	(0.15)	(0.2)

Source: U.S. Census Bureau, 2010 Census Coverage Measurement, 2006-2010 American Community Survey
Standard Errors are shown in parentheses below the estimate.
The 2010 Census count excludes persons in group quarters and persons in Remote Alaska.
An asterisk (*) denotes a percent net undercount that is significantly different than zero.

5.1.3 High School Graduation Rate
Table 3 shows the components of census coverage by high school graduation rate. Each person in a block group is assigned by whether they were counted in a block group with

- Less than 10% NOT high school graduation rate
- Between 10% and 20% NOT high school graduation rate
- Between 20% and 30% NOT high school graduation rate
- Between 30% and 40% NOT high school graduation rate

- Between 40% and 50% NOT high school graduation rate
- 50% or more NOT high school graduation rate

The undercounts of persons living in block groups where between 30% and 40%, between 40% and 50%, and more than 50% of people 25 or older are not high school graduates are all significantly different than 0. The correct enumeration rate of persons living in block groups where between 0% and 10% of people 25 or older are not high school graduates is significantly higher than those persons living in block groups where between 10% and 20% of people 25 or older are not high school graduates.

Table 3: Components of Census Coverage by Percentage of Persons in Block Groups Who Are 25 or Older and Are Not High School Graduates

Percentage of Persons in Block Groups Who Are 25+ and Are Not High School Graduates	Census Count (Thousands)	Correct (%)	Erroneous (%)		Whole-Person Imputation (%)	Population Estimate (Thousands)	Correct (%)	Pct Undercount (%)	Omissions (%)
			Duplication	Other					
U.S. Total	300,703	94.7	2.8	0.5	2.0	300,667	94.7	-0.01	5.3
	(0)	(<0.1)	(<0.1)	(<0.1)	(0)	(429)	(0.1)	(0.14)	(0.1)
<10%	134,355	95.4	2.4	0.5	1.8	134,096	95.6	-0.19	4.4
	(0)	(0.1)	(<0.1)	(<0.1)	(0)	(169)	(0.2)	(0.13)	(0.2)
10% to 20%	84,399	94.7	2.8	0.5	2.0	84,251	94.9	-0.18	5.1
	(0)	(0.1)	(0.1)	(<0.1)	(0)	(128)	(0.2)	(0.15)	(0.2)
20% to 30%	41,938	93.9	3.3	0.5	2.3	41,940	93.9	0.01	6.1
	(0)	(0.2)	(0.2)	(<0.1)	(0)	(83)	(0.2)	(0.20)	(0.2)
30% to 40%	20,673	93.8	3.1	0.7	2.4	20,758	93.4	0.41*	6.6
	(0)	(0.3)	(0.3)	(<0.1)	(0)	(50)	(0.4)	(0.24)	(0.4)
40% to 50%	10,511	92.1	4.7	0.7	2.4	10,615	91.2	0.98*	8.8
	(0)	(0.6)	(0.6)	(<0.1)	(0)	(34)	(0.6)	(0.32)	(0.6)
≥ 50%	8,828	91.8	5.0	0.7	2.4	9,007	90.0	1.98*	10.0
	(0)	(0.8)	(0.7)	(<0.1)	(0)	(51)	(0.8)	(0.55)	(0.8)

Source: U.S. Census Bureau, 2010 Census Coverage Measurement, 2006-2010 American Community Survey
Standard Errors are shown in parentheses below the estimate.
The 2010 Census count excludes persons in group quarters and persons in Remote Alaska.
An asterisk (*) denotes a percent net undercount that is significantly different than zero.

Tables 2 and 3 indicate the relationship between educational attainment of an area and census coverage. It can be seen that persons living in less educated areas have a tendency to be undercovered as compared to those persons living in areas with higher educational attainment. In addition, persons living in more educated areas tend to have higher correct enumeration rates.

5.1.4 Mobility

Table 4 shows the components of census coverage by how many people in the block group moved in the last year. Each person in a block group is assigned by whether they were counted in a block group with

- Less than 10% moved in last year
- Between 10% and 20% moved in last year

- Between 20% and 30% moved in last year
- Between 30% and 40% moved in last year
- Between 40% and 50% moved in last year
- 50% or more moved in last year

The undercounts of persons living in block groups where between 30% and 40%, between 40% and 50%, and more than 50% of people moved in the last year are all significantly different than 0. Conversely, the overcount of persons living in block groups where between 0% and 10% of people moved in the last year is significantly different than 0. As the mobility rate increases, the rate of whole-person imputations increases.

Table 4: Components of Census Coverage by Percentage of Persons in Block Groups Who Moved From Another Residence Within the Last Year

Percentage of Persons in Block Groups Who Moved From Another Residence Within the Last Year	Census Count (Thousands)	Correct (%)	Erroneous (%)		Whole-Person Imputation (%)	Population Estimate (Thousands)	Correct (%)	Pct Undercount (%)	Omissions (%)
			Duplication	Other					
U.S. Total	300,703	94.7	2.8	0.5	2.0	300,667	94.7	-0.01	5.3
	(0)	(<0.1)	(<0.1)	(<0.1)	(0)	(429)	(0.1)	(0.14)	(0.1)
<10%	117,000	95.2	2.8	0.4	1.5	116,706	95.4	-0.25*	4.6
	(0)	(0.1)	(0.1)	(<0.1)	(0)	(145)	(0.2)	(0.12)	(0.2)
10% to 20%	104,137	94.9	2.7	0.5	1.9	104,035	95.0	-0.10	5.0
	(0)	(0.1)	(0.1)	(<0.1)	(0)	(141)	(0.2)	(0.14)	(0.2)
20% to 30%	48,342	94.3	2.7	0.6	2.4	48,434	94.2	0.19	5.8
	(0)	(0.2)	(0.2)	(<0.1)	(0)	(85)	(0.2)	(0.18)	(0.2)
30% to 40%	19,416	92.6	3.7	0.7	3.0	19,531	92.0	0.59*	8.0
	(0)	(0.5)	(0.5)	(<0.1)	(0)	(48)	(0.5)	(0.25)	(0.5)
40% to 50%	7,485	92.8	2.7	0.7	3.7	7,564	91.8	1.04*	8.2
	(0)	(0.3)	(0.3)	(0.1)	(0)	(26)	(0.4)	(0.33)	(0.4)
≥ 50%	4,323	91.2	3.5	1.0	4.4	4,397	89.6	1.68*	10.4
	(0)	(0.5)	(0.5)	(0.3)	(0)	(21)	(0.6)	(0.47)	(0.6)

Source: U.S. Census Bureau, 2010 Census Coverage Measurement, 2006-2010 American Community Survey
Standard Errors are shown in parentheses below the estimate.
The 2010 Census count excludes persons in group quarters and persons in Remote Alaska.
An asterisk (*) denotes a percent net undercount that is significantly different than zero.

5.2 Demographic Characteristics
This section summarizes the census coverage for people in block groups by demographic characteristics. These include estimates of coverage by:

- Hispanic Concentration
- Black Alone Concentration
- Other Language Rate

5.2.1 Hispanic

Table 5 shows the components of census coverage by Hispanic rate. Each person in a block group is assigned by whether they were counted in a block group with

- Less than 10% Hispanic
- Between 10% and 20% Hispanic
- Between 20% and 30% Hispanic
- Between 30% and 40% Hispanic
- Between 40% and 50% Hispanic
- 50% or more Hispanic

Table 5 shows that the undercounts of persons living in block groups where between 40% and 50% and more than 50% of people identify as Hispanic are all significantly different than 0.

Table 5: Components of Census Coverage by Percentage of Persons in Block Groups Who Identify as Hispanic

Percentage of Persons in Block Groups Who Identify as Hispanic	Census Count (Thousands)	Correct (%)	Erroneous (%)		Whole-Person Imputation (%)	Population Estimate (Thousands)	Correct (%)	Pct Undercount (%)	Omissions (%)
			Duplication	Other					
U.S. Total	300,703	94.7	2.8	0.5	2.0	300,667	94.7	-0.01	5.3
	(0)	(<0.1)	(<0.1)	(<0.1)	(0)	(429)	(0.1)	(0.14)	(0.1)
<10%	185,404	95.0	2.8	0.4	1.7	184,994	95.2	-0.22	4.8
	(0)	(<0.1)	(<0.1)	(<0.1)	(0)	(277)	(0.1)	(0.15)	(0.1)
10% to 20%	40,930	94.7	2.4	0.6	2.3	40,873	94.8	-0.14	5.2
	(0)	(0.1)	(0.1)	(<0.1)	(0)	(74)	(0.2)	(0.18)	(0.2)
20% to 30%	20,866	94.3	2.6	0.6	2.4	20,869	94.3	0.01	5.7
	(0)	(0.2)	(0.2)	(<0.1)	(0)	(44)	(0.3)	(0.21)	(0.3)
30% to 40%	13,247	93.2	3.6	0.7	2.5	13,279	93.0	0.24	7.0
	(0)	(0.7)	(0.7)	(<0.1)	(0)	(29)	(0.7)	(0.22)	(0.7)
40% to 50%	9,858	93.6	3.2	0.6	2.6	9,903	93.2	0.46*	6.8
	(0)	(0.3)	(0.3)	(<0.1)	(0)	(23)	(0.4)	(0.23)	(0.4)
≥ 50%	30,398	93.6	3.2	0.7	2.5	30,749	92.5	1.14*	7.5
	(0)	(0.2)	(0.2)	(<0.1)	(0)	(122)	(0.4)	(0.39)	(0.4)

Source: U.S. Census Bureau, 2010 Census Coverage Measurement, 2006-2010 American Community Survey
Standard Errors are shown in parentheses below the estimate.
The 2010 Census count excludes persons in group quarters and persons in Remote Alaska.
An asterisk (*) denotes a percent net undercount that is significantly different than zero.

5.2.2 Non-Hispanic Black Alone

Table 6 shows the components of census coverage by non-Hispanic Black alone rate. Each person in a block group is assigned by whether they were counted in a block group with

- Less than 10% non-Hispanic Black alone
- Between 10% and 20% non-Hispanic Black alone
- Between 20% and 30% non-Hispanic Black alone
- Between 30% and 40% non-Hispanic Black alone

- Between 40% and 50% non-Hispanic Black alone
- 50% or more non-Hispanic Black alone

Table 6 shows that the undercounts of persons living in block groups with a non-Hispanic Black alone rate between 20% and 30%, between 30% and 40%, between 40% and 50%, and more than 50% are all significantly different than 0. Also, the overcount of persons living in block groups between 0% and 10% is significantly different than 0. The correct enumeration rate for persons in areas between 0% and 10% is significantly higher than those persons living in block groups between 10% and 20%.

Table 6: Components of Census Coverage by Percentage of Persons in Block Groups Who Identify as Non-Hispanic Black Alone

Percentage of Persons in Block Groups Who Identify as Non-Hispanic Black Alone	Census Count (Thousands)	Correct (%)	Erroneous (%)		Whole-Person Imputation (%)	Population Estimate (Thousands)	Correct (%)	Pct Undercount (%)	Omissions (%)
			Duplication	Other					
U.S. Total	300,703	94.7	2.8	0.5	2.0	300,667	94.7	-0.01	5.3
	(0)	(<0.1)	(<0.1)	(<0.1)	(0)	(429)	(0.1)	(0.14)	(0.1)
<10%	214,569	95.2	2.7	0.4	1.7	214,060	95.4	-0.24*	4.6
	(0)	(<0.1)	(<0.1)	(<0.1)	(0)	(278)	(0.1)	(0.13)	(0.1)
10% to 20%	32,092	94.4	2.7	0.6	2.3	32,140	94.2	0.15	5.8
	(0)	(0.2)	(0.2)	(<0.1)	(0)	(59)	(0.2)	(0.18)	(0.2)
20% to 30%	16,061	93.0	3.8	0.7	2.6	16,125	92.6	0.40*	7.4
	(0)	(0.6)	(0.6)	(<0.1)	(0)	(36)	(0.6)	(0.22)	(0.6)
30% to 40%	9,436	93.7	2.8	0.7	2.8	9,500	93.0	0.68*	7.0
	(0)	(0.4)	(0.4)	(0.1)	(0)	(26)	(0.4)	(0.27)	(0.4)
40% to 50%	6,108	92.4	4.2	0.4	3.0	6,161	91.6	0.85*	8.4
	(0)	(1.1)	(1.1)	(<0.1)	(0)	(19)	(1.2)	(0.31)	(1.2)
≥ 50%	22,437	92.2	3.9	0.8	3.2	22,681	91.2	1.07*	8.8
	(0)	(0.3)	(0.3)	(<0.1)	(0)	(115)	(0.5)	(0.50)	(0.5)

Source: U.S. Census Bureau, 2010 Census Coverage Measurement, 2006-2010 American Community Survey
Standard Errors are shown in parentheses below the estimate.
The 2010 Census count excludes persons in group quarters and persons in Remote Alaska.
An asterisk (*) denotes a percent net undercount that is significantly different than zero.

The results from tables 5 and 6 are in accord with the results as shown in Keller and Fox (2012). That paper shows that Black alone or in combination persons had an undercount of 2.06% (0.50%) in Census 2010. Persons with Hispanic origin had an undercount of 1.54% (0.33%). This research shows the undercounts in areas with higher concentrations of Black and Hispanic persons are significantly different than 0. In other words, it makes sense that areas with high Black and Hispanic concentrations would be undercounted given that Black and Hispanic persons are undercounted and vice versa.

5.2.3 Other Language
Table 7 shows the components of census coverage by other language rate. Each person in a block group is assigned by whether they were counted in a block group with

- Less than 10% speak another language
- Between 10% and 20% speak another language

- Between 20% and 30% speak another language
- Between 30% and 40% speak another language
- Between 40% and 50% speak another language
- 50% or more speak another language

Table 7 shows an undercount of persons living in block groups in which more than half the people speak a language other than English in their home.

Table 7: Components of Census Coverage by Percentage of Persons in Block Groups Who Are 5+ and Speak a Language Other Than English At Home

Percentage of Persons in Block Groups Who Are 5+ and Speak a Language Other Than English At Home	Census Count (Thousands)	Correct (%)	Erroneous (%)		Whole-Person Imputation (%)	Population Estimate (Thousands)	Correct (%)	Pct Undercount (%)	Omissions (%)
			Duplication	Other					
U.S. Total	300,703 (0)	94.7 (<0.1)	2.8 (<0.1)	0.5 (<0.1)	2.0 (0)	300,667 (429)	94.7 (0.1)	-0.01 (0.14)	5.3 (0.1)
<10%	142,598 (0)	95.0 (<0.1)	2.9 (<0.1)	0.4 (<0.1)	1.7 (0)	142,264 (232)	95.2 (0.2)	-0.23 (0.16)	4.8 (0.2)
10% to 20%	55,147 (0)	95.1 (0.1)	2.4 (0.1)	0.5 (<0.1)	2.1 (0)	55,090 (81)	95.2 (0.2)	-0.10 (0.15)	4.8 (0.2)
20% to 30%	30,692 (0)	94.3 (0.3)	2.8 (0.3)	0.6 (<0.1)	2.3 (0)	30,687 (56)	94.3 (0.3)	-0.02 (0.18)	5.7 (0.3)
30% to 40%	20,014 (0)	94.0 (0.4)	2.9 (0.4)	0.7 (<0.1)	2.4 (0)	20,043 (42)	93.8 (0.4)	0.15 (0.21)	6.2 (0.4)
40% to 50%	14,177 (0)	93.9 (0.4)	2.9 (0.4)	0.8 (<0.1)	2.5 (0)	14,214 (31)	93.6 (0.4)	0.26 (0.22)	6.4 (0.4)
≥ 50%	38,075 (0)	93.6 (0.2)	3.4 (0.2)	0.7 (<0.1)	2.3 (0)	38,369 (137)	92.9 (0.3)	0.77* (0.36)	7.1 (0.3)

Source: U.S. Census Bureau, 2010 Census Coverage Measurement, 2006-2010 American Community Survey
Standard Errors are shown in parentheses below the estimate.
The 2010 Census count excludes persons in group quarters and persons in Remote Alaska.
An asterisk (*) denotes a percent net undercount that is significantly different than zero.

5.3 Unemployment Characteristics

This section summarizes the census coverage for people in tracts by unemployment for persons sixteen years of age and older. Each person in a tract is assigned by whether they were counted in a tract with

- Less than 2.5% unemployment
- Between 2.5% and 5% unemployment
- Between 5% and 7.5% unemployment
- Between 7.5% and 10% unemployment
- Between 10% and 12.5% unemployment
- Between 12.5% and 15% unemployment
- 15% or more unemployment

Table 8 shows an undercount of persons living in tracts with 15% or more unemployment. The correct enumeration rate of persons living in tracts with less than 2.5% unemployment is significantly higher than the rate of those persons living in tracts with between 10% and 12.5% unemployment.

Table 8: Components of Census Coverage by Percentage of Persons in Tracts Who Are 16+ and are Unemployed

Percentage of Persons in Tracts who are Unemployed	Census Count (Thousands)	Correct (%)	Erroneous (%)		Whole-Person Imputation (%)	Population Estimate (Thousands)	Correct (%)	Pct Undercount (%)	Omissions (%)
			Duplication	Other					
U.S. Total	300,703	94.7	2.8	0.5	2.0	300,667	94.7	-0.01	5.3
	(0)	(<0.1)	(<0.1)	(<0.1)	(0)	(429)	(0.1)	(0.14)	(0.1)
<2.5%	15,731	95.5	2.3	0.5	1.8	15,695	95.7	-0.23	4.3
	(0)	(0.2)	(0.2)	(<0.1)	(0)	(23)	(0.3)	(0.15)	(0.3)
2.5% to 5%	65,499	95.2	2.7	0.5	1.7	65,387	95.3	-0.17	4.7
	(0)	(0.2)	(0.2)	(<0.1)	(0)	(87)	(0.2)	(0.13)	(0.2)
5% to 7.5%	81,305	95.0	2.6	0.5	1.9	81,217	95.1	-0.11	4.9
	(0)	(0.1)	(0.1)	(<0.1)	(0)	(107)	(0.2)	(0.13)	(0.2)
7.5% to 10%	59,441	94.7	2.8	0.5	2.0	59,420	94.7	-0.04	5.3
	(0)	(0.2)	(0.2)	(<0.1)	(0)	(85)	(0.2)	(0.14)	(0.2)
10% to 12.5%	35,138	94.5	2.7	0.5	2.2	35,184	94.4	0.13	5.6
	(0)	(0.2)	(0.2)	(<0.1)	(0)	(61)	(0.3)	(0.17)	(0.3)
12.5% to 15%	19,172	93.4	3.6	0.6	2.4	19,217	93.1	0.23	6.9
	(0)	(0.4)	(0.4)	(<0.1)	(0)	(40)	(0.4)	(0.21)	(0.4)
≥15%	24,417	92.8	3.8	0.7	2.7	24,547	92.3	0.53*	7.7
	(0)	(0.3)	(0.3)	(<0.1)	(0)	(76)	(0.4)	(0.31)	(0.4)

Source: U.S. Census Bureau, 2010 Census Coverage Measurement, 2006-2010 American Community Survey
Standard Errors are shown in parentheses below the estimate.
The 2010 Census count excludes persons in group quarters and persons in Remote Alaska.
An asterisk (*) denotes a percent net undercount that is significantly different than zero.

6. Conclusions and Future Work

The goal of this research was to provide census coverage person estimates for areas with certain socioeconomic, demographic, and employment characteristics. Generally, we show net undercoverage of persons living in areas with higher concentrations of poverty, lower educational attainment, and higher mobility. We also show more whole-person imputations for these areas. With respect to demographic characteristics, we show net undercoverage of persons in areas with higher concentrations of Hispanic, non-Hispanic Black alone, and persons who speak a language other than English at home. With respect to unemployment, we show net undercoverage of persons in areas with higher concentrations of unemployment.

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