How to Use the Population Reference Bureau's Young Child Risk of Undercount Database

By

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Introduction

This paper is meant to help people understand and use the Young Child Risk of Undercount database prepared by the Population Reference Bureau (PRB) and Dr. William O'Hare. The purpose of this database is to help people identify neighborhoods and census tracts where the risk of undercounting young children in the 2020 Census is the highest. Identifying the census tracts where young children are most at risk of being missed in the 2020 Census will allow advocates, complete count committees, elected officials, non-profit organizations, and funders interested in getting a complete and accurate count of young children to concentrate resources in those areas. This paper is a companion to a webinar offered by Count All Kids on February 13, 2020; the recording of that webinar is available at https://youtu.be/JqXJEzGE4eo. The data base is focused on young children because children ages 0 to 4 had a higher net undercount than any other age group in the 2020 Census (O'Hare 2015). More than 10 percent of young children were missed in the 2010 Census (U.S. Census Bureau 2016).

In this paper, the term young children refers to children ages 0 to 4 and the term large counties refers to counties with at least 5,000 children ages 0 to 4 in the 2010 Census. Most of these counties have a total population of 100,000 or more.

This document is intended for people who are more interested in getting and using the database rather than understanding how the data was developed. Details about the development of the database can be found ina short description of the methodology in Appendix A of this paper as well as through the references to materials (such as the statistical estimation methodology).Those details are not provided in the paper. Appendix C of this paper provides URLs for several online sources of information about the undercount of young children in the census.

Background--Why We Need A Separate Metric For Young Children

This project was developed because currently available measures do not do a very good job of identifying places where young children are likely to be missed at the highest rates in the 2020 Census. One of the metrics currently available is the Census Bureau's Low Response Score (LRS) (Erdman and Bates 2017; https://www.census.gov/roam) and a second metric is the Hard to Count (HTC) metric on the City University of New York (CUNY) census mapping application (https://www.censushardtocountmaps2020.us/) which, like the LRS, is linked to the mail return rate from the 2010 Census.

Statisticians use a term called "percent of variance explained" to quantify how well a prediction or estimation works. Zero percent of variance explained means one variable or set of variables are no help in predicting the value of a different variable and 100

percent of variance explained means that one variable or set of variables can explain all of the differences in another variable. The higher the percent of variance explained, the better the estimation or prediction.

In terms of predicting 2010 Census county-level net undercount rates for young children in the largest counties, the mail return rate explains only 17 percent of the variance and the percent of young children living in HTC tracts identified by mail return rates explains 20 percent of the variance. In contrast, the PRB predictive model for the largest counties (those with a total population of 250,000 or more) explains about 52 percent of the variance in net undercount rates for young children in these counties.

The metrics based on mail return rates offer little predictive help, which is understandable given the evidence that a large share of young children are missed because they were left off a census questionnaire that was returned rather than living in households that were missed entirely (Fernandez et al. 2018). The PRB model is a better method for census advocates to identify areas where young children are most likely to be missed in the 2020 Census.

There is evidence that the factors most closely associated with the undercount of young children in the census are different than those associated with adults. In Table 1, the six factors that were statistically significant in the PRB model predicting the net undercount of young children in the largest counties are listed along with the top six factors in the LRS model. There is little overlap between these two lists of factors. Table 1 shows that the main factors driving the undercount of young children are different than those driving the LRS/Mail Return Rates.

Table 1. Comparison of the Six Statistically Significant Variables in the PRB Model to the Six Most Powerful Estimators in the Erdman-Bates Model for Low Response score	
PRB Undercount Model (County-Level, Counties with 250,000+ People)	**Erdman-Bates Low Response Score Model (Census-Tract Level**
Percent of children under age 18 living in a female-headed household with no spouse present	Number of persons per household
Percent of children under age 18 who are in immigrant families (child is foreign-born or at least one parent is foreign-born)	Percent of population ages 65+
Percent of adults ages 18-24 with less than a high school diploma, GED, or alternative	Percent of housing units that are renter-occupied
Percent of persons living in renter-occupied households	Percent of housing units that are vacant
Percent of households that are linguistically isolated (no one ages 14+ speaks English "very well"	Percent of population that is non-Hispanic White
Percent of children under age 6 living with a grandparent householder	Median home value
Note: Variables are shown in descending order by the strength of their association with the dependent measures net undercount and low response, respectively).	

Description of the Database

The basic geographic unit used in the PRB database is a census tract. The country is divided into about 74,000 census tracts which are geographic units used by the Census Bureau to collect and report out census data. The Census Bureau (2012) defines census tracts as:

"an area roughly equivalent to a neighborhood established by the Bureau of Census for analyzing populations. They generally encompass a population between 2,500 to 8,000 people."

Of the 74,000 Census tracts in the country, nearly 58,000 are in the 689 counties included in the study, and 56,638 tracts are included in the PRB database. We did not

produce risk estimates for places outside of the 689 counties because the prediction model was based solely on relationships seen in these large counties. Statistical relationships in smaller counties may not be the same as those in larger counties which would compound estimation error for census tracts in small counties.

The counties included in the study account for 93 percent of the net undercount of young children, and had a collective net undercount rate of 4.4 percent, based on the Census Bureau's Revised 2018 Experimental DA Estimates.

For most census tracts in large counties, a risk measure was produced indicating the predicted net undercount rate for young children. The prediction is based on the most recent data available from the American Community Survey (ACS) for census tracts (i.e. 2013-2017 five-year ACS estimates) in combination with the statistical relationships between explanatory variables and net undercounts for young children seen in the 2010 Census.

Some census tracts had too few young children to produce reliable estimates, so no risk measures were produced for tracts with fewer than 25 young children in 2010 based on 2010 Census data. Very few tracts were eliminated for this reason and relatively few children resided in eliminated tracts.

After detailed estimations of the expected net undercount rates for young children were produced for each of the census tracts, census tracts were put into three categories based on predicted net undercount rates:

1. Low Risk of Undercount (predicted net overcount of young children)

2. High Risk of Undercount (predicted net undercount rate between 0 and 8.29%)
3. Very High Risk of Undercount (predicted net undercount rate of 8.3% or higher)

The thresholds were established so that one-quarter of the census tracts were in the very high-risk category—these are the top 25 percent of tracts in terms of predicted undercount rates. Detailed estimates were put into three broad categories for two reasons. First, many of the estimates or predictions had some error associated with them - providing the detailed figures would give people a false sense of precision. Putting the estimates into three broad categories reduced the chance of providing imprecise estimates. Second, for most uses, people are only interested in broad categories of risk of young children being undercounted.

The database has a record for each of the census tracts with at least 25 young children in the 689 counties that had at least 5,000 young children in the 2010 Census. A codebook for the database is provided in Appendix B of this report.

Each record in the database can be thought of as having three parts: 1) a unique geographic code created by the Census Bureau to identify a given census tract, 2) a three-level undercount risk score for young children living in that census tract, and 3) tract-level data for the seven measures that were used to estimate the undercount rate for young children. The seven measures are included so people can identify what particular characteristics make a given census tract a high risk for young children and tailor their outreach activities accordingly. These measures are listed in Table 1, in addition to the percent of children under age five living in families with incomes below

100 percent of the poverty level, which was statistically significant in the model for counties with less than 250,000 total population. The number of children ages 0 to 4 in each census tract in 2014-2018 along with data for young children by race and Hispanic origin status are also provided.

Using the Database

There are three main ways users can utilize the database. The first option is mapping, the second application is statistical analysis, and the third use is to locate data for a particular census tract. Each of these applications is described below. Keep in mind that there are many ways the database could be used and only a few applications are covered here. Some of the passages in the next few pages assume users have a rudimentary knowledge of how to manipulate data using EXCEL software.

Mapping

Using the PRB database in mapping applications can be done one of two ways. First, the database has been put into the widely used 2020 Hard-to-Count mapping application developed by City University of New York. (CUNY). This mapping application is available at http://www.censushardtocountmaps2020.us/ .

This mapping application is relatively intuitive but there is a brief online tutorial on using the CUNY mapping application with the PRB database available in the last half of the webinar recording at https://youtu.be/JqXJEzGE4eo.A note about how the PRB database on risk of undercounting young children has been incorporated into the CUNY mapping system is available at this URL: https://mailchi.mp/da4ad37868ba/census-2020-htc-map-updates-feb-2020.

Perhaps the most important thing to note on the CUNY mapping site is that there is a toggle button in the legend in the lower right-hand part of the screen for turning on the information on risk of undercount of young children. Make sure to click on this button (Undercount Risk for Young Children) and toggle on the undercount of young children to get maps showing the risk related to young child undercounts. You can also turn this on by scrolling down the left hand side to this phrase "Click/tap below for more info on factors affecting [geographic area]'s participation in the 2020 Census", clicking on it, and then toggling on the young child feature.

Maps for twelve large counties and cities are already available for downloading on the PRB website (https://www.prb.org/new-strategies-to-reduce-undercount-of-young-children-in-2020-census/#what) along with associated data for young children.

The twelve cities and counties are:

List of Twelve Large Cities and Counties with maps
New York City
Washington DC
Los Angeles County, California
Cook County, Illinois (includes Chicago)
Harris County , Texas (includes Houston)
Maricopa County Arizona (includes Phoenix)
Miami-Dade County, Florica (includes Miami)
King County, Washington (includes Seattle)
Clark County, Nevada (includes Las Vegas)
Wayne County, Michigan (includes Detroit)
Middlesex County, Massachusetts
Philadelphia County, Pennsylvania

People with an interest in one of these twelve places can assess the maps that have been pre-drawn by PRB. Also, these maps will also be useful for giving people a good idea of what they can produce for the counties they are interested in.

The second mapping application, for those who have the resources, is to download the database and import it into their own mapping application.

Statistical Analysis

The PRB tract-level database is in an EXCEL file that can be downloaded from the Population Reference Bureau website (https://www.prb.org/new-strategies-to-reduce-undercount-of-young-children-in-2020-census/) for statistical analysis. Analysis can be done using EXCEL, or the data can be imported into a statistical analysis software package such as SPSS or SAS for more powerful statistical analysis.

In terms of statistical analysis, for example, one can download the database and calculate what number and/or percent of young children live in very high risk of undercount census tracts in one of the counties in the database. If someone is only interested in data for the large counties in Florida, for example, one can use EXCEL functions to strip off all the records except those for Florida then use EXCEL statistical functions to analyze data for Florida for the counties included in the study (i.e. sort records on state name – STATE-NAME – then delete all records that are not for Florida). One could also do the same thing by copying all the records for Florida to a new EXCEL file. Use the statistical functions in EXCEL to sum the young children living in very high risk of undercount census tracts. The same procedure can be used for other geographies such as a particular state or county.

In another example, one could calculate what percent of all young children in Illinois in counties included in the study living in a very high risk of undercount Census tract live in Cook County (where Chicago is located).*Locating Data for a Particular Census Tract*

To identify a particular tract, the Census Bureau uses an **11-digit** code consisting of a **2-digit** code for the state, a **3-digit** code for the county (either of which may include one or more "leading" zeros), and **6 digits** for the census tract (including any leading zeros). These are commonly referred to as FIPS codes. FIPS stands for "Federal Information Processing Standards" and they are widely used in mapping applications. In the PRB file, state and county FIPS codes along with state abbreviation and county names are provided to make it easier to locate and sort tracts by state and county.

If you know the Census tract number of a tract you are interested in, you can use the PRB EXCEL file to find that tract and all the data for that tract by entering the tract geo-identification code (often called the FIPS code) in the find function for EXCEL.

Another way to find information on a particular tract is to use the CUNY mapping system. Hover the arrow over the tract you are interested in and information for that tract will appear in the left-hand side of the screen. The data can also be downloaded.

Information on the Census Bureau's website regarding location of specific census tracts can be found here https://www.census.gov/geographies/reference-maps/2010/geo/2010-census-tract-maps.html.

Examples

In this section several examples of how the database and mapping applications might be used are offered. Keep in mind there are an enormous number of ways the

data could be used and only a couple of examples are offered here to give readers a better sense of the possibilities.

Example #1 – Finding areas with very high risk of undercount of young children in a state

In this example, someone is trying to find the areas in the state of Georgia with the highest undercount risk for young children. Using the CUNY map, one can produce a map of Georgia with the very high risk of Undercount tracts in large counties highlighted. There are two different ways one can do this with the CUNY mapping application. First, using the "+" and "-" buttons on the CUNY mapping application, focus in on the geography area you are interested in and center the arrow over the county you are interested in. The tracts in the county will show which census tracts are at very high risk of undercount, which are at high risk of undercount, and which are a low risk of undercount.

Also on the CUNY mapping application (https://www.censushardtocountmaps2020.us/) in the upper left-hand corner there is a box for "ST./CO". Click on that box, hover the arrow over the state of Georgia and click the "Zoom in" button in the upper lefthand corner of the screen. Using the "Share Map" button" in the upper lefthand corner of the page, one can then download the URL that will take people to this map of Georgia. For the Georgia Map the URL is https://www.censushardtocountmaps2020.us/?latlng=32.70873%2C-82.13379&z=7&query=coordinates%3A%3A32.84267%2C-83.84766&promotedfeaturetype=states&arp=arpRaceEthnicity&baselayerstate=1&infotab=info-contacttypes&filterQuery=false.

Since resolution at the state level may make it difficult to distinguish neighborhoods in highly populated counties, one can also produce separate maps for large counties. This URL will take people to a map focused on Fulton County (where the city of Atlanta is located)

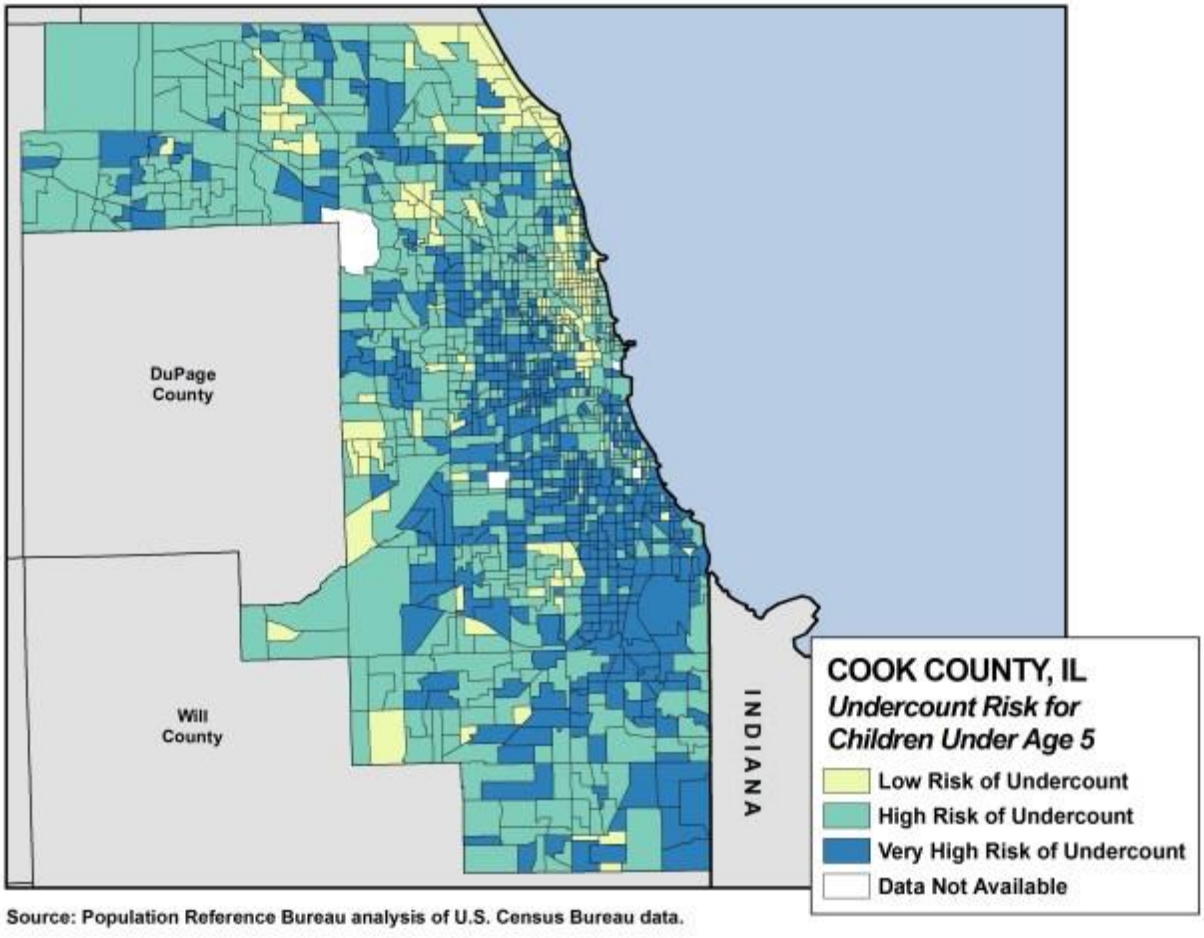
https://www.censushardtocountmaps2020.us/?latlng=33.59718%2C-84.31801&z=11&query=coordinates%3A%3A33.73291%2C-84.46289&promotedfeaturetype=counties&arp=arpRaceEthnicity&baselayerstate=2&infotab=info-contacttypes&filterQuery=false

Example #2 – Finding tracts with very high risk of undercount in Cook County Illinois (where Chicago is located)

There are two different ways one can do this with the CUNY mapping application. First, using the "+" and "-" buttons on the CUNY mapping application to center the arrow over Cook county, Illinois. The map will show which census tracts are at very high risk of undercount, which are at high risk of undercount, and which are a low risk of undercount.

Another way to approach the same problem is to go to the upper left-hand corner of the CUNY map page where there is a "St./Co" button which will produce the option of finding the state or a county you want to focus on. Hover the arrow over the county you are interested in click on "zoom to" to focus in on the county you selected.

The map below, for Cook County, Illinois, was downloaded from the PRB website.



Source: Population Reference Bureau analysis of U.S. Census Bureau data.

Using the CUNY Mapping application (https://www.censushardtocountmaps2020.us/) one can produce a county-level map for any of the 689 large counties in the PRB database.

Example # 3 Calculating the number of young children living in very high risk of undercount census tracts among the included counties in the state of California.

Download the PRB database from the PRB website (URL https://www.prb.org/new-strategies-to-reduce-undercount-of-young-children-in-2020-

census/). Use EXCEL functions to delete all the records that are not for California (or copy all the records that are for California to a new EXCEL file).

Use the EXCEL statistical functions to sort the remaining records by Risk of Undercount category (YC_UNDERCNT-Rsk) then delete all the records that are not for tracts with a very high risk of undercount (which is denoted as Code =3 in the YC_UNDERCNT-Rsk variable). Or copy all the records that are for very high risk of undercount tracts to a new EXCEL file. Use the EXCEL "formulas" button and the "Auto Sum" button to sum all the number of young children living in the high risk of undercount census tracts.

Example #4 Calculating what percent of all the young children living in very high risk of undercount census tracts in Virginia are African American

Download the PRB database from the PRB website (URL IS https://www.prb.org/new-strategies-to-reduce-undercount-of-young-children-in-2020-census/). Use the EXCEL, delete all the records that are not for Virginia (or copy all the records that are for Virginia to a new EXCEL file).

Use the EXCEL statistical functions to sort the remaining records by Risk of Undercount category (YC_UNDERCNT-Rsk) then delete all the records that are not for tracts with a very high risk of undercount (which is denoted as Code =3 in the YC_UNDERCNT-Rsk variable). Or copy all the records that are for very high risk of undercount to a new EXCEL file).

Use the "formulas" button and the "auto Sum" buttons in EXCEL to sum all the number of young children living in the high risk of undercount census tracts for the total and for

each race group. Divide the number of African American young children (pop04B-1418) in very high risk of undercount tracts by the total number of young children (pop04-1418) in very high risk of undercount tracts to calculate the percent of all children in Virginia that are living in very high risk of undercount census tracts that are African American.

Example # 5 Finding data for a given census tract

If you know the tract number of a tract you are interested in, you can find the relevant data in the tract-level database. For example, if one was only interested in one census tract in Los Angeles County, one could download the data for all the tracts and use the "find" function in EXCEL to locate the records for the tract you are interested in by putting the entire FIPS code in the find application.

That allows users to create their own map using mapping characteristics that are used in the CUNY mapping application below. Probably the best way to do this is to download the whole file and then strip off the records for the area you are interested in.

Conclusion

The PRB tract level database provides a powerful tool for those working to reduce the high net undercount of young children in the Census. There is additional information about this database on the PRB website. Incorporating the young child risk of undercount database into the CUNY mapping applications provides users with an easy way to locate areas where young children are most likely to be undercounted in the 2020 Census. A few examples of how the database and mapping can be used have

been provided in this paper, but we expect users will find many more uses for this product.

Appendix A - Methodology

A detailed description of the methodology used to calculate the predicted risk of undercount score for young children by Census tracts is provided in a companion report (O'Hare et al. 2020) available here: https://www.prb.org/wp-content/uploads/2020/02/us-census-undercount-of-children.pdf. A brief summary is presented here.

Below is a description of the five key steps used to develop the model and make the estimates.

1. Obtain county-level net undercount estimates for children ages 0 to 4 in the 2010 Census from the Census Bureau.
2. Identify variables associated with the net undercount of young children from literature review (40 variables identified).
3. Eliminate variables that are highly correlated (data set reduced to 21 variables).
4. Use variables in county-level models with net undercount rate of young children as the dependent variable.
5. Use coefficients from county-level models with updated independent variables for tracts to predict tract-level net undercount rates for 2013-2017.

The analysis discussed here used the Census Bureau's Revised 2018 Experimental DA Estimates for children under age 5 which provide net undercount rates for young children for 689 large counties that had at least 5,000 children under age 5 in 2010. These were the dependent variable values used in our analysis.

We next assembled 40 potential explanatory variables for the 689 counties with at least 5,000 young children in 2010 based on the literature. To assemble this list, we reviewed literature on the undercount of young children (for example, U.S. Census Bureau 2014; O'Hare 2015: O'Hare et al 2019) as well as the literature for overall census coverage (Erdman and Bates 2017; U.S. General Accountability Office 2018; O'Hare 2019).

The 40 potential explanatory variables were sorted into six different domains or categories including:

1. Race and Hispanic Origin.
2. Socioeconomic Status.
3. Family Structure and Living Arrangements.
4. Other Demographic Measures.
5. Housing.
6. Census Response/Return Rates.

The list of 40 variables in each of six domains are provided in the methodological paper produced by PRB: https://www.prb.org/wp-content/uploads/2020/02/us-census-undercount-of-children.pdf.

While there are several papers that reflect conditions or characteristics related to net undercounts of young children, most of those conditions or characteristics are highly correlated with each other. Using stepwise multiple regression analysis allows researchers to sort out the relative importance of several variables and to combine the variables to produce the most precise estimates. Stepwise regression analysis is a commonly used approach in demographics and statistics. A similar approach was used in producing the Census Bureau's Low Response Score, which estimates self-response rates (Erdman and Bates 2017).

Analysis showed that producing separate models for counties with 250,000 or more people and the counties with less than 250,000 people provided more accurate estimates.

The Young Child Risk of Undercount measure was developed by examining statistical relationships between 21 explanatory variables and young child net undercount rates for large counties based on the 2010 Census, then using those statistical relationships with data from the 2013-2017 American Community Survey to make updated estimates of young children undercounts for census tracts in those large counties.

The stepwise regression defined the best combination of the explanatory variables to estimate the net undercount of young children for the 689 counties in the database.

Based on the statistical relationships between explanatory variables and the Census Bureau's Revised 2018 Experimental DA Estimates for children ages 0 to 4 in large counties we produced net undercount estimates for tracts in those counties.

Then we used the statistical relations seen in 2010 along with 2013-17 ACS data to produce updated post-2010 estimates for census tracts. As far as we know, these are the only estimates for the undercount of young children that incorporate post-2010 data.

Appendix B- Code Book for the PRB Data File	
Variable	**Label**
GEOID	Combined State County Tract FIPS code
GEOIDtxt	Combined State County Tract FIPS code as text
STATE	State FIPS code
STUSPSAB10	State abbreviation
STATE_NAME	State name
county10	County FIPS code
county_name	County name
YC_UNDERCNT_RISK	Undercount of young children risk category (based on 2013-2017 ACS data) 1=Low risk of young child undercount, 2=High risk of young child undercount, 3=Very high risk of young child undercount
pop04_1418	Number of children ages 0 to 4 ACS 2014-2018 table B01001
totpop_1418	Total population ACS 2014-2018 table B01003
pop04_p	Percent of population that are young children ages 0 to 4 ACS 2014-2018 table B01001
pop04B_1418	Number of young children ages 0 to 4 that are Black or African American Alone ACS 2014-2018 table B01001B
pop04C_1418	Number of young children ages 0 to 4 that are American Indian and Alaska Native Alone ACS 2014-2018 table B01001C
pop04D_1418	Number of young children ages 0 to 4 that are Asian Alone ACS 2014-2018 table B01001D
pop04E_1418	Number of young children ages 0 to 4 that are Native Hawaiian and other Pacific Islander Alone ACS 2014-2018 table B01001E
pop04G_1418	Number of young children ages 0 to 4 that are Two or More Races ACS 2014-2018 table B01001G
pop04H_1418	Number of young children ages 0 to 4 that are White Alone, Not Hispanic or Latino ACS 2014-2018 table B01001H
pop04I_1418	Number of young children ages 0 to 4 that are Hispanic or Latino ACS 2014-2018 table B01001I
POVUN05_p	Percent of children under age 5 living in families with incomes below 100% of poverty level ACS 2013-2017 table B17001
lthsun1834_p	Percent of adults ages 18 to 34 with less than a high school diploma ACS 2013-2017 table B15001
cwm_p	Percent of children under age 18 living in a female-headed household with no spouse present ACS 2013-2017 table B09005
chun06grp_p	Percent of children under age 6 living with a grandparent householder ACS 2013-2017 B10001 table B09001
lingiso_p	Percent of households that are limited English speaking ACS 2013-2017 table C16002
immfam_p	Percent of children under age 18 living in immigrant families (child is foreign-born or at least one parent is foreign-born) ACS 2013-2017 table B05009
perlivrnt_p	Percent of population living in renter-occupied housing units ACS 2013-2017 table B25008

Appendix C - Websites for more information on the undercount of young children

Book – The Undercount of Young Children in the U.S. Census
https://www.springer.com/us/book/9783319189161

Book - Differential Undercounts in the U.S. Census,
https://link.springer.com/book/10.1007/978-3-030-10973-8

The Census Bureau infographic on children under five:
https://www.census.gov/library/visualizations/2018/comm/counting-children-2020.html

U.S. Census Burau summary report on research related to the undercount of young children,
https://www2.census.gov/programs-surveys/decennial/2020/program-management/final-analysis-reports/2020-report-2010-undercount-children-summary-recent-research.pdf

Count All Kids (National Complete Count Committee for young children) website,
https://countallkids.org/

Detailed Census Bureau research reports on the undercount of young children are available at
https://www.census.gov/programs-surveys/decennial-census/2020-census/planning-management/memo-series.html

Census Bureau website for information on the undercount of young children.

https://www.census.gov/programs-surveys/decennial-census/2020-census/research-testing/undercount-of-young-children.html

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